



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### SEP 2023 - BOOKLET-1

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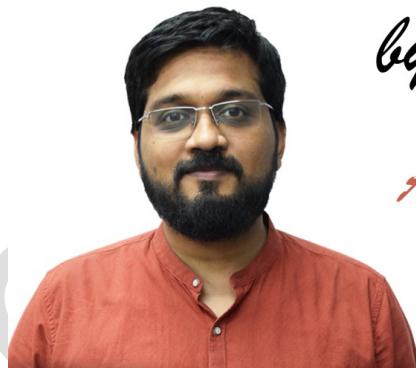
# HISTORY

## OPTIONAL FOUNDATION 2.0

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*by* **Nikhil Sheth  
& Vishal Singh**

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## 1. GS2: ISSUES RELATED TO POVERTY AND HUNGER

### 1) PYQS OF LAST 10 YEARS

- “The incidence and intensity of poverty are more important in determining poverty based on income alone”. In this context analyze the latest United Nations Multidimensional Poverty Index Report. [15 marks, 250 words] **[MAINS 2020]**
- There is a growing divergence in the relationship between poverty and hunger in India. The shrinking of social expenditure by the government is forcing the poor to spend more on non-food essential items squeezing their food-budget – Elucidate. [10 marks, 150 words] **[Mains 2019]**
- How far do you agree with the view that the focus on lack of availability of food as the main cause of hunger takes the attention away from ineffective human development policies in India? [15 marks, 250 words] **[Mains 2018]**
- Hunger and Poverty are the biggest challenges for good governance in India still today. Evaluate how far successive governments have progressed in dealing with these humongous problems. Suggest measures for improvement. [10 marks, 150 words] **[Mains 2017]**
- “Poverty Alleviation programs in India remain mere showpieces until and unless they are backed up by political will.” Discuss with reference to the performance of the major poverty alleviation program in India. [15 marks, 250 words] **[MAINS 2017]**
- Though there have been several different estimates of poverty in India, all indicate reduction in poverty levels over time. Do you agree? Critically examine with reference to urban and rural poverty indicators. [12.5 marks, 200 words] **[Mains 2015]**

## 2) POVERTY

- Why in news?
  - As per National Multidimensional Poverty Index (MPI) prepared by NITI Aayog, India has lifted 135 million people out of Multidimensional Poverty between 2015-16 to 2019-21 (Aug 2023)
    - The UNDP had earlier estimated that India lifted 415 million people out of poverty (MDPI) over 2005-06 to 2019-21.
    - As per the PLFS survey, the unemployment had reached a 45 year high in 2017-18.
- What is Poverty?
  - Poverty is a situation or condition in which a person or community lacks the financial resources essential for a minimum standard of living. Poverty stricken people and families may be surviving without good enough food, housing facilities, health and education facilities.
- Poverty Situation in India:
  - At the time of independence, more than 80% of country's population were in extreme poverty.
  - This has come down to less than 15% (2019-21) as per National MDPI released by NITI Aayog and 11% based on income criteria (\$2.15 PPP).
- Causes of Poverty:
  - In Indian context, the causes of poverty may be described as:
    - i. **Historical Factors:** Colonial rules -> deindustrialization -> lack of development of modern industries etc.
    - ii. **Rapidly Rising Population** -> strain on resources
    - iii. **Low Agriculture productivity:** This is due to fragmented holdings; non-scientific cultivation; lack of focus on value addition etc.
    - iv. **Unemployment:** The situation is still bad and as per Periodic Labour Force Survey (PLFS) by NSO, the unemployment had reached a 45 year high in 2017-18.
    - v. **Shortage of Capital and able entrepreneurship**
    - vi. **Social Factors:**
      - Social set up is still backward and is not conducive for faster development. Laws of inheritance, caste system, gender discrimination etc. are putting hindrances in the way of faster development and have aggravated the problem.
    - vii. **Increasing Inequalities**
    - viii. **COVID-19 Pandemic and its impact**
- Problems faced by poor and pains of poverty.
  1. Inability to fulfill basic needs:
    - **Housing challenges:** Poor people (specially in urban areas) suffer from houselessness, overcrowding, slums and rental laws. Substandard houses leave little for the prerequisite of decent living.
    - **Malnourishment**
    - **Poor health and educational opportunities**

2. **Social Discrimination:** Poor people are harassed, humiliated and discriminated against at every level. They have to face the challenge of illiteracy and hostility by the powerful. Poverty is not only about *economic poverty*, but also about *inequality*.
  3. **Sub-culture of poverty:** When poverty is transmitted over generations, it becomes a culture, according to Oscar Lewis.
- **Other Negative impacts of poverty:**
    1. **Radicalization and Criminalization:** It is easy to radicalize people who have nothing to lose.
    2. **Economic growth suffers:** When a large section of population live in poverty, their demand is generally much lower than middle class. This hampers the overall demand of the economy and keeps the economic growth of the country below its actual potential.
    3. **Hampers India's soft power** at international forums.
  - **Three Distinct strategies** for reducing poverty in India may be identified:
    1. In 1950s, the policymakers focused on maximization of economic growth by stepping up investment assuming that the benefits arising out of it would 'trickle down' and diffuse among all sectors of the society.
      - But it was realized later that the benefits of economic growth (including agricultural growth) didn't percolate to the rural poor.
    2. **Redistribution:** This approach pleaded for the establishment of egalitarian society and suggested distribution of assets through land reforms, community development programs, cooperative farming and nationalization of big industries.
      - But even this approach was unable to reduce poverty substantially.
    3. **Focused Poverty alleviation program:**
      - Since 1980s, a number of schemes are focused on attacking poverty through rural development programs. In recent years, MGNREGA has emerged as a landmark scheme to alleviate rural poverty in the country.
  - **Key Measures which contributed to fight against Poverty:**
    - **Poverty Reduction Initiatives**
      - » **MGNREGA**
      - » **PMAY**
      - » **National Food Security Act, 2013**
        - **PMGKAY**
      - » **PMUY**
  - **Other steps which have helped in poverty reduction:**
    - **Economic Reforms:**
      - » For e.g., the 1991 economic reforms paid huge dividends after a few years of transitional adjustments.
      - » LPG reforms have also increased opportunities within the country.

- **Promoting Manufacturing Sector** in India: Make in India; Atmanirbhar Bharat; Various PLI Schemes
  - **Skill Initiatives**
  
- **Current Situation:**
  - As per National Multidimensional Poverty Index (MPI) prepared by NITI Aayog, India has lifted 135 million people out of Multidimensional Poverty between 2015-16 to 2019-21. Poverty levels have reduced to less than 15% of the total population by 2019-21.
  - The UNDP had earlier estimated that India lifted 415 million people out of poverty (MDPI) over 2005-06 to 2019-21.
  
- **Measures that need to be taken for poverty alleviation**
  - **Focus on better implementation of schemes which help vulnerable groups** like NFSA, PMJAY, MGNREGA etc.
    - **Decentralized Planning and its execution:** For the success of anti-poverty programs, it is necessary that they should be planned by village panchayats/ Municipality levels.
    - We need to provide **minimum income for poor and vulnerable** - cash transfers for women, increasing MGNREGA to 150 days in rural areas; introduction of urban employment guarantee scheme etc.
  - **Employment Generation:**
    - Skill development in emerging technologies
    - Training in horticulture, animal husbandry, food processing sector
    - Women empowerment and creation of SHG led initiative
  - **Promoting ease of doing business:**
    - Reforming labor laws and other regulatory framework
    - Land Reforms
  - **Focus on Agri-growth:**
    - Marketing reforms, land leasing reforms etc.
    - Reduce dependency of people on agriculture sector -> industries need to expand, and rural workforce needs to be skilled to serve these industries.
  - **Fight growing inequality:** Though total egalitarianism in income and property may not be possible, but tax reforms can be introduced to reduce generation of black money. Similarly, laws can be better implemented to ensure that benami transfers and deals doesn't take place.
  - **Economic development and Economic Growth:**
    - Rapid Industrialization
    - Increased budget for welfare measures and reducing unnecessary expenses.

- Make Statistical System Independent of state interference - to get proper numbers.
- Conclusion:
  - Various stakeholders, including government, civil society organizations, and citizens need to move constantly towards a vision of an egalitarian democracy where people can live fulfilling lives, instead of remaining mired in notions of minimal reparation or remedies.

### 3) POVERTY ESTIMATION IN INDIA

- Why in news?
  - India has not released its Consumption Expenditure Survey (CES) data since 2011-12. Normally, a CES is conducted by the National Sample Survey Office (NSO) every five years.
- Post-Independence Poverty Estimation in India
  - In 1962, Planning commission formed a **Working Group to estimate poverty** nationally. This working group formulated a separate poverty line for Rural and Urban Areas (Rs 20 and Rs 25 per capita per year respectively)
  - In 1971, **VM Dandekar and N Rath** made the first scientific assessment of poverty estimation based on NSS data from 1960-61.
    - They argued that poverty line should be determined by expenditure that was necessary to provide 2250 calories per day in both rural and urban India.
  - **Alagh Committee** (1979) was a task force created by Planning commission for the purpose of poverty estimation.
    - It formulated a poverty line for rural and urban India based on nutritional requirements (24,00 calories for Rural India and 2100 calories for urban India).
  - **Lakdawala Committee** (1993) was formed in 1993 to review the methodology of poverty estimation.
    - He recommended:
      - Consumption expenditure should be calculated based on calorie consumption as earlier.
      - State Specific poverty lines should be constructed, and these would be updated using the CPI(IW) and CPI (RL) in urban and rural areas respectively.
    - It assumes that basket of goods and services included in (CPI-IW) and CPI-RL reflect the consumption pattern of poor.
  - **Suresh Tendulkar Committee (2009)**
    - Planning Commission formed an expert group chair by Suresh Tendulkar to review the methodology for poverty estimation in 2005.
    - It recommended four major changes:
      - A shift away from calorie consumption-based poverty estimation.

- b. Incorporation of private expenditure on health and education while estimating poverty.
  - c. Shift to **Mixed Reference Period (MRP)** based estimates, as opposed to Uniform Reference Period based estimates.
- The committee concluded the poverty line of just Rs 32 per capita per day in Urban India and Rs 27 in Rural India.
- **Rangarajan Committee (2012)**
  - In 2012, the Planning Commission constituted a new expert panel on poverty estimation, chaired by C. Rangarajan in light of public outrage over the planning Commission's suggestion of Rs 27 a day as poverty line for rural areas.
  - **Key recommendations**
    - **Poverty Threshold:** Rs 47 a day in urban areas and Rs 32 in villages
    - This method estimated that the number of poor were 29.6%.
  - In 2014, the **NDA government had junked the C Rangarajan Committee Report on poverty as it had pegged 100 million more BPL vis a vis the last estimate based on Tendulkar Committee Report**.
- Since, government is **not conducting Consumption Expenditure Survey since last few years**, the official poverty estimates haven't been updated.
  - The last consumption survey of 2017-18 was rejected by government as defective.
  - So, currently the last official estimate of poverty that is comparable over time, undertaken by planning commission, is for the year 2011-12.
- Is there a need of consumption-based poverty estimation when there is a National Multidimensional Poverty Index by NITI Aayog?
  - **What is the need of MPI?**
    - » **Capabilities Approach** - Some of the capabilities may not be tightly linked to the privately purchased consumption basket.
  - **But there are concerns about MPI:**
    - » Multidimensional indicators/measures raise several issues regarding their measurability, aggregation across indicators, and database which provide the requisite information at reasonably short interval.
      - **For e.g., Child Mortality** indicator is a problem as it is for population groups and not for individual households.
      - **Aggregation is another problem** - Drinking water can't be aggregated with indicator like Child mortality.
      - **Arbitrary weight** being given to different components.
  - **Why consumption-based poverty data should be supplementing MPI?**
    - » **Easy to understand and measure** - In the minds of people, being rich or poor is associated with levels of income.

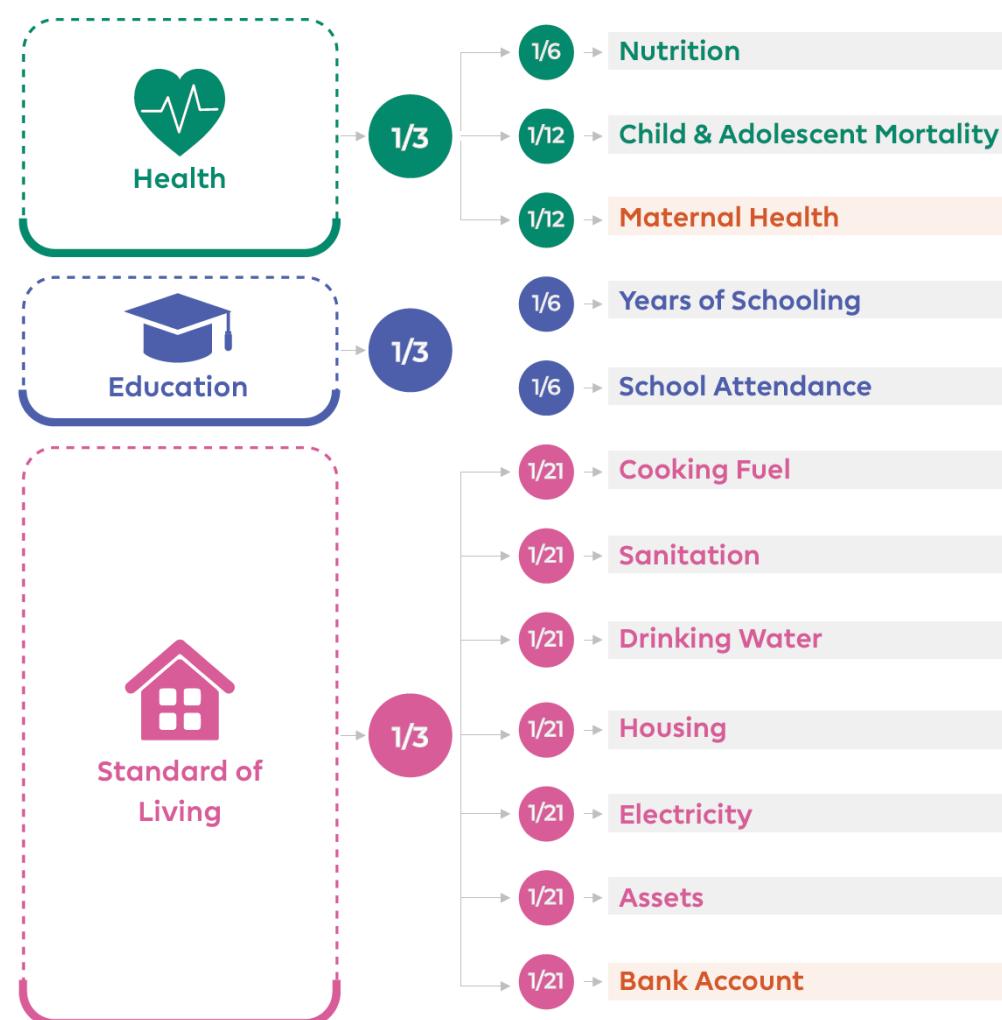
- **Challenges for Poverty Line estimation**
  - Determining the poverty line basket (PLB) is a crucial challenge in a country like India because of varying consumption pattern, prices etc. in different part of the country.
  - Bringing states on board has also remained a challenge.
    - The current official measures are based on Tendulkar Committee's recommendations, but some states suggest that C Rangarajan method will be a better estimation.
  - Poverty Line has to be very dynamic - because of rapid changes in demography, consumption pattern, and technology.
- **Why is poverty estimation crucial?**
  - To get public opinion to support massive and urgent cash transfers.
    - The world outside India has moved onto proposed high fiscal support, as economic rationale and not charity.
  - To ensure honest evaluation of various policies on the basis of whether they meet the needs of the majority.
  - Holding public representatives more accountable
  - Poverty, inequality and a deeper understanding of what works for poverty reduction is not just an academic exercise but is crucial for designing policies and programs that work. It is crucial for any government to prioritize social sector schemes in a data driven fashion.
- **Way Forward:**
  - We need reliable data provided by independent public bodies ring fenced from potential political interference.
  - Complete the new CES at the earliest and decide yardstick for measuring poverty which is the poverty line.
- **Conclusion:**
  - Many of our fellow citizens are living in abject poverty. Counting them would be a much-needed start to convey that each life matters.

#### 4) NATIONAL MULTIDIMENSIONAL POVERTY INDEX, 2023

- **Why in news?**
  - NITI Aayog publishes 2nd version of the National Multi-dimensional Poverty Index (July 2023)
- **Background:**
  - Historically, poverty estimation has relied on income as the sole indicator.

- However, the **Global Multidimensional Poverty Index (MPI)**, based on the **Alkire-Foster (AF)** methodology, captures **overlapping deprivations** - in **health, education and living standards**.
  - Goi has acknowledged the significance of the global MPI under the mandate of **Global Indices for Reform and Action** (GIRG) initiative.
  - In this context, NITI Aayog, has created an **indigenized index** for monitoring the performance of states and UTs in addressing multidimensional poverty in coordination with various ministries and technical partners - OPHI and UNDP.
- **Key features of India's MPI:**
- It captures overlapping deprivations in **health, education and living standards**. These three dimensions have been given **equal weights**, which have further been represented by **12 indicators**. The primary data source to arrive at the numbers of MPI is the NFHS-5.

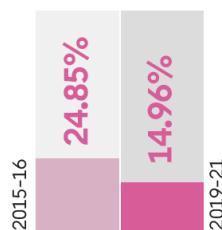
### Indicators and their weights



- **Key Highlights of the second edition of National MPI** which is a follow up of baseline report published in 2021.

- **Steep Decline in Poverty** between 2015-16 and 2019-21, indicating success of the country's commitment and action to address multidimensional nature of poverty through its multi-sectoral approach.
  - » **Population under multidimensional Poverty (H)**: **14.97% (2019-21)** when compared to **24.85%** in 2015-16.
    - In absolute terms, approximately **13.5 crore Indians escaped poverty** in the period, courtesy in improvements in indicators like access to cooking fuel, sanitation, drinking water, and bank accounts among others.
  - » **Poverty intensity (A)** has also reduced to **44.39% (2019-21)** when compared to **47.14%** in 2015 - 16.
    - $MPI = H \times A = 0.066$  (which was 0.117 in 2020-21)
  - » **Rural Areas** have seen fastest decline in poverty from **32.59%** to **19.28%** in the period owing to improvements in states like Bihar, UP, Madhya Pradesh, Odisha and Rajasthan.

### Steep decline in Poverty Headcount Ratio



**135 million  
(13.5 crore)**

people escaped  
multidimensional  
poverty between 2015-16 and 2019-21



India on track to achieve  
**SDG Target 1.2**  
(reducing multi-dimensional  
poverty by at least half)  
much ahead of 2030

All **12**  
indicators have  
shown improvement

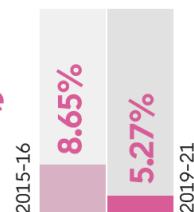
suggesting that impact of Government  
interventions is increasingly visible on ground

Fastest decline in percentage  
of multidimensional poor in  
rural areas from

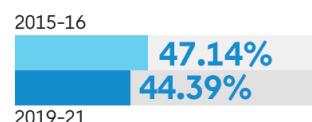


**Reduction  
in the incidence  
of poverty**

in urban areas



The **Intensity of poverty**,  
which measures the  
average deprivation among  
the people living in  
multidimensional poverty  
improved from about



UP, Bihar, MP, Odisha  
and Rajasthan  
recorded steepest  
decline in number of  
**MPI poor**

Improvement in **nutrition**,  
**years of schooling**,  
**sanitation**, and **cooking  
fuel** played a significant role  
in reducing the MPI value



### Concerns:

- **In the health category** - the three indicators - nutrition, Child and adolescent mortality, and maternal health - showed only moderate improvement, the report showed.

- Nutritional deprivation decreased from 37% to 31%;
      - Lack of nutrition contributed close to 30% - the highest - in the overall calculation of India's multidimensional poverty index.
    - Maternal health deprivation improved from 22.5% to **19.7%**; and
    - Child and adolescent mortality deprivation declined from 2.69% to **2.06%**.
  - **Other indicators** that didn't record a significant decline and aided the most in keeping Indians poor include lack of years of schooling (16.65%); inadequate access to maternal health services (11.73%), and less-than-desired school attendance (9.10%), among others.
  - **Cooking fuel** is an area where significant improvement has taken place but close to 44% of India's population is still deprived of it.
  - **Sanitation** numbers have also improved, but still 30% of the population is deprived when it comes to sanitation services.
  - **Access to housing** was another indicator where progress was marginal. In 2015-16, 46% didn't have access which has come down to 41% now.
- **Performance at State Level:**
- **States with less than 10% people living in multidimensional poverty doubled** in last five year. There were 7 states (Mizoram, Himachal Pradesh, Punjab, Sikkim, TN, Goa, and Kerala) in this category in 2015-16, which has doubled to 14 states with seven new states added including Telangana, Andhra Pradesh, Haryana, Karnataka, Maharashtra, Manipur and Uttarakhand.
  - **Except for Bihar**, no other state in India has more than 1/3rd of its population living under Multidimensional Poverty. However, even in Bihar's case, the reduction in multidimensional poverty has been significant over the five year time period - in 2015-16, over 51.89% of people lived in multidimensional poverty, by 2019-20, the figure dropped to 33.76%.
- **Conclusion:**
- India's stellar progress in the National MPI between 2015-16 and 2019-21 reflects the Government's commitment to improving the quality of people's lives - through targeted policies, schemes, and developmental programs rolled out at both national and subnational levels.
  - Key government schemes such as Swachch Bharat Mission (SBM), Jal Jeevan Mission, Poshan Abhiyan, Samagra Shiksha, Pradhan Mantri Sahaj Bijli Har Ghar Yojna (Subhagya), Pradhan Mantri Ujjwala Yojna (PMUY), Pradhan Mantri Jan Dhan Yojna (PMJDY), Pradhan Mantri Awas Yojna (PMAY) and many more have contributed significantly in driving the tremendous progress highlighted in National MPI.

## 5) GLOBAL MULTIDIMENSIONAL POVERTY INDEX, 2023

- **About the report:**
- The update is released by UNDP and the **Oxford Poverty and Human Development Initiative (OPHI)** at the University of Oxford.
- **Key Highlights:**
- **25 countries** including India, successfully halved their global MPI values within 15 years, showing that rapid progress is attainable.

- **1.1 billion** out of 6.1 billion people (just more than 18%) live in acute multidimensional poverty across 110 countries.
    - **Sub Saharan Africa** (534 million) and **South Asia** (389 million) are home to approximately five out of every six poor people.
  - **Nearly 2/3rd of all poor people** (730 million) lives in middle income countries, making actions in these countries vital for reducing poverty.
- **Most important Highlights for India.**
- India lifted 415 million people out of poverty (MDPI) over the period 2005-06 to 2019-21.
    - Incidence of poverty fell from 55.1% in 2005/2006 to 16.4% in 2019/2021.
  - The deprivation in all indicators declined in India and "the poorest states and groups, including children and people in disadvantaged caste groups, had the fastest absolute progress".
    - **Poor and deprived of cooking fuel** fell from 52.9% to 13.9%.
    - Those deprived of sanitation fell from 50.4% in 2005/2006 to 11.3% in 2019/2021.

## 6) RURAL POVERTY VS URBAN POVERTY

### A) RURAL POVERTY

- **Introduction:**
  - As per National Multidimensional Poverty index released by NITI Aayog, the rural areas have seen fastest decline in percentage of multidimensional poor in rural areas from (32.59% in 2015-16) to 19.28% in 2019-21.
  - However, there are still some challenges which allows the rural poverty to exist.
- **Causes:**
  - Inadequate and Ineffective implementation of anti-poverty programs
  - Very small population engaged in non-agricultural activities.
  - **Agriculture related issues:**
    - **Monsoon dependence on Agriculture** makes farmers dependent on vagaries of nature. Irrigation facilities are still not available for most of the agricultural land in India.
    - **Low productivity** of agriculture and allies' activities. For e.g., wheat production/acre or milk production per animal in India is way lower than that of developed countries.
  - **Poor Infrastructure:** Poor roads, inadequate electricity etc. make economic development of rural areas difficult.
  - **Social Factors:**
    - Poor situation of health and education facilities in rural areas.
    - **Inter-caste conflicts and rivalries**
    - **Excessive expenditure** on ceremonies like marriage, childbirth etc.
- **Way Forward:**
  - **Improvement implementation** of the poverty alleviation programs like MGNREGA, MUDRA, PDS etc.
  - **Infrastructure improvement:** Providing accessibility to electricity, water supply etc., to make rural areas suitable for establishment of agriculture.
  - **Reform Agriculture** -> Agri-Market reforms, land leasing reforms etc.; Focus on improving productivity of animal husbandry sector.
  - **Improved focus on education, skill development and entrepreneurship** in rural areas.
  - **Promoting cottage industries, agro-based industries** and food processing industries

### B) URBAN POVERTY

- **Example Questions:**
  - "The Past Practice of seeing all poverty in a rural light and applying rural solutions in urban conditions will not yield expected results" Elaborate [10 marks, 150 words]
- **Background:**
  - Poverty eradication has been a key goal of Government of India since many decades now. But, the focus has mostly been on rural areas as most of the Indian population lived in rural area and rural poverty was pervasive.

- However, Urban population has kept on rising and so has been the number of poor in Urban areas. One key reason for it has been migration of rural poor into cities in search of better livelihood. This phenomenon is universally acknowledged as the Urbanization of Poverty.
  - Urban Poverty is manifested in terms of increasing slums, and around 20% of urban population lives in slums.
- **There are some similarities** in urban and rural poverty. These include - lack of adequate food, employment, healthcare and education; Access to information and lack of voice and representation in the settlements; the ability to influence decision making is remote, since they end up powerless in the face of the landed gentry in villages and the rich and organized classes in cities.
- **But there are some key differences in between urban poor and rural poors.**
  - i. **Adequate housing and basic services** clearly differentiate urban and rural poor.
    - In Urban areas security of tenure is an issue; this is not generally a concern in rural areas.
  - ii. **Urban poor are** also much more deprived in terms of sanitation and infrastructure.
    - The non-availability of toilet facilities, especially for women; lack of clean drinking water, clean air and ventilation; and exposure to disease make living conditions awfully rundown.
  - iii. **Other challenges** of urban poor include challenges of transport, dangers of extortion and increased vulnerability to crime.
  - iv. **Social and Psychological situation:** The stark differences that are seen in the living standards of the urban rich and the urban poor have a significant bearing on the psychology of the urban poor.
    - Within the rural society, the stratification is far less. Consumption pattern is likely to be less dissimilar, since the variety of consumer products available in a village is narrow.
    - The deprivation of poverty, therefore, unlike the rural areas, hit the urban poor hard, because they see what the others have and what they don't. The situation breeds powerlessness, emotive confusion, resentment and buried anger.
- **Conclusion:**
  - Acknowledgment of these differences is crucial for creating effective antidotes against urban poverty. The past practice of seeing all poverty in a rural light and applying rural solutions in urban conditions will not yield the expected results. Furthermore, the design of anti-poverty policies needs to be looked at in the context of overall urban policies, urban planning and legal and institutional framework.

## 7) UNIVERSAL BASIC INCOME

- **Why in news?**
  - 'The State of Inequality in India', a report released by the Economic Advisory Council to the Prime Minister (EAC-PM) Chairperson Bibek Debroy. [May 2022]
    - It calls for an urban job guarantee scheme and introducing Universal Basic Income (UBI).
- **Example Questions:**

- i. What is Universal Basic Income? What can be the advantage of UBI over the current poverty reduction efforts?
  - ii. Do you agree that Universal Basic income will facilitate a more inclusive society with reduced inequalities? Give reasons for your answer
- **Definition**
- A basic income (unconditional basic income or universal basic income) is a form of social security in which all citizens or residents of a country regularly receive an unconditional sum of money, either from government or some other public institutions, in addition to any income received from elsewhere.
- **UBI Has three components**
- i. Universality
  - ii. Unconditionality
  - iii. Agency ( by providing support in the form of cash transfers to respect, not dictate, recipients' choices)
- **The time has come for UBI because of following reasons**
- i. **Social Justice**
    - UBI is, first and foremost, a test of a just and non-exploitative society. Almost every theory of Justice has argued that a society that fails to guarantee a decent minimum income to all citizens will fail the test of justice.
  - ii. **Poverty Reduction**
    - Conditional on the presence of a well-functioning financial system, a UBI may simply be the fastest way of reducing poverty. The COVID-19 pandemic highlighted how the poor were most vulnerable and needed an assured income to fulfil their basic needs.
  - iii. **Employment concerns**
    - As we move towards a more technologically competent world, a large section of the workforce may not be able to find work. UBI can be granted to compensate for the losses to make ends meet.
    - Further, a basic income will make employments less exploitative.
  - iv. **Agency**
    - **Problems with other schemes to deal with poverty**
      - Our current welfare system, even when well intentioned, inflicts a indignity upon the poor by assuming that they cannot take economic decisions relevant to their lives.
      - **UBI**, an unconditional cash transfer treats them as agents, not subjects.
        - It liberates citizens from paternalistic and clientelist relationships with the state.
        - By taking the individual and not the household as the unit of beneficiary, UBI can also enhance agency, especially of women within household.
    - v. **Administrative Efficiency and Transparency**

- The existing welfare schemes are riddled with misallocation, leakages and exclusion of the poor.
  - UBI is a way of ensuring that state welfare transfers are more efficient so that the state can concentrate on other public goods.
  
- vi. Increase in financial inclusion
  - Payment - transfers will encourage greater usage of bank accounts, leading to higher profits for banking correspondents (BCs) and an endogenous improvement in financial inclusion.
  - Credit - increased income will release the constraints on access to credit for those with low income levels.
  - Profitable for banks: More money in the bank accounts, which have remained inactive.
  
- vii. Numerous Successful trials have found that basic income, whether given to everyone or specific groups or communities, improve health, life satisfaction, trust in others and employment opportunities among participants.
  - A nationwide experiment in Finland showed these favourable results.
  
- The Conceptual Case Against UBI / Criticism of UBI / Factors hindering implementation of UBI:
  - i. Weather UBI reduces incentive to work
    - Critics conjure up images of potential workers frittering away their productivity. It may hamper labour supply.
    - This argument is highly exaggerated?
      - For one thing, the levels at which universal basic income are likely to be pegged are going to be minimal guarantee at best; they are unlikely to crowd incentive to work.
      - One school of thought would argue that, it truly is a diminution of human dignity to suppose that the only motivation for which people work is necessity.
  - ii. Will UBI promote social vice like drinking, smoking etc?
  - iii. Should Income be detached from employment?
    - Society already does this, but largely for rich and privileged.
      - Any society where any form of inheritance or accepting non work related income is allowed, already detaches incomes from employment.
      - So receiving a small unearned income as it were, from the state should be economically and morally less problematic than the panoply of unearned incomes our society allow.
  - iv. Reciprocity: If society indeed is a "scheme of social cooperation", should income be unconditional, with no regard to people's contribution to society?
  - v. Fiscal cost given political economy of exit
    - Once introduced, it may be difficult for government to wind up a UBI in case of a failure.
    - This might affect implementation of other welfare schemes.
  
- Why Universalize
  - Limitations of Existing Schemes
    - » Sheer large number of schemes (950+ by central government only)
      - Too much bureaucratic cost involved.

- » Effectiveness of the schemes is poor - Misallocation -> Leakage
- » Exclusion of genuine beneficiaries
- How come an Universal UBI overcome these issues
  - » Every citizen getting basic income -> few chances of misallocation
    - Success hinges much less on local bureaucratic ability than do other schemes.
  - » UBI further reduces the burden on administration by doing away with the tedious task of separating the poor from the non-poor.
  - » Direct Benefit transfer eliminates out of system leakages and scope of diversion reduces considerably.
  - » Further because state is answerable to a larger section of its citizen, the out of system leakage further decreases.
  - » Universalization ends exclusion error.
- Way Forward: Three principles that can help guide thinking in this direction.
  - a. De jure universality, de facto quasi-universality:
    - Exclude on the basis of assets; Bring Give it Up Scheme; list of UBI beneficiary should be publicly displayed; Self-Targeting; Tax UBI;
  - b. Gradualism
    - One of the guiding principles can be gradualism the UBI must be embraced in a deliberate, phased manner. A key advantage of phasing would be that it allows reform to occur incrementally - weighing the cost and benefit at every step.
  - c. UBI and redistributing resource transfers to states
    - A number of state governments receive large amount of transfers that may not prima facie increase growth or consumption. The UBI offers a possible way around :
      - A part of the redistributing resource transfers may be transferred by the centre directly into beneficiaries accounts in the form of pilot UBI programme.
  - d. Other Key way-forwards:
    - i. Ensure 100% coverage of Jandhan-Aadhar and Mobile
    - ii. Create a framework for Centre-State Cooperation
      - A key federal question will be the centre-state share in funding of the UBI. This would like the GST, involve complex negotiations between federal stakeholders.
      - ESI suggest that initially, a minimum UBI can be funded wholly by the centre. The Centre can then adopt a matching grant wherein for every rupee spent in providing a UBI by the state, the centre matches it.
    - iii. Spread awareness about usefulness of UBI for the entire society and develop public support for it.
- Conclusion:
  - » Like the social market economy, the UBI reconciles economic efficiency and social security. It is radical, but also just. It is liberal and contemporary. Therefore it may offer the best social-political prerequisites for "prosperity of all" in the 21st century.
  - » India should begin to explore the nuances of shifting to basic income, explore alternatives, feasibility and gather evidence to make an informed choice.

## 8) SDG2: ZERO HUNGER BY 2030

- **Why in news?**
  - The Key to India's Hunger Challenge: A focus on gender sensitive growth (Aug 2023: Source: IE)
- **Hunger:**
  - **Hunger** is a situation when a person is not able to consume sufficient food to meet basic nutritional needs for a sustained period. The required number of calories may vary according to age, sex, physical activities etc.
  - **The UN mandated SDG-2 of "Zero Hunger": ending hunger and ensuring access to nutritious and sufficient food for all** is supposed to be achieved by 2030.
    - This goal works in tandem with many others: Poverty Elimination (SDG1); Good Health and Well Being (SDG3); and the Need for Clean Drinking Water (SDG6).
  - **Similarly other SDG goals (SDG4 - Education; SDG5 - Gender Equality; SDG8 - Decent Work and Economic Growth; SDG10 - Reduction of Inequality; SDG11 - Sustainable Cities and Communities; SDG16 - Peace, Justice and Strong Institutions; and SDG17 - partnership for goals also influence consumption patterns and healthy diet choice.**
- **Hunger Situation in India:**
  - **Malnourishment** is a major challenge faced by India, especially amongst children below the age of five.
    - **As per NFHS-5**, 32% of children were underweight; 35% are stunted and 19% are wasted.
  - **Global Hunger Index, 2022** has also ranked India 107/121 countries (worse than all our neighbours except **Afghanistan** (109)).
    - **Though India has criticized GHI** on several grounds, but still, it throws some light on the hunger levels in India.
      - GHI is using erroneous measure of hunger (i.e., it is measuring hunger in terms of other variables beyond the lack of food).
      - 3/4 variables are related to children and can't be representative of whole population.
      - The data for undernourished population is based on a poll conducted on a very small size of 3,000.
      - GHI seems to have ignored initiatives like PMGKAY, Anganwadi Scheme, PMMVY etc.
  - **As per a report by UNICEF**: Child Food Poverty, 13 countries across the world (including India), more than 40% of children live in severe food poverty.
- **Key initiatives to fight Hunger Situation in India:**
  - **NFSA 2013** and the Public Distribution System
    - **PMGKAY**
  - **Poshan Abhiyan**: Launched by MoW&CD in 2018 is focused on reducing stunting, undernutrition, and anemia (among young children, women and adolescent girls).

- **Integrated Child Development Services (ICDS) Scheme:** Launched in 1975, the ICDS scheme offers a package of six services - Supplementary Nutrition; Pre-School non-formal education; Nutrition and Health Education; Immunization; Health Checkups; and Referral Services.
  - **Eat Right Movement:** It's an initiative by Food Standards and Safety Authority of India (FSSAI) for citizens to nudge them towards eating right.
  - **Various initiatives for Poverty Reduction; Health (like Mission Indradhanush); Employment; Environment Protection** etc. also contribute to fighting hunger situation.
- **Other Measures over the years which have contributed to fight against Hunger:**
  - **Green Revolution:** It has turned India from a "Ship to mouth" economy to the largest exporter of rice in the world. It has allowed the successful implementation of PDS, PMGKAY etc.
  - **White Revolution:** India has emerged as the largest producer of milk in the world.
- **Causes for high Hunger Levels in India:**
  - Hunger is a complex multidimensional problem.
  - In a 2008 paper, Hunger in the Contemporary World, Amartya Sen enumerated the interdependence of food deprivation and hunger on multiple factors.
    - **Low Income (Poverty)** - Poverty leads to poor living conditions, less income, insufficient food which eventually leads to malnourishment and hunger.
    - **Social Factors:**
      - **Gender Inequality:**
        - Inter-Family food distribution rules: Patriarchy leads to girl child getting food at the last or lesser food.
        - Low female literacy and education: Lack of adequate knowledge amongst mothers regarding nutrition, breast-feeding, and parenting.
      - **Economic Factors**
        - Poor Employment
      - **High Government spending** in non-social sector
        - **Huge Military expenditure** (as India lives in a very vulnerable neighborhood)
- **Other Factors include:**
  - **Poor Administration and Governance:** Corruption; Faulty PDS system; Unidentified hunger (inclusion and exclusion errors due to wrong allocation of BPL cards);
  - **Hidden Hunger:** Several types of nutritional deficiencies are occurring due to poor diet, diseases, and failure to meet the needs of women during pregnancy and lactation period.
  - **Economic and Health challenges** associated with **COVID-19**.
    - COVID-19 pandemic has exacerbate child undernutrition in general and child wasting in particular.
  - **Climate Change and weather extreme** also pose big challenge to India's food system and poverty alleviation targets.
- **Way Forward:**
  - **Intensive Hunger Specific Initiatives:**

- Improve the implementation of NFSA by removing all kinds of exclusion errors.
- In Post-Covid scenario, bring back and strengthen functional Anganwadis providing food and other services.
- Mid-day meal scheme should restart with full vigour in schools.
- **Improving Implementation:**
  - Social Audit
  - IT for better monitoring
- **Focus on other associated issues** like Water, Health, Sanitation, maternal and child health etc.
- **Focus on dietary diversity** -> Encouraging consumption of more diverse range of foods, particularly fruits, vegetables, and protein rich diets.
- **Social Changes:**
  - Addressing gender inequality
- **Accelerated and Inclusive Economic Growth:**
  - Women's participation rate in labour force is around 30% currently, which needs to increase. Here focus on literacy, skill development would be important.
  - **Look into the issues of Livelihood:** Expand rural employment guarantee scheme.
  - **Sustainable Agriculture:** Investment, Research, and Innovation for Sustainable Agriculture
- **Reducing food wastage and losses**
- **Adaptation and Mitigation** to climate change.

## 2. GS3: CYBER SECURITY

### 1) PYQS OF LAST 22 YEARS

- What are the different elements of Cyber Security? Keeping in view the challenge in cyber security, examine the extent to which India has successfully developed a comprehensive National Cyber Security Strategy (Answer in 250 words)
- Keeping in view India's Internal Security, analyze the impact of cross-border cyber-attacks. Also discuss defensive measures against these sophisticated attack [10 marks, 150 words]
- Discuss the types of Cybercrime and measures required to be taken to fight the menace [10 marks, 150 words] [Mains 2020]
- What is CyberDome project? Explain how it can be useful in controlling internet crimes in India. [10 marks, 150 words] [Mains 2019]
- Discuss the potential threat of cyber-attacks and the security framework to prevent it. [10 marks, 150 words] [Mains 2017]

- Considering the threats cyberspace poses for the country, India needs a "Digital Armed Force" to prevent crimes. Critically evaluate the National Cyber Security Policy, 2013 outlining the challenges perceived in its effective implementation. [200 words, 12.5 marks] [Mains 2015]
- Cyber warfare is considered by some analysts to be larger threat than even Al-Qaeda or terrorism. What do you understand by Cyber Warfare? Outline the cyber threats which India is vulnerable to and bring out the state of the country's preparedness to deal with the same. [200 words, 10 marks] [CSM 2013]
- What is a malware? [50 words] [CSM 2007]
- What is a firewall? [50 words, CSM 2007, CSM 2002]
- Who are 'hackers' in computer world? [50 words, CSM 2006]
- What is VIRUS? [50 words, CSM 2005]
- What is an 'Internet Worm'? Explain DDoS [CSM 2003]
- How does Computer virus destroy data? [CSM 2000]
- What is computer virus? How does it infect systems? [CSM 1999, 5 marks]

## 2) BASICS

- Cyberspace is the connected Internet Ecosystem".
  - Cyberspace today covers almost every crucial defence and civilian infrastructure including information technology network, banking and finance, transportation system, water supply etc.
  - It has also emerged as the largest unregulated and uncontrolled domain in the history of mankind.
  - It is the fifth potential theatre of warfare along with land, sea, air and space.
  - Thus, protecting cyber space has become a very high priority for every government in the world.
- Cyber Crime is a criminal activity that involves a computer and a network i.e., a criminal activity on the cyberspace.
  - It involves offences committed against people/ organization/ governments with a criminal motive to cause physical or mental harm, or loss to victim directly or indirectly.
  - It also threatens nation's security and financial health.
  - Cyber criminals are getting sophisticated with each passing day and are wreaking havoc by defacing websites and stealing confidential and privileged data for financial gain.
- Cyber Security is protecting our cyber space (critical infrastructure) from attack, damage, misuse and economic espionage.
  - It is a complex issue that cuts across multiple domains and calls for multi-dimensional, multilayered initiatives and responses.

## 3) GENERAL CYBER SECURITY CHALLENGES

- i. **Cyberspace has inherent vulnerabilities** that can't be removed.

- **Innumerable entry points** to internet
    - Even if a few points are vulnerable, the whole system can be cyber attacked.
  - The coming up of technologies like IoT which connects various 'things' with internet- increases the vulnerabilities of internet.
  - **Increasing penetration of Internet** with a large number of first-time users.
    - **Increasing connectivity of different sectors** -> more data being stored digitally -> more vulnerability.
- ii. **Difficult to identify the source of attack.**
- For e.g., CIA's UMBRAGE project has advanced capabilities of misdirecting attribution to another nation-state ("false flag attacks") by leaving behind false fingerprints.
- iii. **Fast evolving technologies**
- This allows cyber attackers to quickly exploit vulnerabilities. Further in the absence of timely updates, attack technologies surpass the defense technology allowing exploitation of the vulnerabilities.
- iv. **Nation states, non-state actors, and individuals** are at a **peer level**, all capable of waging attacks.
- v. Some countries **promote, shelter and encourage** cyber-crime as a political tactic.
- vi. **Cyber criminals (hacking groups have become very organized)**
- They are part of the underground ecosystem that channels tools, expertise, and infrastructure in criminal operations that extract billions of dollars of profit from data theft, extortion, and fraud.

#### 4) IMPACT OF CYBER ATTACK – DIFFERENT WAYS IN WHICH CYBER ATTACK DAMAGES

- **National Security:** Cyber-attacks pose a major challenge to any country's National Security.
  - » **Cyber Espionage, Warfare, Terrorism** etc. emerged as a new challenge in India's National Security.
    - Cyber-attacks on India originating from China has increased manifold after the increased tensions on the borders.
    - US-Israeli joint efforts had unleashed the Stuxnet Worm in 2010 - which helped it disable several hundred centrifuges at the Iranian nuclear facility in Natanz.
  - » **Disabling of Critical Infrastructure** such as telephone network, satellite system, financial services can be brought by Cyber-attack.
    - For e.g., the malware 'DTrack' had breached a system at Kudankulam Power Plant.
- **Economic Loss - Financial Frauds**
  - » Cybersecurity Ventures estimate the global annual cybercrime cost to be \$6 trillion in 2021.
    - **Information Loss:** The largest cost impact from cybercrime is information loss (39%).
    - **Business Disruption:** Loss (36%)

- **Information Warfare:** It aims to impact the decision-making process of the target's citizenry for advancing particular narratives.
  - » With Big data, Behavioural and predictive analytics and AI, the nature of warfare in cyberspace has evolved.
  - » Sixth Generation Warfare (6GW) applies 'reflexive control' aided by these developments to target in an individualized manner and change the beliefs of the leadership or citizenry of the adversary through mass data and behavioral analytics.
- **Social Media** has been used for:
  - » Fake news - promoting social tensions and harming national integrity.
  - » Radicalization of youth has been happening through online platforms.
  - » Honey trapping
  - » Data phising
- **Cyber Hacktivists**
  - » They hack sites and servers to virally communicate the "message" for specific campaigns.
- **Violation of Right to Privacy**
  - » Individual's personal data is disclosed on public platforms.
- **Other Crimes:** e.g., Online Abuse, Harassment, Stalking, Child Pornography etc.

## 5) CYBER SECURITY SITUATION IN INDIA

- **Steady spike of Cyber Security** in the past five years:
  - As per NCRB, there were 12,317 cases of cybercrime in 2016, which has increased to 50,035 in 2020.
  - Late CoDS Bipin Rawat had said that cybercrime went up by 500% during the Pandemic.
- **Cybercrime increased drastically after the increased border tensions with China.**
  - Most of these attacks are DDOS, phising, data exfiltration, remote access tool malware and keylogging (tracking every keystroke made by a user).
  - Government websites and web portals have been the targets in the past too. What is different this time is that attackers appear to be well planned and aimed at extracting information and sensitive data.

## 6) LAWS, POLICIES, INSTITUTIONS, INITIATIVES TO ENSURE CYBER SECURITY IN INDIA

### A) LEGAL FRAMEWORK

- Currently, the **Information Technology Act, 2000** is the primary law for dealing with cyber-crimes in India.
  - » Section 43 (Data Protection), Section 66 (hacking), Section 66B punishment for illegally possessing stolen computer resource and communication devices, Section 67 (protection against unauthorized use of data), Section 69 (Cyber terrorism), etc. are some key provisions which cover Cyber Security.

## B) NATIONAL CYBER SECURITY POLICY 2013

- Aim:
  - i. Protection of information infrastructure in cyberspace
  - ii. Reduce vulnerabilities.
  - iii. Build capabilities to prevent and respond to cyber threats.
  - iv. Minimize damage from cyber incidents through a combination of institutional structure, people, process, technology and cooperation.
- Key Provisions
  - a. **Institutional Framework to promote Cyber Security**
    - **National Critical Information Infrastructure Protection Centre (NCIIPC):** it is a 24X7 mechanism to deal with cyber threats and works under NTRO to safeguard critical infrastructure.
    - **CERT-IN** has been designated as nodal agency for coordination of crisis management. It will also coordinate and operationalize sector CERTs.
  - a. **Developing Cyber-security Human Resource** (creating a workforce of 5,00,00 professional in 5 years)
  - b. **Promote R&D**
    - More Investment; Industry-Academia collaboration; Setting up Centre of excellence in cyber security areas; R&D in cutting edge security tech; focus on indigenous development of cyber security solutions.
  - c. **Promoting PPP and collaborative engagements** through technical and operational co-operation
  - d. **Each organization to promote cyber security through an information security policy and using only certified IT products.**
  - e. **Other provisions include** Updation of legal framework; Awareness program on cyber space; Periodic review of the adequacy and effectiveness of cyber security infrastructure etc.
- Need of Review
  - **Technological advancements** in the field of Artificial Intelligence, 5G, Internet of Things etc. have made the 2013 policy outdated.
  - **Human Resource Development** has been poor.
  - **Need of Governance Reform**
    - » India has 35+ different central bodies to look after cyber issues. Each organization has its own reporting structure and CERT (Indian Computer Emergency Response Team). This plethora of agency leads to confusion.
  - **Need of a Unified Cyber Security Framework** across various regulators
  - **Need of a Cyber-Defence Agency** - to implement the cyber defence strategy for national security.
    - » This should also provide for cyber commando forces to neutralize any cross border cyber terrorism or cyber-attack and help in development of specialized cyber police cadres in all state police departments.

- Awareness level in police and judiciary is still very low about cyber security.

### C) VARIOUS INSTITUTIONS AND INITIATIVES:

- National Security Council (NSC) usually chaired by the NSA plays a key role in shaping India's cyber policy ecosystem.
  - National Information Board, also chaired by NSA, is meant to be the apex body to promote cross-ministry coordination on cybersecurity policymaking.
- National Critical Information Infrastructure Protection Centre established under the NTRO in Jan 2014 is mandated to facilitate the protection of critical informational infrastructure.
- The Indian Computer Emergency Response Team (CERT-IN) is the national nodal agency which responds to various cyber security threats to non-critical infrastructure.
- Ministry of Defence (MoD) has established a Defence Cyber Agency, a tri-service command of the Indian armed forces to coordinate and control joint cyber operations and craft India's Cyber doctrine.
- **Cyber Swatchta Kendra (Botnet Cleaning and Malware Analysis Centre)**: It has been launched for detection of malicious software programmes and to provide free tools to remove the same.
- **Cyber AASHVAST: India's first Cyber Crime Prevention Unit**
- **Other Initiatives to Promote Cyber Security in India**
  1. Awareness Generation
    - **Cyber Surakshit Bharat Initiative**
      - It was launched in 2018 to promote awareness about cyber-crimes and building capacity for safety measures for Chief Information Security Officers (CISOs) and frontline IT staff across all government departments.
    - **PMGDISHA**
  3. All the new government websites and applications are audited prior to hosting and on regular basis after hosting.
- 4. **Increased International Cooperation**
  - The second ASEAN-India Track 1.5 Dialogue on Cyber Issues was held in Oct 2020.
  - India also signed Memorandum of Cooperation with Japan in the field of Cybersecurity.
  - **Quad** countries also have agreed for cooperation on Cyber-Security

## 7) PROBLEMS ASSOCIATED WITH INDIA'S CYBER SECURITY SYSTEM

1. **Cyber Security Policy, 2013 and IT Act** needs to be updated to ensure that it remains fast tracked.

**2. No Procedure Code for the investigation of Cyber or computer-related offences:**

- As electronic evidence is entirely different in nature when compared to evidence of traditional crime, laying down standard and uniform procedures to deal with electronic evidence is essential.

**3. Lack of coordination among the various institutions involved in cyber security.**

- We don't have a unified national cyber security architecture. There are too many agencies which have led to concerns around effective coordination, overlapping responsibilities and lack of clear institutional boundaries and accountability.

**4. Lack of trained manpower / Lack of focus on cyber security in educational and research institutes.**

- In June 2023, a report by Team Lease Digital said that India had 40,000 job openings in the field of cyber security, but 30% of these vacancies couldn't be filled due to huge skill shortage.

**5. Dependency on ICT Imports**

- Mains hardware attacks can be Manufacturing Backdoors, Hardware tempering etc.
- Further, lack of digital solutions like data-sharing facilities and social media platforms have adversely impacted nation's self-reliance and cyber security.

**6. Lack of awareness among public** regarding the cyber security and significance of it.

- According to a survey by security solutions provider NortonLifeLock, around 52% adults admitted that they don't know how to protect themselves from cybercrime.

**7. Rapidly changing technology**

**8. Use of Substandard Devices and rampant use of unlicensed software increases cyber security vulnerabilities in India.**

**9. Lack of private investment**

**10. India's cyber capabilities are mostly defensive and lacks offensive power.**

- A cyber arsenal is also needed for strategic deterrence and this will also enhance our defensive approach.

**11. Almost Complete absence of Cyber Security Framework at state level** in many states

**12. Absence of 'Global Cyber Norms'** which can balance the competing demands of national sovereignty and transnational connectivity.

## **8) WAY FORWARD AND CONCLUSION**

- **Reform policy, laws** - Both Cyber Security Policy 2013 and the IT Act, 2000 don't fully sync with today's cyber threat.
  - The new cyber security policy should also ensure coherence and coordination between various institutions.
  - It's high time that data privacy laws are prioritized by the legislature.

- **Human Resource Development**
  - Skill shortage has to be dealt with high priority:
    - Fill all the relevant position with cyber security experts.
    - States should set up a special cyber police station in each district or range, having technically qualified staff in every police station.
  
- **Upgrade Cyber Labs:**
  - Cyber forensic labs of states must by upgraded with the advent of new technologies.
  - The state of art, National Cyber Forensic Lab and the Cyber prevention, Awareness and Detection Centre (CyPAD) of the Delhi Police should also be asked to extend professional help to state labs.
  
- Focus on **Infrastructure and More R&D** in the sector.
  - Focus on how AI and ML can boost cyber defenses.
  - Promote cutting edge technology growth in the country to reduce dependency on imports of ICT.
  
- **Enhancing Cyber Warfare Capabilities:**
  - These enhancements would be technological, organizational, and human, employed for cyber offence, cyber defence, cyber deterrence, or combination of these.
  - Developing **offensive deterrence capabilities**
    - Specialized cyber security cells are needed in police departments of each state.
  
- **Promote Cyber Hygiene -**
  - **Ensure security in imported ICT devices.**
    - Set up **Trust Centres** (labs) to determine the level of trustworthiness of ICT vendors.
  - **Nurturing young netizens through digital civics.** Regular updates of hardwares and softwares, regular password changes etc.
  
- **Reduce dependency on imported ICT devices.**
  - Promote ICT manufacturing in the country.
  
- **Promote the role of Private Players**
  - **Encourage startups** in the field of social networking, cloud computing etc.
  - Private sector should get involved in **more industry focused processes** such as the Microsoft-initiated Cybersecurity Tech Accord and the Siemen's led Charter of Trust.
  
- Increasing **International Cooperation** to develop **Cyber Norms**.
  - Acceding to **Budapest Convention**, or **Convention on Cybercrime of the Council of Europe** (CETs no. 185), which started as a European Initiative but has attracted others, is an option that India should examine.
  - Further, International agreements should provide a binding obligation on 'red lines' with respect to cyberspace-targets that should be considered illegitimate due to their significance for human life, such as health-care systems, electricity grids, water supply and financial systems.

- Prepare for implication of Quantum Computing on Cyber security.
- Protect the country from informational (6th Generation warfare): - Measures to reduce foreign data collection; sectoral data localization; Enact the data protection bill; Integrate this modern form of warfare while developing India's security strategy.

### **Conclusion**

- In India, it is imperative for our national security that cyber networks, software and cyber-physical systems, and platforms should be cyber-secure. This requires a judicious mix of people, policies and technologies, as well as robust Public Private Partnership.
- Various institutions need to be strengthened to bring in a **much-needed synergy** among various institutions and to work out a coordinated approach to cyber security, including cyber deterrence.

## **9) CYBER SECURITY THREATS FROM CHINA, AND CHINESE HARDWARE AND SOFTWARE**

- **Why in news?**
  - A suspected cyberattack on the AIIMS in Delhi compromised personal health data of millions of patients, which was likely sold off on the dark web (Dec 2022)
- **Example Questions:**
  - "Adequate measures need to be adopted to strengthen India's cyber defence as it has become increasingly susceptible to Chinese Cyber Attacks" Elaborate [10 marks, 150 words]
- In 2018, CERT-IN (Computer Emergency Response Team - India) reported that **China was responsible for 35% of the total number of cyber-attacks** on official Indian website. Military forces suspect that this attack has increased substantially after the Galwan clashes.
- **Recent Example of Chinese Cyber Attacks:**
  - Cyber-attack on AIIMS in Dec 2022 which was may have compromised data of 3-4 crore patients.
  - **Attack on Ladakh Power Grid** in April 2022.
  - Earlier in 2021, Chinese state-backed hackers' group had targeted the IT system of two Indian vaccine makers - Bharat Biotech and Serum Institute of India (SII)
  - The Oct 2020, Mumbai power outage was also a result of multiple malwares deployed by Chinese group RedEcho.
- **Various types of Cyber threats from China:**
  - **Direct Cyber-attacks** - Hacking, DDOS, Phising, etc.
  - **Threats from Chinese apps and hardware**
  - **Smart Technology also pose security risks:** SMART Products which encompass the range of everyday technology that is being operated across residential and office spaces in India. These

include CCTVs, air conditioners, refrigerators, coffee machines, printers etc. Even the western produced devices depend on data sensors, modules and transmitters.

- In UK, a report sent to government explains that these Chinese components can be used to track the movements of intelligence officers and ministers. It can also be used for stifling industrial activities.

- **Key steps taken:**

- **Ban on several Chinese apps and technology** due to data leaks, vulnerabilities, and national security risks that they pose.
  - In 2020, India started banning Chinese applications which now cover more than 250 applications.
- **Examples of Chinese firms under wider scrutiny in India**
  - Exclusion from 5G telecom trials
  - Increasing restrictions on research collaboration
  - Income Tax Searches

- **Way Forward:**

- **Work on outlining technical evidence** to prove that the attacks are from China.
- **Complete analysis of Chinese Products** (Apps, Software, SMART Products) etc being used in India.
- **Work on developing competitive replacements** to Chinese firms.
- **Expand Cyber Defence and Cyber Offensive Capabilities** to counter these cyber-attacks.
- **Other suggestions to strengthen Cyber Security** (already discussed in detail)

## 10) STATE'S USE OF NON-STATE ACTOR IN CYBERSPACE

- **Example Question:**
  - Without proper legislation, states using non-state actors for cyberwarfare pose a significant threat to governments, businesses, and individuals (Aug 2023)
- **Introduction:**
  - A Cyber non-state actor is an entity with no specific physical territory or territorial sovereignty that operates in cyberspace. It can include individuals, groups, or organizations that operate independently or in association. Non-state actors can significantly threaten governments, businesses, and individuals.
- **Why do states choose non-state actors?**
  - **Protect themselves:** Though cyberspace ensures anonymity, non-state actors provide additional protection to the states during cyberattacks, as they can claim plausible deniability and avoid blame to evade indictment.
    - For instance, North Korea uses Bureau 121, a hacking group, to carry out cyberattacks primarily against South Korea while maintaining certain distance from their repercussions.
  - **Other factors** include lack of national capabilities, lack of resources, lack of national talent pool etc.

### - Examples of non-state actors:

Types	Motives	Examples	Examples of their activities
State-Sponsored hacking groups	Advancing the states' geopolitical agenda as well as accruing financial gain	Lazarus Group: a North Korean-sponsored hacking organisation	A phishing attack on the Bangladesh Bank network to steal US\$81 million in 2016.
Cyber mercenaries	Financial gain	Team Jorge: A group of Israeli contractors engaged in malicious cyber activities	Kenya's presidential election campaign rigged by hacking personal chats and contacts of personal aides of President William Ruto to send messages to military commanders and ministers.
Hacktivists	Desire to contribute to social or political change	Ukraine IT Army: Cybersecurity experts who volunteered to attack Russia	Distributed denial of service attacks on 5,500 Russian websites in the initial months of the war.

### - Implications:

- Cyberspace and non-state actors have reduced the gap between the well-off country and a developing country in terms of their capability to attack.
  - Non state actors are also used for strengthening cyber defences.
- **Threats:**
- The non-state actors also have a very disruptive and destabilizing nature.
  - They can also be a threat to democratic process - for instance cyber mercenary group Team Jorge claims to have interfered in 27 Presidential-level campaigns worldwide through hacking, disinformation, planting fake intelligence etc.
- **What should be done?**
- **International Treaty** - Against using non-state actors for cyber-attacks (use can be allowed for strengthening defences)
  - **Legislation** is necessary to curtail activities on non-state actors.
  - **Strengthen own Cyber Offence and Defence Capabilities.**
- **Conclusion:**
- As geopolitical rivalries deepen with time, the use of non-state actors is only set to grow. It is important that the nation states come to a international agreement against the use of non-state actors.

## 11) MAIN TYPES OF CYBER THREATS ON THE BASIS OF MECHANISMS USED

### A) MALWARE

**Malware** (Malicious Software) is any program of file that is harmful to a computer user. It includes computer viruses, worms, Trojan horses and spyware.

- These malicious programs can perform a variety of functions, including stealing, encrypting or deleting sensitive data, altering or hijacking core computing functions and monitoring users' computer activities.
- **Virus**
  - A virus is a malware that can execute itself and spreads by infecting other programs or file. Viruses are typically attached to an executable file or a word document. They often spread via P2P file sharing, infected websites, and email attachment downloads.
  - Once a virus finds its way onto your system, it will remain dormant until the infected host file or program is activated, which in turn makes the virus active enabling it to run and replicate on your system.
- **Worm** is a type of malware that can self-replicate without a host program. Worms typically spread without any human interaction or directives from malware author.
- **Trojan Horse** is a malicious program that is designed to appear as a legitimate program. Once activated following installation, trojans can execute their malicious functions.
- **Spyware** is a kind of malware that is designed to collect information and data (including intellectual property data) on users and observe their activity without users' knowledge.
- **Ransomware** is a sophisticated malware that bypasses the traditional layers of security and makes the user's computer files inaccessible by either locking them up or encrypting them. The user is then asked to pay a "ransom" to the cybercriminals to regain access to the data.
  - E.g. **WannaCry** (May 2017)
  - Ransomware attacks on AIIMS in Dec 2022.
- **Rootkit** is a type of malware designed to obtain administrator level access to the victim's system. Once installed, the program gives threat actor the root or privileged access to the system.

### B) ADVANCED PERSISTENT THREAT (APT)

- An APT is a prolonged and targeted cyberattack in which an intruder gains access to a network and remains undetected for an extended period of time.
- The intention of an APT attack is usually to monitor network activity and steal data rather than to cause damage to the network or organization.
- They typically target organizations in sectors such as national defense, manufacturing and financial industry as these companies deal with high-value information, including IPR, military plans etc.

### C) DENIAL OF SERVICE (DISTRIBUTED DENIAL OF SERVICE)

It is an attack in which a malicious bot sends more traffic to a targeted IP address than the programmers who planned its data buffers anticipated someone might send. The target becomes unable to resolve legitimate requests.

### D) RANSOMWARE – MORE DETAILS

- **Why in news?**
  - In Nov 2022, for sometimes, e-services of All India Institute of Medical Sciences (AIIMS) were crippled by what is being suspected to be a ransomware attack.
- **What is Ransomware?**
  - It is a type of malicious software, used by criminals, to infect a computer system by blocking access to the stored data by encrypting the files. A ransom is then demanded from the owner in exchange of the decryption key.
- **How serious was the AIIMS ransomware attack?**
  - At least five of the AIIMS' servers that hosted data related to more than three crore patients were compromised.
- **How serious are ransomware attacks?**
  - Cybersecurity firm Trellix, in its third quarter global report, had identified 25 major ransomware in circulation. As per Interpol, Ransomware was the second highest ranking threat after money laundering, at 66%. It is also expected to increase the most (72%).
  - In India, several cases of ransomware attacks targeting commercial and critical infrastructure have been reported in the recent past.
    - » In May 2022, SpiceJet had faced such threat.
    - » In April 2022, Oil India, a PSU was targeted.

### E) CRYPTOJACKING

- **Definition:**
  - It is a cyber-attack wherein a computing device is hijacked and controlled by the attacker and its resources are used to illicitly mine cryptocurrency.
  - In most cases, the malicious program is installed when the user clicks on an unsafe link or visits an infected website - and unknowingly provides access to their internet-connected device.
- **Why has Cryptojacking incidents gone up?**
  - The crackdown on other kinds of attacks like ransomware has forced cybercriminals to look for alternative methods.
  - Cryptojacking involves lower risk and promises higher returns.
    - Unsuspecting users across the world see their devices get unaccountably slower, but it's hard to tie to criminal activity, much less point to the source.
- **Way Forward:**

- Increase awareness of Cyber Hygiene and enhance cyber security (already discussed in details).

## F) ACOUSTIC SIDE CHANNEL ATTACKS

- Why in news?
  - A research paper titled "A Practical Deep Learning-Based Acoustic Side Channel Attack on Keyboards", published and supported by the ethics committee of Durham University, U.K., revealed that **AI can be used to decode passwords by analysing the sound produced by keystrokes** (Aug 2023)
- Understanding Side Channel Attacks (SCAs):
  - SCAs are methods of hacking a cryptographic algorithm based on analysis of auxiliary systems used in the encryption method. It can be done by collections of signals emitted by devices, including electromagnetic waves, power consumption, mobile sensors as well as sound from keyboards and printers to target devices. Once collected, these signals are used to interpret signals that can be then used to compromise the security of a device.
  - Studies have shown that when a classifier is trained on keystrokes by a nearby phone, it achieves an accuracy of 95%, the highest accuracy seen without the use of a language model.
- In Acoustic Side Channel Attacks (ASCAs), the sound of clicks generated by a keyboard is used to analyze keystrokes and interpret what is being typed to leak sensitive information.
  - These attacks are very dangerous as sound from keyboards are readily available and their misuse is under-estimated by users.
  - Penetration of laptops have also made it more risky as same laptop models tend to have the same key making it easier to AI Deep Learning to deal with it.
- ASCAs are not new and have been used since 1950s when acoustics emanating from encryption devices were used to crack their security. But, with new technologies like deep learning the threats have enhanced.
  - How can users protect against ASCAs?
    - No explicit means of defence but some measures like touch-based typing of passwords can reduce vulnerability.
    - Creating stronger passwords that use a combination of lower- and upper-case letters can solve the problems to some extent.
    - Avoid easily recognizable phrases which can make it easier for AI models to predict the text.

### 3. PRELIMS FACTS

#### 1) S&T: CYBER SECURITY: C-DOT

- **Why in news?**
  - C-DOT celebrates its 40th Foundation Day (25th Aug 2023)
- Centre for Development of Telematics (C-DOT) was established in 1984 as an autonomous Telecom R&D centre of DoT, Gol. It is a registered society under the Societies Registration Act, 1860.
- It is chaired by Ministry of Communication and Information Technology.
- It is a registered public funded research institute with the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology.
- **Key contribution:**
  - In its initial years, it triggered the telecom boom in the rural India that was responsible for all around socio-economic development.
  - As part of its development process, it also spawned a wide base of equipment manufacturers and component vendors for the industry.
- Over the years it has evolved into full-fledged telecom R&D institution, that complies with level-5 maturity on CMMI Model and has capabilities to undertake large-scale state of art telecom technologies development programs.
- C-DOT as a torch bearer of indigenous telecom R&D continues to develop latest technology products in areas like Optical, Switching, Wireless, Security and Network Management while also working on futuristic technologies like M2M/IOT, 5G, AI etc.
- It also works towards realizing the objectives of various flagship programs of the Government of India that include Digital India, Make In India, Skill India, Startup India, and Smart Cities.

#### 2) S&T: CYBER SECURITY: TRINETRA – ENTERPRISE SECURITY OPERATION CENTRE

- Ministry of communication and information technology has launched TRINETRA on 25th August 2023.
- It is aimed at providing end-to-end security solution to the organizations for detection, analysis and mitigation of cyber security threats.
- It is a combination of multiple security systems like Security Information and Event Management (SIEM), Security Orchestration and Automated Response (SOAR), Data Loss prevention etc.
- It provides 24X7 near real-time actionable cyber security status and detection and resolution of cyber threats (Virus, Malware, Ransomware, Spyware etc.)
- It also performs security evaluation of organization's IT assets by protecting endpoints including PC, Laptop, Servers and VMs by detection, analyses, and mitigation of vulnerabilities and giving AI enabled automated responses to the cyber threats ensuring protection of sensitive data.



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

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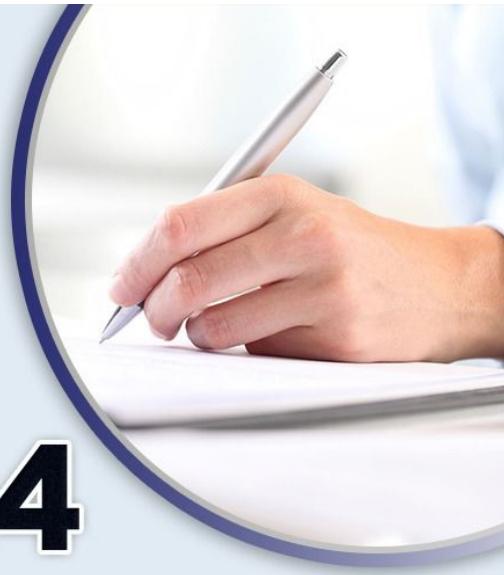
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# Optional DAMP 2024



## DAILY ANSWER WRITING & MENTORSHIP PROGRAM



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## 1. GENERAL STUDIES-2

### 1) POLITY: ELECTIONS – ONE NATION ONE ELECTION

- **Why in news recently?**
  - The government has constituted an 8-member high-level committee headed by former President of India **Ram Nath Kovind** to explore the possibility of "one nation, one election" (Sep 2023)
- **Practice Questions:**
  - Discuss the key problems simultaneous elections to Lok Sabha and State Legislative assemblies are expected to solve. [10 marks, 150 words]
  - 'Simultaneous election to the Lok Sabha and the State Assemblies will limit the amount of time and money spent in electioneering but it will reduce the government's accountability to the people' Discuss [10 marks, 150 words] [CSM 2017]
- **What is Simultaneous Elections?**
  - Simultaneous Elections is defined as structuring the Indian election cycle in a manner that elections to Lok Sabha and State assemblies are synchronized together. In such scenario, a voter would normally cast his/her vote for electing members of Lok Sabha and State Assembly on a single day and at the same time.
- **History**
  - Though Vidhan Sabha and Lok Sabha elections started simultaneously in the fifties, in time they developed a natural rhythm of their own, responding to their specific contexts.
- **Why the demands for simultaneous elections?**
  1. **Reduce Policy Paralysis due to frequent elections.**
    - Currently, the Indian polity is in a perennial election mode where the country witnesses 4-5 assembly elections and a number of local body elections throughout the year.
      - Model code of conduct from the time of announcement of elections actually put a lot of limitations on new developmental projects and schemes by both center and states.
      - NITI Aayog has found that MCC is in force for an average of 4 months every year, thus limiting the work of development for 33% of the period in a year.
      - Ministers (being politicians) focus more on elections rather than on various ministries/departments.
  2. **Diversion of Human Resource** (like teachers and other government staff) for election purpose
  3. **Focus on long term goal/ politically difficult decisions**
    - Frequent elections forces government to focus on short term populist measures due to the electoral process.
  4. **Saving Expenses:** Simultaneous elections will save a lot of money - by ECI as well as by the Political Parties.
  5. **Easy for Election Commission**
    - Election commission will have to focus on election only once or twice in five years according to plan taken

6. Limit the use of security forces for election work
7. Voter Participation may increase as they have to come only once or twice to the booth.
8. Other problems due to frequent elections
  - Disrupts normal public life and impacts the functioning of essential services
  - Frequent elections **perpetuates casteism and communalism.**
    - For Chief Election Commissioner wrote that **elections are polarizing events which have accentuated casteism, communalism, corruption and crony capitalism.**

- Commissions/Committees

- Law Commission of India headed by Justice **B.P. Jeevan Reddy** in its **170th report (1999) on Reform of Electoral laws recommended** simultaneous elections to Lok Sabha and State legislative assemblies. It was **reiterated by draft recommendations of LCI in Aug 2018.**
  - It also provided a mechanism of preventing dissolution of assembly by **replacing no confidence motion with a constructive no confidence** through appropriate amendments.
- The **Department related parliamentary Standing Committee on Personnel, Public Grievance, Law and Justice** in its **79th report (Dec 2015)** and recommended holding simultaneous elections.
- NITI Aayog in a **white paper released in 2017** also supported simultaneous elections.
- Now, on **1st Sep 2023**, the central government has **constituted a committee under the chairmanship of former President Ram Nath Kovind** to examine the issue.

- Some Criticisms and Impediments to simultaneous Elections

1. May undermine federal structure and democracy.
  - Constitution recognizes existence on **28 states which have a constitutional status of their own** in matters of elections and government formation. Any violation of this federal structure **may be seen as the violation of the basic structure of the constitution.**
  - **Keeping absolute power in check:** In our constitutional scheme, the **federal structure is an important check upon the concentration of power** (buttressed by the existence of the Rajya Sabha at the Central Level). This federal structure is **sustained by a plurality of political outfits**, at the State Level. But simultaneous elections may **undermine this plurality**, and risk concentration of power.
  - **Elections are about democratic representation everything else is secondary (including expenditure).**
2. Simultaneous Elections may hamper public participation and debate:
  - In the Indian Constitutional scheme, we don't have **public participation in law making a guaranteed right. Elections are the only form of participation in public sphere. Relatively regular and frequent elections allow for more extended public participation and debate;**
3. **Impractical:** Needs constitutional amendment; Preventing decoupling would be a challenge.
  - a. **Beginning the process would be challenging.**
    - Some state assemblies will have to be **extended** while some will have to be **cut short** - this would be unfair to sovereign democratic mandate given to states in the first place.
  - b. **How to stop decoupling cycle to start once again**
    - If Lok Sabha is dissolved before five years -> what happens to all assemblies

- If any other state government falls -> what happens to this state
  - **Options: Constructive No Confidence Motion**
    - Instead of dissolving invite opposition to form government for rest of the period.
  - c. **Not possible in existing constitutional framework:** Constitutional Amendment would be required to initiate the simultaneous election process in articles such as **Article 83** (fixed tenure for LS i.e. five years), Article 85, **Article 172** (Fixed tenure for legislative assembly i.e. 5 years), Article 174 and 356 of the constitution.
4. **Local issues may be put to backburners**
  5. **Benefit national parties at the cost of regional players**
  6. **Frequent elections keep governments on alert**
  7. **If Model Code of Conduct is an issue - amend and modify it**
- **Conclusion1** (if you are not supporting simultaneous elections)
    - Constitutional experts like Gautam Bhatia say that administrative benefits from simultaneous elections are overstated at best, and non-existent at worst. But, the damage to federalism and democracy may be big. Therefore, the idea of simultaneous elections is a bad one, and ought not to be acted upon.
  - **Conclusion2:** (If you are supporting simultaneous elections)

## 2) G20/G21

- **Introduction**
  - The Group of Twenty (also known as G-20 or G20) is an international forum for the governments, finance ministers and the central bank governors from 20 major economies.
  - It was founded in 1999 as an informal forum of Finance Ministers and Central Bank Governors of its members to meet annually, with the aim of studying, reviewing, and promoting high level discussion of policy issue pertaining to the promotion of international financial stability.
  - Its agenda was expanded in 2008 with the inclusion of the head of government in the meet. After this first summit it replaced the G8 as the main economic council of the wealthy nations.
  - G-20 in the current form is the child of 2008 global financial crisis.
  - Please note that G20 is an informal grouping and thus it doesn't have permanent secretariat/ staff. **Rather, G20 presidency rotates annually** among members and is responsible for bringing together the G20 agenda, organizing its workings and hosting summits.
- **Members**
  - **19 countries and EU**
    - Canada, US, Mexico, Brazil, Argentina, UK, France, Germany, Italy, Turkey, South Africa, Saudi Arabia, Russia, China, India, Japan, South Korea, Indonesia and Australia.
    - EU is represented by European Commission and European Central Bank.
  - **Note:** In the 2023 summit in Delhi, inclusion of African Union has been agreed upon.
  - **The UN, IMF and WB** also attend G20 meet.

- Spain is a permanent guest invitee at the summit.
- Objectives:
  - Policy Coordination between its member countries in order to achieve global economic stability, sustainable growth.
  - To Promote Financial Regulations that reduce risks and prevent future financial crisis.
  - To Create a new international financial architecture.
- Significance of G20
  - G20 has emerged as the premier forum of international economic cooperation, a sort of mini-UN, towards building an open world economy. G20 got its reputation because of its ability to restore stability in the global financial system after the 2008-09 crisis.
  - Discussions and agreements at G20 help in reshaping the governance of global finance. It has enabled work towards reform of IMF, WB and United Nations as all the major world economies are represented here.
  - The member countries (before addition of AU) represent 90% of the Gross World Product, 80% of the trade, 2/3rd of the World Population and approximately half of the world land area.
  - When global governance in general is continuing to reflect the power equations at the end of World War - II, the G20 is a recognition of the changed realities and has given a place at the international high table to emerging powers.

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#### A) 2023 G20 SUMMIT: INDIA

- India's Presidency Theme was "Vasudhaiva Kutumbakam" which means "the world is one family".
- Key Outcomes:
  - New Delhi Declaration: The G20 has adopted a consensus declaration with following highlights:
    - **On Ukraine War:**
      - All states must act in a manner consistent with purposes and principles of UN charter in its entirety.
      - They must refrain from threat or use of force to seek territorial acquisition against territorial integrity and sovereignty or political independence of any state. States must also refrain from use of or threat of use of nuclear weapons.
      - Peaceful resolution of conflicts and efforts to address crisis as well as diplomacy and dialogue are critical.
      - **"Today's ERA must not be of war"**
    - **On Grain/Food/Energy Security:**
      - The declaration calls on Russia and Ukraine to ensure unimpeded delivery of food and fertilizer inputs from Russia and Ukraine.
    - **On Economies and Financial Market:**
      - It endorses financial board's high level recommendations for regulation, supervision and oversight of Crypto-assets, activities. Finance Ministers and central bank governors will discuss taking forward the cryptocurrency roadmap at their meeting in October.

- **Renew our commitment** to ensure a level-playing field and fair competition by discouraging protectionism, market distorting practices.
  - **On Climate Change:**
    - Notes that there is a need to accelerate efforts to phase down unabated coal power, in line with national circumstances.
    - The declaration noted that \$5.8-5.9 trillion in pre-2030 period is required by developing countries, in particular for their needs to implement their emission targets.
  - **On Global Debt Vulnerability:**
    - It committed to promoting resilient growth by urgently and effectively addressing debt vulnerabilities in developing countries.
  - **Health:** It remains committed to strengthening global health architecture.
  - **Terrorism:** It condemns terrorism in all its forms and manifestations, including those on the basis of xenophobia, racism, and other forms of intolerance, or in the name of religion or belief, recognizing the commitment of all religions to peace.
- **Announcement of G-20 decision to include the 55-nation African Union**, the second regional bloc to join the G-20 after the EU.
- With this, the future summits in Brazil and South Africa is expected to take India's Global South Initiative forward.
  - The move help tilt the balance within G-20 away from Power-11 of the geopolitical powers, the G7, Australia, the EU and the Russia and China combined to the Developing 10 (Argentina, Brazil, Mexico, African Union, South Africa, Turkey, Saudi Arabia, India, South Korea and Indonesia) who make up rest of the member.
- **Finance Track of India's G20 Presidency** also paved the way for coordinated global approach to regulating cryptocurrencies, strengthening multilateral development banks' lending capacity and replicating the use of digital public infrastructure like the India Stack to expand financial inclusion around the world.
- Discussion on the regulation roadmap for cryptocurrencies and strengthening of developmental banks will continue in Morocco in Oct when the G-20 ministers will meet in Marrakech for the IMF and World bank autumn meeting.
- **Announcement of India-Middle East - Europe Economic Corridor (IMEE EC)** to strengthen economic connectivity between India-West Asia and Europe.
- **Launch of Global Biofuel Alliance** on the sidelines of G20 summit.
- **Analysis:**
- **Positives:**
    - **India's G20 presidency was both a challenge and opportunity for India to showcase its leadership in global affairs:**
      - There were several challenges - the international order is in a flux, geopolitical contestation has sharpened, weaknesses of existing multilateral institutions and the global economy is facing strong headwinds.

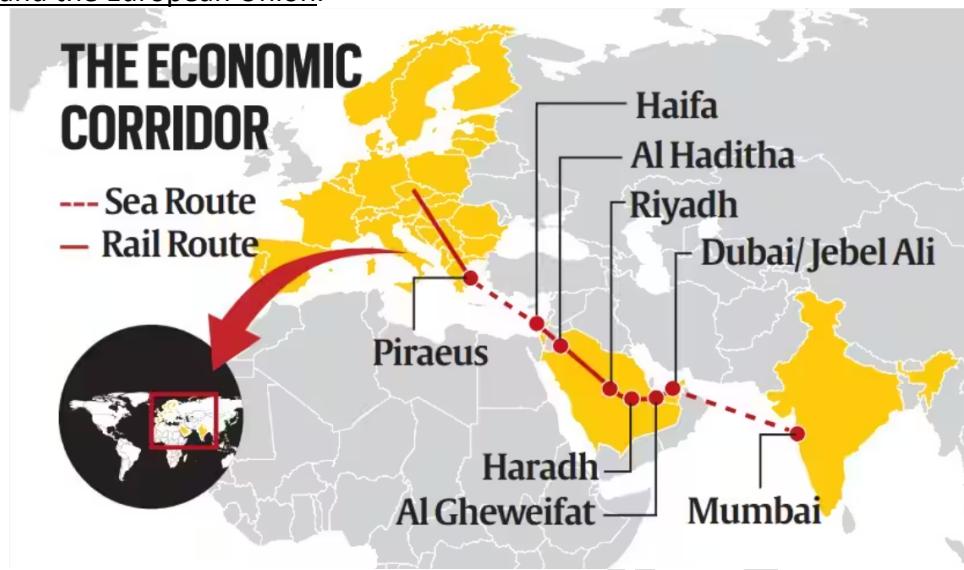
- But, by forging the consensus between the G-20 nations on New Delhi Declaration, India has shown its diplomatic ability, growing clout and cordial relations on both sides of the divide.
- **India has made G-20- more inclusive:** What was once a summit merely for technocrats and policy wonks has become a people's festival.
  - It was a tremendous organizational effort, with over 200 meetings in 60 cities, and association of sections of society, economy and the academic community.
- **Interest of Global South** has been given much higher profile in this summit.
  - India organized a Voice of Global South Summit with participation from 125 countries.
  - The inclusion of African Union was a powerful symbol of importance attached to the Global South
- IMEE EC which was unveiled during the summit has the potential to be an effective counter, though comparatively limited in scope, to the ambitious BRI.
- The GBA was an important step towards more research and delivery of alternative energy sources for a world still dependent on fossil fuel.
- The summit also focused on Technological Transformation and Digital Public Infrastructure (DPI), thus providing India an opportunity to showcase its considerable accomplishments in these areas.
- **Conclusion 1:**
  - "With its deft leadership, New Delhi has managed to put its own distinct imprimatur on the G-20, making it a much more dynamic platform and in the process, India has managed to elevate its own credibility in the global order" - Harsh V Pant.
- **Conclusion 2:**
  - "As the G20 President, we had pledged to make the global table larger, ensuring every voice is heard, and every country contributes. I am positive that we have matched our pledge with actions and outcomes" - PM Narendra Modi.

---

## B) INDIA-MIDDLEEAST-EUROPE ECONOMIC CORRIDOR (IMEE EC)

- It was announced by PM Modi during the G20 Summit in India in 2023
  - India, USA, UAE, Saudi Arabia, France, Germany, Italy and the European Union Commission have signed MoU to establish IMEE EC.
- It entails an ambitious project that could leverage railway tracks and shipping corridors to help physically link up a vast stretch of the Eurasian subcontinent and in the process improve digital connectivity and catalyze trade among countries including energy products including Green Hydrogen.
- It will consist of **two separate corridors**:
  - **East Corridor** connecting India to West Asia/ Middle East
  - **Northern Corridor** connecting West Asia/Middle East to Europe

- i. It involves laying of a railway link through the Arabian Peninsula that could then link up with shipping passages to India and Europe on both ends.
- The initiative is jointly spearheaded by the US and India, and spans India, UAE, Saudi Arabia, Jordan, Israel, and the European Union.



- **Significance:**
  - **Impetus to Economic Development:** It is being positioned as a modern-day spice route which can lead to enhanced connectivity and economic integration.
  - **Strategic Significance:** it will act as weighty ideological alternative to China's BRI.
  - **Reduce dependency on Suez Canal:** The use of land route in the Arabian Peninsula could mean bypassing the congested Suez Canal that cargo ships currently take. Eventually it will create a seamless corridor running all the way from Southeast Asia to Europe.
- **Official timelines and Funds** details is yet to be announced.

### C) GLOBAL BIOFUEL ALLIANCE

- Launched during the sidelines of G-20 Summit in Delhi in 2023 by PM Modi and a host of global leaders including US President Joe Biden, Brazilian President Lula da Silva, Bangladesh PM Sheikh Hasina and Italian Prime Minister Giorgia Meloni.
- **Initiating members** include USA, Brazil, Argentina, Italy, South Africa, Mauritius, UAE, India and Bangladesh.
  - **Observer Countries:** Singapore and Canada.
- Other G-20 countries have been urged to join the initiative.
- **The alliance is aimed** at facilitating global cooperation in increasing the sustainable production and use of biofuels across the sector.
  - Its focus is on strengthening market, facilitating global biofuel trade, developing concrete policy lesson-sharing and providing technical support for national biofuel program worldwide.
  - **Target:** Take ethanol blending with petrol globally to 20%.

- The Alliance mirrors International Solar Alliance (ISA) which aims to bring clean and affordable solar energy within the reach of all.

### 1) ECONOMY: INDIRECT TAX: GST

- **Why in news?**
  - Total GST collection for **FY23** stood at **18.10 lakh crores**, 22% higher than the previous year.
- **Example Questions:**
  - "The last six years of the GST journey have been like the "samudra Manthan" that began with unwanted element of transition, but slowly yielded the nectar of higher revenues" Elaborate [10 marks, 150 words]
- **Introduction**
  - The GST is the most important indirect tax reform in recent years and it carried VAT to its logical conclusion. It was passed by Parliament in Aug 2016 through the 101st Constitutional Amendment Act and was rolled out from 1st July 2017.
- **Key Features:**
  - It has subsumed several indirect taxes at central and state level and acts as one indirect tax for the whole nation on the supply of goods and services.
  - **Avoids Cascading** of taxes through input tax credit (ITC) mechanism.
  - It is applicable on supply of goods and services instead of earlier concept of tax on the manufacture or sale of goods or on provision of services. It is a destination-based tax. Earlier indirect taxes were origin based.
  - GST is a dual tax and centre, and states are simultaneously levying it on a common base.
  - An integrated GST (IGST) is levied on inter-state supply of goods and services.
  - **Imports of goods or services** are deemed as supply of goods or services or both, in the course of inter-state trade or commerce and thus attract IGST.
    - Note: Basic custom duties which were levied on import of goods, continue to be levied in addition to IGST on imported goods.
  - **Exports** are zero-listed.
  - **GST Council** is a federal Constitutional authority created to give recommendations on the rates of taxes on different goods and services. It is chaired by Union Finance Minister.
- **Advantages of GST**
  - i. **For Business and Industry-> Easy compliance** (online filing, single tax, less chance of harassment); **Uniform tax rate** (common national market, easy expansion); **Removal of cascading** (reduction of total tax payment); Increase competitiveness; **gain for manufacturers and exporters**.
  - ii. **Advantages of Government (Center and State) -> Easy administration** (Single Tax, end to end IT system); **Better control over leakage** (robust IT infra, simple tax structure -> easy compliance); **Improved tax base**; A more transparent basis for apply WTO's National Treatment Principle; **Higher revenue efficiency** (less cost of administration); **Spur economic growth**; **Reduced**

**corruption; Promote cooperative federalism** (In GST system center and states work together for the nation's benefit).

**iii. For Consumers/citizens -> Cheaper goods and services;** Higher revenue efficiency-More money with government -> More social initiatives; **increased resource for resource consuming states** (as this is a destination-based tax).

## A) 6 YEAR ANALYSIS OF GST AND KEY SUGGESTIONS FOR IMPROVEMENT

### - Positives:

- **Tax base has increased** (Update)
  - **Average monthly GST collections** has increased to 1.55 lakh crore in 2022-23.
  - **Number of GST taxpayers** have increased from 70 lakh in FY18 to 1.4 crore in FY23.
  - **Small businesses and informal sectors** initially faced some issues, but many of them jumped to the tax net to take advantage of ITC.
  - **GSTN**, as a common technology platform has simplified tax compliance. It provides a one stop solution where key business process registration, payment of duties and filing of returns are done online in a transparent manner.
  - **Action taken against tax evaders, including steps being taken by tax authorities**, has resulted in better compliance and helped push the growth in GST collection.
- **Facilitated free movement of goods and services** and **Increased efficiency of logistic supply chain:**
- **Reduced Tax Burden:** Overall tax on many essential use items have come down. Further, with input tax credit the cascading has been reduced.
- **Push for Cooperative federalism:** GST Council has played a crucial role in forging a national consensus on key issues related to tax regime - rates, exemptions, business, processes, and movement of ITC.
- **System has evolved to simplify tax compliance for MSME sector:** Recently, threshold exemption limit was increased from 20 lakh to 40 lakh for goods and Quarterly Returns and Monthly Payments (QRMP) system was introduced.
- **Tax Evasion has reduced:**
  - E-Invoicing has become an integral part of doing business in India.
  - The GST number that can track every supply chain transaction has helped to address fraudulent claim.
  - **Coordination between CBIC and CBDT** has increased to ensure easy compliance.

### - Negatives/Limitations

- **Federal Issues:**
  - **Fiscal Autonomy reduces for states and ULBs** - states now have limited scope to raise their own revenue. **ULBs are also much weaker and more dependent on state grants.**
  - It **harms the producer state and reward the consumer state** in terms of revenues.
    - States like TN which have invested heavily in their manufacturing ecosystem are not facing revenue challenges. **GST compensation period has also ended. After the end of GST compensation, fiscal strain is expected in state budget as the median growth rate of subsumed tax in many states are much lower than 14%.**
- **GST Council decides the increase or decrease of tax rates.** Earlier, these powers were only with Parliament/state legislatures.

- **Criticism of keeping some items out of GST Net.**
  - This goes against the principle of 'One nation one tax'. It also allows continuance of cascading.
    - Further, sectors like airline industry is not able to get credit for taxes paid of jet fuel.
    - Major black money generating sector such as real estate are out of the GST regime
  - **Multiple Rates and Cess -> not a simple tax**
  - **Advanced Economies like USA have also not moved onto GST path yet:** It is mostly due to their federal structure and federal autonomy.
  - **Large businesses/units are reluctant to purchase from MSME sector** as they don't get ITC.
  - **Delay in establishment of Appellate tribunal** related to GST is increasing the burden on Judiciary. Trapped GST refunds and numerous court cases are alarming.
  
- **Way Forward:**
  - **GST structure needs to be further simplified and rationalized:** This was recommended both by 15th Finance Commission and the Revenue Neutral Rate Report.
    - New structure should have lesser number of rates (preferably 2, but at max 3).
    - National Institute of Public Finance and Policy has also recommended a three-rate framework of 8%, 15% and 30%.
  - **Petroleum products** should be brought under GST regime. This should be followed by inclusion of real estate and electricity sector.
  - **To increase the attractiveness of MSME sector** by large enterprises, amend the law to provide that all units buying from unregistered GST suppliers would have to pay duty on a reverse charge basis.
  - **Set up GST Appellate Tribunal** as soon as possible as dispute resolution remains a pain point.
  - Finally, **GST Council's working needs tweaking**.
    - During Vajpayee regime, Yashwant Sinha established a culture of consensual decision making on indirect taxes. He did this by requiring the Empowered Committee of State Finance Ministers to be headed by a finance minister from an opposition-run-state government, such as Asim Das Gupta from WB and Sushil Modi from Bihar. This spirit can be translated in GST Council's functioning as well.

## B) GST ON GAMING SECTOR

- **Why in news?**
  - GST Council, in its 50th meeting in July 2023 decided to levy a uniform 28% tax on full face value for online gaming, casinos, and horse-racing. (July 2023)
  
- **About Online Gaming Market:**
  - The revenue of the Indian Mobile Gaming industry is expected to exceed \$1.5 billion in 2022 and is estimated to reach \$5 billion in 2025.
    - It grew at a rate of 38% CAGR between 2017-20.
  
- **Details of GST Council's decision:**

- The GST council has recommended a uniform levy of 28% tax on the face value of chips purchased in the case of casinos, on the full value of bet placed with bookmaker/totalizer in the case of horse racing, and on the full value of the bets placed in case of online gaming.
  - Government has now expected to bring amendment to the GST-related laws to include online gaming and horse racing in Schedule III as taxable actionable claims.
- **Significance:**
- Increase in tax base.
  - The taxation aligns with the regulation of the MeitY.
  - Moral suasion to stay away from betting and online gaming addiction.
  - Simplification and transparency in the gaming sector.
- **Criticism:**
- Online gaming companies have said that this will be catastrophic for online gaming industry which have to compete with several international players.
  - They also complaint that it will benefit illegal gaming platforms.
  - Nowhere in the world is tax levied on the entire money that is pooled in online game. The levy of tax is always on the amount charged for the provisions of service and this can only be on the platform fee or service charge levied by any gaming company.
  - Negative impact on employment in a sector which already employs more than 100,000 employees.

## 2) INCREASING DIRECT TAX BASE

- **Why in news?**
  - Less than 6% of the population has filed ITR in FY23 (July 2023)
    - Only 7.4 crore people out of 140 crore population have filed ITR in 2022-23.
- **Example Questions**
  - Though the direct tax collection has increased in recent years, there is still a huge scope for improvement. Suggest measures to increase direct tax base in India. [10 marks, 150 words]
- **What is Direct Tax?**
  - Direct taxes are those taxes where impact and incidence lie on the same point (i.e. the burden for the tax falls on the entity that is being taxed). These taxes are generally progressive in nature and are highly elastic.
  - Because the direct taxes are **progressive**, they bring equity in society (which doesn't happen with indirect taxes). Therefore, the direct taxes need to be monitored carefully.
- **Direct Tax in FY23:**
  - India's net direct tax collection has risen by 17.63% in 2022-23 to touch **Rs 16.61 lakh crores**, as per the data released by Finance Ministry in April 2023.
    - It was 14.09 lakh crore in FY22 and 9.41 lakh crores in FY21.
  - **Corporate Tax - Rs 10.04 lakh crores** (51.1% of direct tax) and **Personal Income Tax** and Securities Transaction Tax accounted for **Rs 9.61 lakh crores** (48.9% of direct tax)

- **Current Tax Base:**
  - Less than 6% of the population has filed ITR in FY23. Only 7.4 crore / 140 crore population have filed ITR in FY23.
  
- **Why is it important to increase the Direct Tax Base?**
  - **Boost Economic Growth:** More Resources with government will let better implementation of various infrastructure and social projects.
  - **Fights Inequality:** Indirect tax are regressive, but direct taxes are progressive and thus promote equality. Direction taxes also avoid severe distortionary trend of indirect taxes.
  - **Educative Value:** Direct tax creates a civic sense among taxpayers. Because money is directly paid by citizens, they become more vigilant of where and how government is spending their money.
  - **Anti-Inflationary:** Direct Tax can be considered a good instrument of anti-inflationary fiscal policy.
  - **Reduce pressure on honest taxpayers.**
  
- **Key Reasons for recent increase in tax base**
  - i. Cross Seeding of PAN with Bank Accounts and Linking PAN with Aadhar.
  - ii. Introduction of new data sources in the Statement of Financial Transaction (SFT), such as dividend, interest, details of shares etc has led to jump in reported information, with additional information of about 3 crore persons.
  - iii. Expansion of the scope of TDS/TCS: Several new transactions were brought under the ambit of TDS and TCS.
  - iv. **Simplified process through technology:**
    - **Faceless assessment Scheme** is one of the biggest direct tax reforms in India based on key principle of Efficiency, Transparency and Accountability.
    - Simplified ITR filing process through a 1-page SAHAJ return process for individual income tax.
    - **Ease of getting refund**, majorly by small and medium taxpayers have also encouragement more filing of ITRs.
  - v. Steps towards formalization of economy
  - vi. Steps to expand digital payment system
  - vii. Streamlining of GST system
  
- **The above growth is still not good enough** and the tax base is very low (only 7.4 crore people filing FIR)
  
- **Key factors for low tax base**
  - i. **Complex Law**
    - **Income Tax Act 1961** isn't suitable for current scenarios. It has become very complex and has thus reduced compliance.
    - This **complicated structure** is difficult to understand for individuals/corporate sector. Plethora of exemptions and deductions, adding to litigation on these, needs to be removed.
    - **High compliance cost**

- ii. **High Rates** are recipe for low tax compliance.
  - Personal income tax rates are very high leading to high rates of evasion.
- iii. **Poor Tax Administration**
  - A lot of tax evaders go scot-free.
  - Income Tax department doesn't have resources to deal with small tax evaders
  - Corruption is rampant in income tax department.
  - Complaints of harassment by tax officials.
- iv. **Large Informal Sector**
- v. **Agriculture-out of tax net** (sometimes non-agri income is also presented as agri-income)

- **Way Forward**
  - **Simplified Direct Tax Law** - A Direct Tax Code (DTC) has been envisaged for long.
  - **A direct tax council on lines of GST Council**
    - To periodically update the tax rates and other provisions
  - **Increasing Compliance**
    - Reducing tax rates for personal income tax as well
    - Simplifying tax filing (for e.g. recent proposal by CBDT to merge 6 ITR methods into 1 is a step in right direction)
    - Increased resources with income tax department to even prevent evasion from among small players.
  - **Focusing on Behavioural Change**
    - Employ social norms in encouraging the individuals to pay taxes. Countries like UK, Norway, Guatemala to name a few have successfully used the social pressure to increase the tax compliance.
    - CBDT campaigns can focus on salience of taxes in providing public goods.
    - **Incentivize honest taxpayers** - For e.g., by determining the amount of pension on the basis of individual's tax contribution.
  - **Enhance use of new technologies like AI and ML to identify tax evaders.**
  - **Bring Agriculture Income under Tax regime.**
- **Conclusion**
  - Higher direct tax collection could lower the tax burden on the poor by creating fiscal space for reduction in GST rates.
  - Therefore, it is important that government keeps working towards increasing the share of direct taxes in overall tax collection and increasing the tax base.

### 3) REDUCTION OF CORPORATE INCOME TAX AND ITS IMPLICATIONS

- **Why in news?**
  - Government lost Rs 1 lakh crore revenue in FY21 after corporation tax rate cut (Aug 2023: Source - IE)
- **Example Questions**
  - Discuss the key changes in the Corporate Income Tax brought by the Taxation Law (amendment) Act, 2019. How far will it be effective in reviving economic growth in India. [15 marks, 250 words]

- Corporate tax rates which used to be more than 50% in early 1990s was brought down to 30% by 2004-05 as per the recommendations of Shome Committee (2001) and Kelkar Committee (2002).
- But, even at the basic rate of 30% the effective corporate tax paid by Indian companies was around 35% which was on the higher side compared to its peers.



- This high tax rate led to low investments which reduced economic growth potential.
- So, through Taxation Laws (Amendment) Ordinance following changes were made in Sep 2019.
  - **Income Tax rate of 22% (Effective 25% with surcharge and cess)** for all domestic companies (provided they don't claim deductions under the Income Tax Act)
  - Domestic manufacturing companies set up on or after Oct 1, 2019, to pay tax at a **lower 15% rate** (effective 17%) if they forego other incentives.
    - Note: These companies must start manufacturing before April 1, 2023.
  - If a company applies for new rates than the same will be applicable in subsequent years.
  - Provisions related to Minimum Alternate Tax (MAT) will not be applicable for companies choosing new tax rates.
  - **Minimum Alternate Tax (MAT)** has been reduced from 18.5% to 15% for companies not choosing the new tax rates.
- **Positive Implications**
  - India's tax rates have become on par with competing Asian peers.
    - This will **increase the profitability** of the corporate players and thus will contribute to making India an **attractive destination for investment**.
  - It may also increase the export competitiveness of Indian companies as now they will be able to price their products at lower price for same profitability.
  - **Sectors like telecom sector**, which are facing high debt burden, can use the extra money to pay off the debt and thus will contribute to **better functioning** of India's banking system.
  - **Contribute to easy credit availability**.
  - In long run, the enhanced economic activities will increase the tax base and thus may also **boost tax collection**.
- **Concerns**
  - **Revenue loss** and thus increased fiscal deficit in short run.
    - For e.g., recently, finance ministry announced that the government faced a revenue loss of more than 1 lakh crores in FY21.
  - **Hasn't kickstarted investment:** RBI has recently noted that the new tax regime didn't kickstart the intended Investment Cycle.
    - In an annual report for 2019-20, the RBI said that tax rate cut may have been used for debt servicing, building up cash, and other current assets.

- **Way Forward**
  - Reduced tax rates alone can't deal with the key challenges faced by Indian economy. It is a bold move but is only one of the supply side reforms. Other steps required are:
    - Land and Labor Reforms -> to further simplify the ease of doing business in the country.
    - Banking reforms -> to ensure easy credit for consumption and investment.
  - Further, the supply side reforms should be complemented with demand side reforms. Without increase demand, increasing supply will be of no use.
    - Here, there should be focus on increasing income of working and middle class. Here reforming agricultural sector would be crucial as it provides income and employment to more than 50% of the India's population.
    - Continuation of the reform process also calls for Rationalizing Personal Income Tax Rates in alignment with the new CIT rates.
  - Further, since there is going to be a large slippage in fiscal deficit, the central government would do well to enhance the efforts to garner additional non-tax revenue as well as disinvestment proceeds over and above the budget estimates.
- **Conclusion:** In long run, the corporate tax cut, can indeed boost economic activities. It's important that to fully utilize the potential of this cut other complementary steps such as reform in labor laws, strengthening of the banking sector also takes place.

#### 4) FOREX RESERVES

- **Example Question:**
  - Why is forex reserve crucial for any economy? Discuss the key factors behind decreasing forex reserve in India over the last few months [15 marks, 250 words]
- **Basics: Composition of India's foreign Exchange Reserves and who manages these reserves?**
  - India's foreign exchange reserves comprise.
    - **Foreign currency assets (US\$, Euro, Pound, and Yen):** It is expressed in US Dollar or Indian rupee terms.
    - **Gold reserves of RBI:** The RBI has gold stocks as a backup to issue currency and to meet unexpected balance of payment problems.
    - **Reserve Tranche:**
      - It consist of **India's quota** (member subscription fee) to IMF and lending to the General Resource of IMF.
        - **Note:** The General Resource Account is the pool of member countries' quota payment.
    - **Special Drawing Rights (SDR)** holdings of the government
- **Managed by RBI.**
  - **RBI Act and Foreign Exchange Management Act, 1999** set up the legal provisions for governing the foreign exchange reserves.

- **The RBI** functions as the custodian and manager of forex reserves and operates within the overall policy framework agreed upon with the Centre. It allocates the dollars for specific purposes.
    - For e.g., under the Liberalized Remittances Scheme, individuals are allowed to remit up to \$2,50,000 every year.
  - The Central bank uses its forex kitty for orderly movement of the rupee. It sells the dollar when the rupee weakens and buys dollar when the rupee strengthens.
- **Why Foreign Exchange Reserves are important?**
- It acts a cushion against domestic currency volatility once the global exchange rate start rising.
  - It increases the confidence in the monetary and exchange rate policies of the government.
  - During balance of Payment crisis foreign exchange reserve come to the rescue of any country so as to absorb the distress related to such crisis.
  - Strong forex reserves also helps a country to adopt more aggressive countercyclical measures and emerge from a short-lived recession.
  - It also adds to the comfort of market participants that domestic currency is backed by external assets and hence it also helps the equity markets of the country, because due to strong reserves many people from foreign countries are willing to invest in the country.
- **However, holding too much foreign exchange reserves is also not advisable -> (Opportunity Cost)**
- **How much Foreign Reserve do we have?**
- India's forex reserve at \$602 billion as of Aug 2023: RBI
    - **Foreign Currency Assets (FCAs):** \$534.40 billion
    - **Gold Reserves:** \$44.34 billion
    - **SDR:** \$18.32 billion
  - **Note:** India's foreign reserve had peaked in Sep 2021 at \$642.45 billion.
- **How did India's foreign exchange reserves increase till Sep 2021? (Not by exports; but by import of capital)**
- **Why the recent drop in the reserves?**
- Largely due to steps taken by the Reserve Bank of India to support the rupee.
  - Increasing trade deficits (and Current Account Deficits)
  - Capital outflow (FIIs have pulled out) [given the rising global interest rates and bond yields on the back of monetary policy tightening by the US Fed and other major central banks.]
- **Some Recent Steps by RBI:**
- In July 2022, RBI has announced a series of measures including relaxation in:
    - i. **Foreign investment in debt:**
      - FPIs in government securities and corporate debt made till 31st Oct 2022, will be exempted from this short-term limit. These will not be reckoned for the short-term limit of one year till maturity or sale of such investments.
    - ii. **External Commercial Borrowings**
      - Increase the limit under automatic route for ECBs from \$750 million or its equivalent per financial year to \$1.5 billion.

iii. NRI Deposits:

- RBI has allowed banks temporarily to raise Fresh Foreign Currency Non-Resident Bank i.e., (FCNR (B)) and Non-Resident External (NRE) deposits without reference to the current regulations on interest rates. This relaxation is available till 31st Oct 2022.
- From July 30, 2022, incremental FCNR(B) and NRE deposits with reference base date of 1st July 2022, will be exempt from the maintenance of CRR and SLR.

– Conclusion:

- With reserve bank of India showing willingness to use reserves to defend the rupee - ensuring "orderly evolution" of the exchange rate with "zero tolerance for volatile and bumpy movements" - a further drawdown of foreign exchange reserve is possible. The forex reserve was, after all, accumulated as a buffer against currency volatility, external shocks and sudden stop in capital flows. As RBI Governor Shaktinath Das has recently put it, "**You buy an umbrella to use it when it rains**".

## 5) EXCHANGE RATES AND ITS IMPLICATIONS

– Why does depreciation take place?

- Core Reason - Demand supply gap of foreign currency (US\$)
  - Increasing Current Account Deficit (More imports, less exports).
  - Monetary and Interest rate hikes by the US Fed
    - This makes US treasury investment more attractive and leads to **FII's moving funds from emerging economies back to US**.
- Other traditional factors affecting India's exchange rates
  - Mounting External Debt
  - Tightening global liquidity
- Further, since India is an emerging market, **inflation rate** here would be higher when compared to developed countries and there will be a long term depreciation.

– Why the recent depreciation in rupee?

- Since March 2022, the US Federal Reserve has been raising its benchmark interest rate causing investors seeking higher returns to pull capital away from emerging markets such as India and back into the USA. This puts pressure on emerging market economies.
- India's Current Account Deficit is expected to hit a 10-year high of 3.3% of GDP in the current financial year.
- Consistently high domestic inflation

– Negative Impacts

1. Decline in forex reserves
2. Negatively impacts Current Account Deficit -> Vicious Cycle
3. Pulling out of Foreign Portfolio Investments
4. Inflation: Increased prices of imported products
  - Further, increases the cost of crude oil import.
5. Negatively impacts business' taking loans from abroad

- With banks already not willing to lend because of increasing NPAs depreciating rupee makes it difficult for business' to borrow from abroad.

## **6. Difficulty in financing external debt**

## **7. Increase in RBI's monetary policy rates**

- Thus impacting economic growth negatively

## **8. Challenges for students studying or wanting to study abroad**

### **- Positives of declining rupee**

- Depreciation helps in increasing exports as exports become cheaper for importing foreign country.

- Therefore, some sectors like IT, Pharma, hospitality can actually benefit from depreciating rupee.
- This may help in chipping away of trade deficit imbalance.

- **Tourism and hospitality** sector may get a boost

- **Remittances tend to increase** during the depreciating phase

### **- Sectoral Impact**

#### **1. Export based industry would benefit.**

- Depreciation acts as booster for IT and Pharma sector which are export based. Further hospitality sectors such as tourism, hotel etc can benefit as foreign tourists would now find it cheaper to visit India.

#### **2. Problems for Oil Marketing Companies**

- Rise in crude oil prices and depreciation of rupee is a double jeopardy for oil marketing companies. The lack of pricing power during major elections further exacerbate the problems for OMCs.

#### **3. Auto sector**

- Companies having high export shares will benefit from this depreciation.
- On the other hand, operating procedure margins of vehicle manufacturers such as Maruti Suzuki which import most of their components and focus on domestic market are going to face problems.

#### **4. Aviation sector will be hit**

- Increasing cost of Crude oil (thus Aviation Turbine Fuel)
- The big capacity additions on the anvil will also face problems.

### **- Steps taken by Government.**

- Steps to fight trade deficit [see Trade Deficit Topics]
- Steps to attract investments [See currency depreciation topic]

### **- Conclusion**

- Most of the reasons for depreciation in rupee are not due to development internal to India and thus the problem is not India specific.
- Further, though a depreciating rupee may be beneficial for a few sectors, but it doesn't bode well for the country's macro-economic stability, unless export growth increases.
- In long run, India should focus on decreasing its energy dependency, expanding its manufacturing sector to reduce current account deficit, and to make India less vulnerable to these external factors.

- We will need to remove policy barriers that are impeding the growth of export oriented sectors.

And finally, there is a need of reform in the monetary policy framework of RBI to reduce the continuous inflationary pressure on rupee.

## 6) ENVIRONMENT: AIR POLLUTION IN INDIA

- **Introduction: Current Pollution situation in India:**
  - As per WHO India has the 37 out of world's 50 most polluted cities. Similarly, as per the Air Quality Life Index Report 2023, India has 50 of the world's most polluted cities.
- **Major sources** of air pollution in India include Transportation, biomass burning for cooking, Electricity generation, industry, construction, waste burning, and episodic agricultural burning.
- **Impacts**
  - i. **Health** - As per the Air Quality Life Index Report 2023, in North India, PM2.5 shortens lives by eight years
    - Air pollution can cause mental health, Alzheimer's and loss of vision.
    - It can also increase vulnerability to diseases such as COVID-19.
    - Women who are chronically exposed to particulate air pollution are more likely to have underweight babies and preterm birth.
  - ii. **Economy**
    - Lost output due to premature deaths and morbidity from air pollution amount to around 1.4% of GDP (i.e. around 2,60,000 crores). **The overall economic cost of air pollution is estimated at around 7% of GDP (or 14 lakh crores)**.
    - **Agricultural losses**: Other than impacting farm labour productivity, air pollution (PM, Ozone etc.) can lead to reduction in wheat and rice production by around 25%.
    - Air pollution impacts various dimensions of economy from labor productivity to crop yield.
  - iii. **Environmental Impact**
    - **Reduction in yields of Solar Power Plants** - due to rising dust and particulate matter (PM)
- **Key challenges in fighting Air Pollution:**
  - **India's Economic growth is built on fossil fuels:**
    - Coal, Oil, and Natural Gas account for roughly 75% of our power generation and 97% of road transport. But they contribute to the pollution of CO, SO<sub>2</sub>, NO<sub>2</sub>, Ozone, PM etc.
  - **Stubble Burning** -> Farmers yet to get credible alternative
  - **Solid Fuel dependency for cooking in rural areas** -> firewood or dung cake -> Drudgery; Health Impact;
  - **Capital and Human Resource** for dealing with air pollution is lacking
    - This leads to poor monitoring and poor compliance of air pollution norms
- **Way Forward**

- **Legal and Policy Initiatives:**
  - **Effective implementation of National Clean Air Program:**
  - **Phase out of existing coal, oil and gas infrastructure**
    - Closure of old coal-fired power plants can yield health benefits that exceed the value of electricity generated.
    - **Phase out dates for diesel, petrol and gas cars -> Promote electric vehicles**
    - **Transition to affordable and carbon neutral transport -> Strengthening of public transport, good walking and cycling infrastructure.**
    - **Transition to renewable energy.**
      - Share of renewable energy in India has risen dramatically to around 100 GW in Aug 2021, but there is still a long way to go.
- **Deal with issue of stubble burning**
  - PUSA decomposer (use of biotechnology); Awareness; Higher subsidy for machinery etc.
- **Healthy Way to Cook:** Critically analyze the shortcomings of PM Ujjwala Yojna and bring changes to ensure 100% coverage and utilization.
- **Revise Ambient Air Quality Standards** to bring them to **WHO levels** and **implement them** without exceptions.
- **Expand country's Air Quality Monitoring Network** - A number of new, low cost monitors have entered service, that capture readings for not only PM2.5 and 10 but also other gases like NO<sub>2</sub>, SO<sub>2</sub>, methane, VoCs etc.
- **Strengthen CPCB and other SPCBs** to effectively implement the air pollution norms.

- **Conclusion**

- China was once amongst the most polluted countries in the world. But consistent efforts in the field of prioritizing zero-emissions transport, staggered use of Internal Combustion engines, promotion of Electric vehicles etc. while continuing to grow economically, shows that air pollution can be clamped down without impeding economic growth.

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**A) REPORT: AIR QUALITY LIFE INDEX REPORT, 2023 – BY THE UNIVERSITY OF CHICAGO**

- The world's fifty most polluted regions belong to northern plains of India. Seven states - Punjab, Chandigarh, Haryana, NCT, Uttar Pradesh, Bihar, and West Bengal comprise a majority of this region.
- In North India, PM2.5 shortens lives by eight years.
- NCT of Delhi is the most polluted city in the world.

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**B) INTERNATIONAL DAY OF CLEAN AIR FOR BLUE SKIES, 2023**

- **About International Day of Clean Air for Blue Skies:**

- The International Day of Clean Air for Blue Skies is commemorated annually on 7th September. It recognizes that clean air is important for the health and day-to-day lives of people, while air pollution is the single greatest environmental risk to human health and one of the main avoidable causes of death and disease globally.

- **UNGA** by a resolution 74/212 of 22nd Jan 2020, designated the Day to emphasize the need to make further efforts to improve air quality, including reducing air pollution, to protect human health.
- **On 7th Sep 2023**, the 4th International Day of Clean Air for blue skies focused on the theme, '**Together for Clean Air**'. The theme aims to highlight the urgent need for stronger partnerships, increased investment, and shared responsibility of overcoming pollution.

### 3. PRELIMS FACTS

#### 1) CULTURE: POILA BAISAKH (POHELA BAISAKH)

- It is the first day of the Bengali Calendar which is also the inspiration for official calendar of BD. It is celebrated on 15th April in India in the states of WB, Tripura, Jharkhand, and Assam (Barak Valley) by Bengalis regardless of religious faith.
- It is celebrated with processions, fairs and family times.
  - In 2016, the UNESCO declared this festivity organized by the Faculty of Fine Arts, University of Dhaka as a cultural heritage of humanity.
- **West Bengal Assembly** has passed a resolution on 'Poila Baisakh' as State Foundation Day (or Bangla Divas) (Sep 2023)
  - **Background Controversy:** A controversy had emerged when Raj Bhavan had observed June 20, as the Foundation Day.
    - **Chief Minister Mamta Banerjee** has criticized this in the assembly saying that there was no particular day which was observed as the State Foundation Day and June 20 which brings back the memories of partition has nothing to do with Foundation of the state.
- **Resolution on making Tagore's 'Banglar Mati Banglar Jol'** (Bengal's soil and Bengal's water) as the official song of West Bengal was also passed by the assembly.

#### 2) CULTURE: LANGUAGE: KOKBOROK

- **Why in news?**
  - Protests and strikes in Tripura by Twipra Students' Federation (TSF) to press for the introduction of Roman script for Kokborok, state's indigenous lingua franca, and other demands (Sep 2023)
- **About Kokborok language:**
  - Kokborok (or Tripuri) is a Tibeto Burman language of the Indian State of Tripura and neighbouring areas of Bangladesh. Its name comes from Kok meaning "verbal" and borok meaning people of "human". The language was formerly called Tripuri & Tipra Kok, with its name being changed in the 20th century. It has been attested since at least 1st century CE, when the historical record of Tripuri kings began to be written.
  - It was originally written using Koloma script.
  - **Official Language:** It is an official language of the state since 1979. Consequently, the language has been taught in schools of Tripura from the primary level to the higher secondary stage since 1980s. Now it also has BA and MA courses.
  - **Demand for inclusion in 8th Schedule** of the Constitution of India is also going on.
- **Script and Associated issues:**
  - The language had a script called Koloma script that was developed in 1st century CE and used by the Royal family of Tripura. But the script fell out of use in the 14th century, and is widely considered to have been lost.
  - **From the 19th century**, **Bengali script** is being used to write the Kokborok. But since the independence, several NGOs have been promoting **Roman Script**.
  - **The script issue has become highly politicized presently**.

- The Left front government advocate usage of the Asian Bengali script and all the regional indigenous parties and student organization and ethnic nationalist organizations advocate for Roman Script.

- **Why the protests recently?**

- In 2022, the Opposition TIPRA Motha party flagged media reports where candidates were claimed to have been compelled by exam invigilators to write answers of the Kokborok paper in Bengali script. The demand for introducing Roman script has intensified since then.

### 3) INFRASTRUCTURE: NYOMA AIRFIELD

Defence Minister Rajnath Singh laid down foundation stone for Nyoma airfield in **Eastern Ladakh very close to LAC** in Sep 2023

It will be developed at a cost of Rs 200 crore and will boost air infrastructure in Ladakh and augment the IAF's capability along the northern border. It will be one of the world's highest airfield and prove game changer for the armed forces.

It will be completed in about two years and will be able to accommodate all fighter jets in the IAF's inventory.



### 4) INFRASTRUCTURE: NECHIPHU TUNNEL

In Sep 2023, Defence Minister Rajnath Singh inaugurated the crucial Nechiphu tunnel on the axis to Tawang in Arunachal Pradesh.

It is a 500-meter tunnel on Balipara-Charduar-Tawang Road. The work for this started in 2020.

This tunnel, along with Sela tunnel, which is under construction, will provide all weather connectivity to the strategic Tawang Region.

**Strategic Significance:** Defence experts say that it will play an important role in neutralizing any threat from China.

**Economic Significance:** More tourism



### 5) INFRASTRUCTURE: SELA PASS TUNNEL

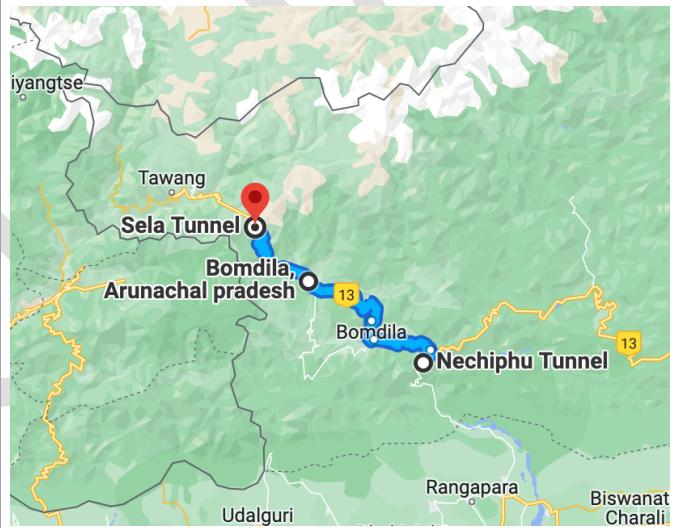
### About Sela Pass

- It is high altitude mountain pass located on the border between the Twang and West Kameng Districts of Arunachal Pradesh.
- It has an elevation of 4170 m (around 13,000 feet), and connects Tibetan Buddhist town of Tawang to Dirang (West Kameng District) and Guwhati i.e. the pass carries the main road connecting Tawang with the rest of India.
- Sela Lake is one of the approximate 101 lakes in the area that are sacred in Tibetan Buddhism.



### About the Tunnel

- It is being constructed by BRO at a cost of Rs 687 crores. It is being constructed using the latest New Australian Tunneling Method (NATM) and is much below the snowline allowing all weather travel challenges without the challenge of snow clearance.
- At this height, it will be the world's longest bi-lane road tunnel. It would provide all weather connectivity to Tawang.



### Significance

- **Strategic:** the tunnel will reduce the travel time between the Indian Army's 4 Corps headquarters at Tezpur in Assam and Tawang.
- **Economic:** it will also boost the tourism industry in the region.

## 6) S&T: SHANTI SWARUP BHATNAGAR PRIZE (SSB PRIZE)

- Why in news?
  - After Year's delay, CSIR's Bhatnagar award for 2022 announced (Sep 2023)
- About Shanti Swarup Bhatnagar Prize
  - Shanti Swarup Bhatnagar Prize for Science and Technology is a prestigious honour and an annual award in science and technology in India.
  - It is awarded by CSIR and its named after its founder director Dr. Shanti Swarup Bhatnagar.
  - The award recognizes outstanding contributions in the field of biological sciences, Physical Sciences, Mathematical Sciences, Chemical Sciences, Engineering Sciences, Medical Sciences and Earth, Atmosphere, Ocean and Planetary Sciences.
  - It is announced each year on 26th Sep to mark the CSIR foundation day.
  - It contains a citation, a plaque, a cash award of Rs 5 Lakh and an endowment of Rs 15,000 per month up to the age of 65 years.

- **About Shanti Swarup Bhatnagar**
  - Shanti Swarup Bhatnagar (1894 - 1955) was an Indian scientist, academic and scientific administrator. He was the first Director General of CSIR and the first chairperson of UGC.
    - The Shanti Swarup Bhatnagar Price was initiated by CSIR in 1958 in his honour.
- **About 2022 Award** (Announced in Sep 2023)
  - The 2022 Bhatnagar prize honours 12 scientists across seven scientific discipline.
  - While the award is usually announced on Sep 26 - CSIR's Foundation day - the prizes weren't announced last year, without any official reason being ascribed.
  - Last year, the Ministry of Home Affairs constituted a committee to review all the national awards administered by various science and medical ministries and whittled down some of them. The **SSB** award however was retained.

## 7) S&T: CYBER SECURITY: C-DOT

- **Why in news?**
  - C-DOT celebrates its 40th Foundation Day (25th Aug 2023)
- Centre for Development of Telematics (C-DOT) was established in 1984 as an autonomous Telecom R&D centre of DoT, Gol. It is a registered society under the Societies Registration Act, 1860.
- It is chaired by Ministry of Communication and Information Technology.
- It is a registered public funded research institute with the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology.
- **Key contribution:**
  - In its initial years, it triggered the telecom boom in the rural India that was responsible for all around socio-economic development.
  - As part of its development process, it also spawned a wide base of equipment manufacturers and component vendors for the industry.
- Over the years it has evolved into full-fledged telecom R&D institution, that complies with level-5 maturity on CMMI Model and has capabilities to undertake large-scale state of art telecom technologies development programs.
- C-DOT as a torch bearer of indigenous telecom R&D continues to develop latest technology products in areas like Optical, Switching, Wireless, Security and Network Management while also working on futuristic technologies like M2M/IOT, 5G, AI etc.
- It also works towards realizing the objectives of various flagship programs of the Government of India that include Digital India, Make In India, Skill India, Startup India, and Smart Cities.

## 8) S&T: CYBER SECURITY: TRINETRA – ENTERPRISE SECURITY OPERATION CENTRE

- Ministry of communication and information technology has launched TRINETRA on 25th August 2023.
- It is aimed at providing end-to-end security solution to the organizations for detection, analysis and mitigation of cyber security threats.
- It is a combination of multiple security systems like Security Information and Event Management (SIEM), Security Orchestration and Automated Response (SOAR), Data Loss prevention etc.
- It provides 24X7 near real-time actionable cyber security status and detection and resolution of cyber threats (Virus, Malware, Ransomware, Spyware etc.)

- It also performs security evaluation of organization's IT assets by protecting endpoints including PC, Laptop, Servers and VMs by detection, analyses, and mitigation of vulnerabilities and giving AI enabled automated responses to the cyber threats ensuring protection of sensitive data.

## 9) DEFENCE: C-295 TRANSPORT AIRCRAFT

- **Why in news?**
  - IAF chief takes delivery of the first C-295 transport aircraft in Spain (Sep 2023)
- **About the Aircraft:**
  - Note: India has ordered 56 C-295Ws for the Indian Air Force, with a plan to order an additional 6 aircrafts for the Indian Coast Guard and 9 aircraft for the Indian Navy.
- **Details**
  - The aircraft comes in transport configuration, equipped with an Indian Electronic Warfare Suite.
  - In Sep 2021, the Defence Ministry signed a Rs 22,000 crore deal with Airbus and Space S.A., Spain for procurement of 56 C-295s.
  - **Total 56 Aircrafts are to be procured by Indian Airforce:**
    - 16 aircraft will come in a fly-away condition from Seville, while 40 will be manufactured by Airbus jointly with Tata Advanced System Limited (TASL).
    - Work is underway to set up the Final Assembly Line (FAL) at Vadodara in Gujarat and the first aircraft manufactured in India would be delivered in Sep 2026.
  - **Need:** Replacing 56 Avro Transport Aircraft: IAF has 56 Avro Transport aircraft procured in the 1960s and they are in urgent need of the replacement.

## 10) DEFENCE: VARUNA 2023

<b>Exercise Varuna</b>	India France	<b>Navy</b> Phase-II of the <u>21st edition of Varuna (Varuna-23)</u> , between Indian and French Navy was conducted in Arabian Sea in Sep 2023. The exercise was conducted over three days and witnessed joint operations, underway replenishment and various tactical maneuvers.	Indian & French Navy bilateral exercise was initiated in <u>1993</u> . The exercise was later christened as ' <u>Varuna</u> ' in <u>2001</u> and has since become a hallmark of robust India-France Strategic bilateral relationship.  It is aimed at <u>enhancing cooperation and interoperability</u> of two navies.
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# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### SEP 2023 : BOOKLET-3

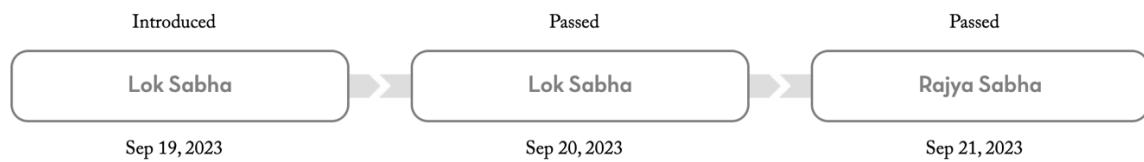
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## 1. GENERAL STUDIES-2

### 1) PARLIAMENT: RESERVATION FOR WOMEN

- Why in news?
  - » Women's Reservation Bill 2023 [The Constitution (128th Amendment) Bill, 2023] passed in both houses of Parliament (Sep 2023)



- Background:
  - » Even though the **2019 Lok Sabha elections** saw the highest ever presence of women in parliament, it still stands at **78 (14.39%) among 543 seats**. This percentage is well below the global average (24.6%) showing that in India gender discrimination is quite prevalent even in case of elections to the top positions in the country. At **state assemblies' level** this performance is more dismal with only **9% seats being filled by women**.
- Previous efforts to provide reservation for women in legislative bodies:
  - » Bills amending the Constitution to reserve seats for women in Parliament and State Assemblies have been introduced in 1996, 1998, 1999, and 2008. The first three lapsed due to dissolution of their respective Lok Sabhas. The 2008 bill was introduced in RS and passed in RS in 2010, but it also lapsed with the dissolution of 15th LS.
- In 2015, the Report on the Status of Women in India noted that the representation of women in state assemblies and Parliament continues to be dismal.
  - » **Decision making positions in political parties** have negligible presence of women.
  - » It recommended reserving atleast 50% seats for women in local bodies, state assemblies, Parliament, ministerial levels, and all decision-making bodies of the government.
- The **National Policy for the Empowerment of Women (2001)** had stated that reservation will be considered in higher legislative bodies.
- The Constitution (128th Amendment) Bill, 2023: (Naari Shakti Vandana Adhiniyam)
  - » **Reservation:** The bill reserves, as nearly as possible, **1/3rd of the seats** for women in LS (insertion of Article **330A**), State Legislative Assemblies (insertion of article **332A**), and the LA of NCT of Delhi (amendment to article 239AA). This will also apply to seats reserved for SCs and STs in Lok Sabha and State legislatures.
  - » **Commencement of Reservation** (insertion of article 334A): This reservation will be effective after the census is conducted after the commencement of this bill has been published. Based on Census, **delimitation will be undertaken to reserve seats for women**. This reservation will be provided for **15 years**. However, this reservation will continue till such date as Parliament determines by a law.
  - » **Rotation of Seats (Article 334A):** Seats reserved for women will be rotated after each delimitation, as determined by a law made by Parliament.

- **Arguments in support of reservation for women in Representative Institutions**

1. **Gender Equality: Ending Discrimination against women.**

- India has signed the **International Convention on the Elimination of All Forms of Discrimination against Women (CEDAW)** adopted in 1979 by the UNGA.
- The Convention provides the basis for realizing equality between women and men through ensuring women's equal access to, and equal opportunities in, political and public life -- including the right to vote and stand for elections - as well as education, health and employment.
- But female representation in Indian legislative bodies is below global average in India. Our legislative bodies don't reflect the contemporary trends in women's education and excellence in varied field and thus are facing credibility crisis.

2. **Social Justice**

- Social justice generally refers to the idea of creating a society or institution that is based on the principles of equality and solidarity, that understands the value of human rights, and that recognizes the dignity of every human being.

3. **Change the Social Structure of India in many ways** - Women at leadership roles will have various other positive social impacts.

4. **Women reservation have been quite successful at PRI level.**

- A 2003 study about the effect of reservation for women in Panchayats showed that women elected under the reservation policy invest more in public goods closely linked to women's concern.

5. **Better decision making because of diversity of thought.**

- Priorities and assumptions of policies and legislations are affected because of the poor participation of the other gender.
- Women issues are generally ignored because of men's lack of empathy and understanding of the issue.

6. Women will be able to **empathize with other struggles** in a better way.

- Women who have got their rights after long struggles will empathize with other struggles better.

7. **Reduce Crime and Corruption**

- Statistically, currently women legislators seems to be less probable to be involved in a criminal activity or corruption cases when compared to men.

- **Criticism of giving reservation to women:**

1. **Perpetuating Gender Inequality**

- It would perpetuate the unequal status of women since they wouldn't be perceived to be competing on merit.

2. **Diverts attention from more important electoral reforms.**

- Criminalization of politics

- Inner Party Democracy
  - 3. **Restricts choice of voters to women candidate**
    - A better option would be reservation in political parties and dual membership constituencies.
  - 4. **Rotation reduces incentive to work for constituency.**
  - 5. **Only promote family member of current politicians ; Quota will be appropriated by Stand-ins.**
    - Of all the women in Lok Sabha, around 70% already have other relatives in politics. This fact perhaps shows that women reservation will not be able to improve the "real" representation of women and only family members of some politicians whose seat becomes reserved will be elected from the seat.
- **Other Criticism of the Bill:**
- » **Why the reservation not brought into force immediately?**
- **Way Forward:**
- » **Capacity enhancement and training** for women politicians and representation.
  - » **User of gender-neutral terms in Parliamentary and government communications** (such as 'Chairperson' instead of chairman for RS chairperson)
    - Patriarchal terms reinforce gender biases and stereotypes against women and transgenders.
  - » **Steps to ensure that women's representation go to around 50%** even without the need of reservation:
    - **Genuine women empowerment** in all sectors right from school education, health and Higher Education.
    - **Addressing Gender based violence and harassment** and making public spaces safe and secure for everyone (including women)
    - **Focus on intra-party democracy** to ensure more women participants.
- **Conclusion:**
- » Almost unanimous passage of the **Naari Shakti Vandana Adhiniyam** is a testament to an irreversible force of social change - it will extend beyond the legislature to we, the people.

## 2) HEALTH: NIPAH VIRUS AND ZOONOTIC DISEASES

### A) NIPAH VIRUS

- **Why in news?**
  - » There has been an outbreak of the deadly Nipah virus in Kerala which have infected five people and killed two of them (Sep 2023)
- **Introduction**
  - » According to WHO Nipah Virus (NiV) infection is a **newly emerging zoonosis** (a disease that can be transmitted from animals to humans) that can infect both humans and animals.
    - It is classified as a "**highly pathogenic paramyxovirus**" and handling it requires the highest grade of facilities called BS-4.

- » The natural host of the virus are **fruit bats** of the Pteropodidae family, Pteropus genus. Humans are generally infected by fruit bat or pigs. Human to human transmission is also known including in the hospital setting.
- **First identification**
  - » First identified during the outbreak of disease that took place in Kampung Sungai Nipah, Malaysia in 1998. In this case pigs were intermediate hosts. Since, then there have been several outbreaks even without intermediate hosts.
  - » In India it was first detected in Siliguri in 2001 and Nadia in 2007. This was a spillover of the outbreak in Bangladesh.
  - » Later in 2018, 19, 21 and again in 2023 it appeared in Kerala.
    - **Why?**
      - Kerala has several fruit plantations that host several species of bats.
      - Better health facilities in Kerala may be leading to better detection, surveillance etc., whereas in other states the cases may go undetected.
    - Note: In 2018, 21 and 2023, the outbreak occurred in Kozhikode district and in 2019 the outbreak was in Ernakulam district.
    - **Why only in these districts?**
      - Not clear. A 2021 study have found that Nipah virus as found to be in circulation in fruit bats in "many districts" in Kerala.
      - An ongoing national survey in 14 states by NIV Pune found NIPAH virus antibody in 9 states, including Kerala, and the UT of Puducherry.
- **Symptoms** of NiV can be **neurological, respiratory and pulmonary**. They include:
  - i. **Encephalitis (brain swelling) due to Inflammation of the brain**
  - ii. Confusion, disorientation and even persistent drowsiness
  - iii. Headache, fever, nausea and dizziness (flu like symptoms)
- **Fatality:** Around 40-70% depending on the local capability for epidemiological surveillance and clinical management.
- **Prevention** (Avoid date palm sap; avoid close contact with NiV Patient; avoid direct contact with pigs/bats in endemic area)
- **Treatment / Vaccine**
  - » **Intensive Support care (no treatment or vaccine is available)**
  - » According to NCDC (National Centre for Disease Control), Ribavirin, an antiviral, may have a role in reducing mortality among patients with encephalitis caused by NIPAH virus disease.

## **B) WHY ZOONOTIC DISEASES ARE FAST SPREADING TO HUMANS**

- **Example Questions**
  - » "The diseases currently associated with forests (zoonotic diseases) can, in several ways be seen as a reaction to change in the relationship between humans and forests" Elaborate [10 marks, 150 words]
- **Introduction**

- » According to WHO, more than 300 zoonotic diseases have been observed over the past 70 years. It constitute about 60% of all human diseases and 75% of all the Emerging Infectious diseases. The last decade has been worst and have caught the humans unprepared. Some recent examples are that of Ebola, Zika, Nipah, Kyasanur Forest disease, COVID-19 etc.
- **Why increase in zoonotic diseases?**
  - » **Dramatic increase in population and mobility** -> Environmental changes , Deforestation etc.  
-> increase human contact with pathogens.
  - » **Increased demand for animal protein**
    - Livestock production is moving closer to towns in the form of poultry farms etc.
  - » **Rise in intense and unsustainable farming**
  - » **Increased use and exploitation of wildlife**
  - » **Unsustainable utilization of natural resources**
  - » **Many Indian villages are located within or around forests**
    - Thus, significant number of people interact with forests in their day-to-day lives
  - » **Global Warming**
    - Increases the population of insects like ticks that harbour and transfer the virus
  - » **Poor Preparation in terms of infra and human resource**
    - Zoonotic diseases become more problematic in countries where health infrastructure is poor (e.g. Ebola in Africa, Zika in South America, Nipah in Asia etc.)
  - » **Lack of awareness** especially in rural areas also
- **Implications**
  - » **Health**
  - » **Economic losses**
    - Death of farm/domesticated animals etc.
    - Negatively hampers tourism of the region.
- **Way forward: How to deal with increasing infectious zoonotic diseases**
  - » Coping with unprecedented rise in the risk of pandemics and epidemics requires a **holistic approach to medicine that treats human health as part of environmental health**. We need to be more proactive in restoring wildlife health.
    - There is a need of closer monitoring and research into how increasing ecological footprint of humans is affecting health and disease dynamics.
    - **Operationalising the One Health approach** in land-use and sustainable development planning, implementation and monitoring, among other fields.
  - » Further, there is a need to increase R&D, improve awareness and better health infrastructure facilities to deal with rising cases of zoonotic diseases.
  - » **Incentivize sustainable land management** practices and developing alternatives for food security and livelihoods that don't rely on the destruction of habitats and biodiversity.
  - » **Improving biosecurity and control**, identifying key drivers of emerging diseases in animal husbandry and encouraging proven management and zoonotic disease control measures;
  - » **Strengthening capacities among health stakeholders** in all countries;

### 3) HEALTH: NON-COMMUNICABLE DISEASES

- **Example Questions**
  - » For long NCDs in rural India have been ignored. Suggest some measures to deal with increasing cases of non-communicable diseases in rural areas. [10 marks, 150 words]
  - » Non-Communicable diseases have become the biggest cause of deaths in India. Discuss the key causes and consequences of increasing non-communicable diseases in India. [10 marks, 150 words]
- **Introduction**
  - » Non communicable diseases (NCDs), also known as chronic diseases, tend to be of long duration and are a result of a combination of genetic, physiological, environmental and behaviour factors.
  - » There are 4 main types of non-communicable disease are:
    1. **Cardiovascular diseases** (like heart attacks and strokes)
    2. **Cancers**
    3. **Chronic Respiratory diseases** (like chronic obstructed pulmonary disease and asthma)
    4. **Diabetes**
- Earlier, mostly elderlies in urban areas were found to be suffering from NCDs. But, now all age groups in all regions (both urban and rural) are increasingly becoming vulnerable to the non-communicable diseases.
- **Key Factors Responsible for increasing NCDs**
  - » **Modifiable Behavioural factors** such as tobacco use, physical inactivity, unhealthy diet etc.
  - » **Malnourishment**
    - Malnourishment makes children vulnerable to NCDs in later phase of life and is one of the major causes of NCDs in India.
  - » **Pollution** has emerged as a major challenge
    - Ambient **air pollution** and **indoor air pollution** have an impact on CVD and mortality. Various studies have shown that household pollution is the third top risk factor in low income countries.
  - » **Increasing Life Expectancy**
    - Life expectancy is increasing in India and with it we see an increase in old age population who are more vulnerable to NCDs like high blood pressure, diabetes and cancers.
  - » **Inadequate health facilities**
    - It prevents early screening, detection and thus awareness generation about NCDs.
- **NCDs are increasing in Rural India too:**
  - » **NCDS in Rural India is affecting a relatively younger population**
    - May be, because of poor nutrition availability during early life. So, there is a need to screen younger population in rural India for chronic diseases
  - » **Very Less awareness**
    - This hinders lifestyle changes and preventive methods.
  - » **Poor health facilities**
    - In rural areas, on many occasions facilities for diagnosis and treatment are not available resulting in late diagnosis and treatment.
  - » **Lack of systematic mechanism to collect data on NCDs from rural India**

- This hinders efforts at measuring the problem, guiding interventions and monitoring them effectively.

## - Impact of NCDs

### » Largest Cause of Death

- According to WHO, nearly 61% (63% globally) of all deaths in India are caused by NCDs including heart disorders, cancer and diabetes. According to MoH&FW cancer alone causes more than 5 Lakh deaths in India every year.

### » Socio-Economic Impact

- **NCDs worsens Poverty:**
  - It threatens fight against poverty reduction and hinders achievement of SDGs.
  - This also burdens government with more health expenditure and reduces economic output of the population.
  - It also leads to **heavy burden on India's healthcare system.**

### » International Image -> India's soft power weakens

- It questions a rising superpowers ability to tackle health problems of its own.

## - Some Recent Steps taken by India

### i. National Health Policy, 2017

- It aims at reducing premature mortality from cardiovascular diseases, cancers, diabetes, or chronic respiratory diseases by 25% by 2025.
- The policy recognizes inter-play of three actions -> Policy & Surveillance, Strengthening of Healthcare systems, and Healthcare Financing.

### ii. National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Strokes (NPCDCS)

- Program by MoH&FW, launched in 2008
- It is focused on health promotion for general population and Disease Prevention for the High Risk Groups

### iii. India Hypertension Management Initiative (IHMI)

- Launched in Nov, 2017 as a collaborative project between ICMR, MoH&FW, State governments, WHO etc
- It is aimed at strengthening the cardio-vascular disease component of the health ministry's National Program for Control of Cancer, Diabetes, Cardiovascular diseases and Stroke (NPCDCS).

### iv. 1.5 lakh health and wellness centres to be established throughout the country

- These health and wellness centres will promote early screening, diagnosis and treatment.

### v. Awareness Initiatives like the recently launched 'Eat Right Movement'

### vi. Eat Right Mela by FSSAI aims to usher in a 'new food culture' by nudging the businesses and consumers to adopt safe, healthy and sustainable food practices in India.

## - Way forward: Prevention and Control of NCDs

- » The prevention and control of NCDs will require comprehensive approach in which all sectors including health, education, finance, transport, urban planning and others will need to play a role in reducing the risk factors and treating the existing NCDs.
- » **Promoting healthy diet, physical activity etc**

- » Reducing both outdoor and indoor pollution will go a long way in fighting against chronic respiratory diseases, cardiovascular diseases, diabetes and lung cancer.
- » Restricting use of Sin goods
  - Prohibition or higher taxes on tobacco products and alcohol
  - More duties on unhealthy food
  - Replacing trans fats with poly unsaturated fats
- » Effective Policy implementation
  - Government of India has already launched a number of initiatives such as National Health Policy, India Hypertension initiative, establishment of 1.5 lakh health and wellness centres etc.
  - Proper implementation of these policies and programs will go a long way in reducing NCDs in India.
- » More Investment in better management of NCDs
  - More facilities for detection, screening and treatment of these diseases especially in rural areas and for providing palliative care for people in need.
  - This kind of investment has huge economic value as it will not only ensure better productivity but reduces cost of treatment on later stages.
- » More R&D to fund cost effective solutions and better ways of management of diseases.

### C) BLOOD PRESSURE / HYPER TENSION

- Why in news?
  - » Who releases its first-ever report on global impact of high BP, states approximately four in every five not treated adequately (Sep 2023)
- What is Blood Pressure?
  - » **Blood pressure** is a measure of how much the blood moving through your arteries pushes against the vessel walls. According to medical standards, the reading on a doctor's BP monitor going above 140/90 accounts for **hypertension**. **High Blood Pressure (Hypertension) is a serious medical condition** that significantly increase the risks of heart, brain, kidney and other diseases.
  - » A large number of people who suffer from hypertension are unaware of this, therefore it is also sometimes referred as a silent killer.
  - » It is a condition that knows no boundaries affecting people of every age and different socio-economic conditions. It can't be cured but can be managed through lifestyle changes, medication, and regular monitoring.
- WHO Report on Global Impact of High BP (Sep 2023)
  - Hypertension affects 1 in 3 adults worldwide and around 1/3rd of the adults with hypertension are unaware of their conditions. Nearly 4/5 people with hypertension are inadequately treated. Scaling up coverage can avert 76 million deaths between 2023-2050.
- The number of people living with hypertension (blood pressure of 140/90 mmHg or higher or taking medication for hypertension) doubled between 1990 and 2019, from 650 million to 1.3 billion.
- Hypertension Situation in India:
  - As per a paper published in *The Lancet*:
    - Hypertension is the most important risk factor for death and disability in India.

- Less than 1/4th of hypertensive patients in India had their blood pressure under control during 2016-2020.
  - There is a growing prevalence of hypertension amongst younger adults and those from lower socioeconomic backgrounds.
  - **NFHS-5** reported a hypertension prevalence of 24% in men and 21% among women, an increase from 19% and 17% respectively from the previous round (NFHS-4)
- **Key Issues with Hypertension situation in India:**
- i. **Lack of Awareness:** As per WHO, 1/3rd of the hypertension patients don't even know that they are suffering from hypertension.
  - ii. **Limited Access to healthcare services**
  - iii. **Inadequate adherence** to medication and lifestyle modifications
- **Way Forward:**
- » **Improving Awareness:**
  - » **Lifestyle changes:** Eating Healthier diet, quitting tobacco, being more active -> this can help lower the blood pressure.
    - Other changes like reduced salt intake, reduce alcohol consumption can also help.
  - » **Early Detection and Effective management** have to be prioritized by countries.
    - Hypertension can be controlled effectively with simple, low-cost medication regimens and yet only 1/5 people in hypertension have controlled it.
    - **Medication adherence** is crucial for control. Forgetfulness among elderly to take medication, medication availability, and affordability pose barriers.
    - Strengthening hypertension control must be part of every country's journey towards universal health coverage.

## 2. PRELIMS FACTS

### 1) PLACES IN NEWS: NAGORNO-KARABAKH

#### Caucasus Region:

It is a region between Black Sea and the Caspian Sea and mainly occupies **Georgia, Armenia, Azerbaijan and Southern Russia**.

It is home to the **Caucasus Mountains** which has been traditionally considered a natural barrier between Eastern Europe and Western Asia.

**Europe's Highest Mountain - Mount Elbrus (5,642 meters)** (located in Russia) is in the western part of the Greater Caucasus Mountain range.



#### NAGORNO-KARABAKH CONFLICT BETWEEN ARMENIA AND AZERBAIJAN

Straddling western Asia and Eastern Europe, Nagorno-Karabakh is internationally recognised as part of Azerbaijan, but most of the region is controlled by Armenian separatists.

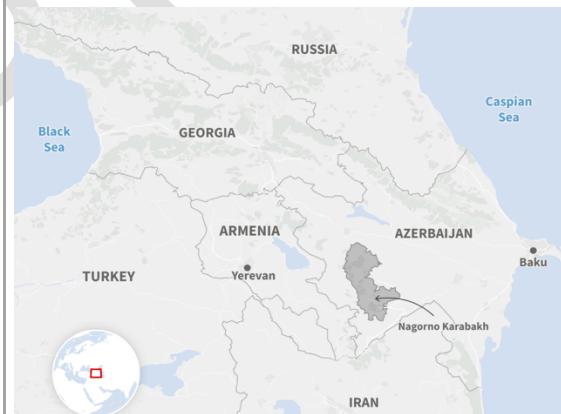
Nagorno-Karabakh has been part of Azerbaijan territory since the Soviet era.

When the Soviet Union began to collapse in the late 1980s, Armenia's regional parliament voted for the region's transfer to Armenia; the Soviet authorities turned down the demand.

**Note: Religious differences:** People of Ngorno Karabakh are primarily Christians whereas Azerbaijan is Muslim dominate.

Years of clashes followed between Azerbaijan forces and Armenian separatists.

The violence lasted into the 1990s, leaving tens and thousands dead and displacing hundreds of thousands.



In 1994, Russia brokered a ceasefire, by which time ethnic Armenians had taken control of the region.

In November 2020, Russia brokered a new peace deal between Armenia and Azerbaijan, after the two countries engaged in military conflict for six weeks over the disputed region in South Caucasus. The armistice also placed a Russian Peacekeeper contingent in Nagorno-Karabakh.

Since then, Azerbaijan alleges that Armenia has smuggled in weapons since then.

2023:

In Sep 2023, Azerbaijan's forces opened fire on Armenian positions in the Ngorno-Karabakh region. It claimed that it was an "anti-terrorist operation". There were concerns that the tensions could escalate into full fledged war.

Later, on 20th Sep 2023, Azerbaijan halted military action after its battlefield successes forced Armenian separatist forces to agree to a ceasefire. Key Highlights:

1. Azerbaijani military had routed separatists and then separatist agreed to cease fire.
2. They are meant to disband and disarm under the deal.
3. Talks on future of the region due to start in 1-2 days.

**Highly tensed relations between Armenia and its long-time ally Russia.**

- Armenia angered Russia, which maintains a military base in the country, by holding military exercise with the USA in Sep 2023 and by moving towards ratifying Rome Convention that created International Criminal Court, which has indicted Russian President Vladimir Putin.

## 2) PLACES IN NEWS: AGUMBE

- Why in news?
  - » How Karnataka's Agumbe lost to little known Udupi towns (Sep 2023)

### - About Agumbe:

**Agumbe Rainforest Complex (ARC)** is located in Shivamogga district of Karnataka in Western Ghats. It is known for its very heavy rainfall of over 8,000 mm during Monsoon. Therefore, it had also been christened as the Cherrapunji of the South. Britishers had erected the first rain gauge here in 1882.

**However**, there might have been many places in Karnataka which received more rainfall than Agumbe. But they didn't have rain gauge. The situation changed in 2022 when many of them got their own rain gauge which became operational in 2023.

Therefore, Karnataka's Agumbe is losing to several towns of Udupi.



### 3) INFRASTRUCTURE: PAMBAN BRIDGE – INDIA'S FIRST VERTICAL LIFT RAILWAY SEA BRIDGE

#### - Why in news?

» New Pamban Bridge may miss its Nov 2023 deadline (Sep 2023)

#### - Details

» **Background:** The existing Pamban Rail Bridge, which connects Rameswaram to mainland India is more than a 100 years old. It was built in 1914 and connects Mandapam to the Rameshwaram Island. Till 1988, it was the only link connecting the two locations when a new road bridge was built parallel to the sea link.



#### - New Railway Bridge:

» The state-of-the-art bridge will be country's first vertical lift railway sea bridge.

- The bridge is stretches for 2.05 km and will have a 63-meter stretch which will lift up while remaining parallel to the deck to allow access to the ships.

» It will help railways to operate trains at higher speed and will carry more weight and increase the volume of traffic.

» It is being executed by Rail Vikas Nigam Limited (RVNL) at a cost of Rs 535 crores.

#### - Missing Deadlines (Sep 2023)

- » Its initial deadline was March 2023, which was then extended to July 2023 and then to Nov 2023. However, in Sep 2023, due to increased wind speed at the project site the work has been hampered.
- » As of Dec 2022, 84% work has been completed.

- **Video:**

- » See video in the link: <https://www.thehindu.com/news/national/tamil-nadu/watch-pamban-bridge-indias-first-vertical-lift-railway-bridge/article65487414.ece> to get better understanding.

## 4) BIODIVERSITY: GAUR / INDIAN BISON

It is also known as Indian Bison and is a bovine native to South Asia and Southeast Asia. It is the biggest among wild cattles.

**IUCN: VU**

**Habitat:** Largely confined to evergreen forests or semi-evergreen and moist deciduous forests.

**Historical Distribution:** It occurred throughout mainland south and southeast Asia.

**Present Distribution:**

- But today the population is fragmented, with it being extinct from Sri Lanka and Malaysian Peninsula.
- They are largely confined to evergreen forests or semi-evergreen and moist deciduous forests, but also inhabits deciduous forest areas at the periphery.

**Note:** The domesticated form of the gaur is called gayal (Bos frontalis) or mithun.



**Distribution in India:**

- **Western Ghats** in particular Wayanad - Nagarhole - Mudumalai - Bandipur complex constitute one of the most extensive extant strongholds of gaur. Nilgiri forest division is estimated to have a population of more than 2,000.
- **Eastern Ghats** also has some population of gaurs in Odisha and Andhra Pradesh.

**Interesting Fact:** The famous drink "Red Bull" is based on a Thai drink 'Gratin Daang', meaning "red gaur".

#### **Bos frontalis (Mithun) - Domesticated form of Gaur:**

**Recent News:** The Food Safety and Standards Authority of India (FSSAI) has recognized the mithun as a 'food animal' with effect from 1st Sep. With this, the mithun can be commercially farmed and its meat processed for pickles, soups, wafers nd biryani.

Work is on to help farmers and triba village communities benefit commercially from the sale and processing of Mithun.

The **Animal** is endemic to Arunachal Pradesh, Nagaland, Manipur and Mizoram. It is semi-domesticated and is reared in free range forest ecosystem. The only supplementary feed that it needs is salt.

It is the **state animal** of both Arunachal Pradesh, and Nagaland. The slaughter of the mithun is traditionally reserved for special occasions such as festivals or weddings (and now a days - elections)

**Biodiversity Significance:** The "food animal" status can increase the commercial value and may increase the population of Mithun.

#### **Mithuns: From farms to the table**



A KG OF  
MITHUN MEAT  
CAN FETCH  
**₹300 PER KG**

## **5) BIODIVERSITY: RHINOS**

### **D) WORLD RHINO DAY, 22<sup>ND</sup> SEP**

- World Rhino Day was first announced by WWF in South Africa in 2010.
- It is observed every year on 22nd Sep and celebrates all five species of rhino: Black, White, Great-one horned, Sumatran Rhino and Javan Rhino.
- It serves as a poinant reminder of the urgent need to protect these magnificent creatures that roam the forested landscapes of our planet.

### **E) VARIOUS SPECIES OF RHINO**

- **2 Rhino in Africa:**
  - » White Rhino: NT

- **Great Comeback:** From a population of around 100 individuals, the population had increased to more than 21,000 at the end of 2012. But since then, the population has decreased by 24% (to around 16K). But it is still the largest population of any Rhino species on earth.
- » **Black Rhino: CR**
  - Population is recently increasing. They are spread across 12 African countries. From a population of around 100,000 in 1960s, they had come down to 2,300 individuals in the 1990s. However, intense protection and management efforts have led to stabilize and increased population by 28% in the past decade.
- **3 Asian Rhino**
  - » **Greater One Horned Rhino:** (VU)
  - » **Javan Rhino: CR**
    - Stable Population (76)
  - » **Sumatran Rhino: CR**
    - Decreasing population (34-47)

## F) GREAT INDIAN ONE-HORNED RHINO (VU)

**Details:** Fifth largest land animal.

### Threats:

- » Poaching - rhino horn great demand in China and other Asian countries for traditional medicines.
- » Habitat loss
- » Fragmentation of Habitat

### Habitat and Distribution

- » **Past:** Once ranged throughout the entire stretch of Indo-Gangetic Plain.
  - Population went down to a mere 200 in the early 1990s and was declared to be endangered.
- » **Present:** Found only in the tall grasslands and forests in the foothills of the Himalayas. Today more than 3,000 Rhino live in wild, most of them confined in Assam (2500+). They range from few pockets in Southern Nepal, northern Bengal, and Brahmaputra Valley.
  - Today, they are mostly found in 7 protected areas:
    - In Assam: Kaziranga National Park, Pobitora WLS, Orang NP, Manas NP
    - In WB: Jaladapara NP and Gorumara NP
    - In UP: Dudhwa NP



Indian rhinoceros (*Rhinoceros unicornis*)  
in the Kaziranga National Park

Conservation status							
<u>Extinct</u>						<u>Threatened</u>	
EX	EW	CR	EN	VU	NT	LC	
Vulnerable (IUCN 3.1) <sup>[2]</sup>							

## 6) BIODIVERSITY: NEW FISH SPECIES DISCOVERED – PTERYGOTRIGLA INTERMEDICA (SEP 2023)

The scientists of Zoological Survey of India (ZSI) have discovered this new fish species. It is the fourth species of Pterygotrigla genus reported in India so far.

It is commonly known as gurnards or sea-robins and belong to the family Trigidae.

**Discovered where:** It's a marine water fish discovered from **Digha Mohana** in WB.



## 7) S&T: RASHTRIYA VIGYAN PURUSKAR (SEP 2023)

- Rashtriya Vigyan Puruskar is a new set of National Awards in the field of Science, Technology and Innovation. It will be one of the highest recognitions in the field of science, technology and innovation in India.
- **Who will be eligible?**
  - » Scientists/technologists/innovators working in government, private sector organizations or any individual working outside any organization, who have made contributions in terms of path-breaking research or innovation or discovery in any field of science, technology, or technology-led innovation shall be eligible for awards.
  - » **People of Indian Origin** staying abroad with exceptional contributions benefitting the Indian communities or society shall also be eligible for the awards.
- The award shall be given in following **Four Categories**:
  - » **Vigyan Ratna** (VR): It will recognize lifetime achievements & contributions made in any field of S&T.
  - » **Vigyan Shree** (VS) award will recognize distinguished contributions in any field of S&T.
  - » **Vigyan Yuva-Shanti Swarup Bhatnagar** (VY-SSB) award will recognize and encourage young scientists upto the age of 45 years who made an exceptional contribution in any field of S&T.
  - » **Vigyan Team** (VT): It will be given to a team comprising of three or more scientists, researchers, innovators etc who have made an exceptional contribution in any field of S&T.
- It will be given in 13 domains, namely Physics, Chemistry, Biological Sciences, Mathematics & Computer Science, Earth Science, Medicine, Engineering Sciences, Agricultural Science, Environmental Science, Technology & Innovation, Atomic Energy, Space Science and Technology, and Others. The representation from each domain/field, including gender parity will be ensured.
- All nominations for these awards will be placed by **the Rashtriya Vigyan Puraskar Committee (RVPC)** to be headed by the Principal Scientific Advisor (PSA) to GoI and comprising of Secretaries of Science Department, members of Sciences and Engineering Academies, and some distinguished scientists and technologists from different fields of S&T.
- **Important Days:**
  - » The nomination for these awards will be invited every year on 14th Jan which would remain open till 28th Feb (National Science Day).

- » The awards shall be announced on 11th May (National Technology Day) every year. The Award Ceremony for all categories will be held on 23rd of August (National Space Day).
- All awards will have a Sanad & Medal.



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### SEP 2023 : BOOKLET-4

## RENEWABLE ENERGY

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## 1. RENEWABLE ENERGY

- **Example Question:**
  - » Discuss the significance of renewable energy in India's sustainable economic development. What are the factors hindering the growth of renewable energy sector in the country? Suggest some measures to deal with these problems. [15 marks, 250 words]
  - » Evaluate the economic and employment opportunities presented by the renewable energy sector in India [10 marks, 150 words]
- **Introduction**
  - » Non-conventional energy sources refer to renewable energy sources which are replenishable at a rate faster than it is consumed i.e., they don't get depleted when used. These sources are also much less hazardous to environment compared to conventional sources of energy.
  - » **Popular Sources of Non-Conventional Energy Sources are:**
    - i. Solar Energy
    - ii. Wind Energy
    - iii. Tidal Energy
    - iv. Geothermal Energy
    - v. Hydropower
    - vi. Biomass Energy
    - vii. Fuel Cell (Green Hydrogen)
- **India's Situation:**
  - » As of Feb 2023, India's total power generation capacity was **412.21 GW**.
    - **Total Renewable Energy Capacity: 168.96 GW** [122 GW without including large hydro]
      - **Solar Energy:** 64.38 GW
      - **Wind Energy:** 42.02 GW
      - **Hydro** (large + Small): 51.79 GW (Small Hydro - Around 5 GW)
      - **Bio:** 10.77 GW
    - Another **86.62 GW** of green energy capacity is under implementation and **40.89 GW** of capacity is under various stages of tendering.
- **Future Target:** Government aims to achieve 500 GW of installed electricity capacity from non-fossil sources by 2030.
- **India's NDC and Renewable Energy:**
  - » While the target was to achieve 40 per cent of the installed electric capacity from non-fossil fuel sources by 2030 in the initial NDC submitted in 2015, the target has already been achieved.
  - » India is now striving to achieve the target of 50 per cent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030, in line with updated NDCs.
- **Why do we need to invest more in the Renewable Energy Sector?**
  - » **Energy Security and Reduced Import Dependency:** As for fossil fuels, India is mostly dependent on crude oil imports.
  - » **Economic growth:**
    - Reduced cost of energy supply

- Reduced CAD -> Saving Forex
  - Opportunity to emerge as a renewable energy hub for the world -> this can become an important source of employment and entrepreneurship.
  - Improved export opportunity in the non-conventional energy sector.
- » **Inclusive Development: Electricity in inaccessible areas**
- Solar, small hydro, wind energy etc. can easily provide electricity in the region where Grid connected electricity has not reached.
- » **Environmental sustainability:**
- **Fighting Climate Change:** Meeting NDCs submitted at COP26 of UNFCCC.
  - **Reducing Air Pollution and Water Pollution**
- » **Strengthening India's Soft Power and Global Leadership:** India could also handhold other developing nations to explore the path of sustainable development via making best utilization of non-conventional sources of energy.
- **Steps taken by Government:**
- » **Ambitious Targets:** GoI has set a target of achieving 50% of its electricity supply through non-fossil sources by 2030.
  - » **Attracting Investment:** FDI upto 100% under automatic route for renewable energy projects including offshore wind energy projects has been allowed.
  - » **Promoting Ease of Doing Business:**
    - **Waiving of Inter-State Transmission System (ISTS)** charges for inter-state sale of solar and wind power for projects to be commissioned by 30th June 2025.
    - **Laying of new infrastructure:** New transmission lines and subs station capacity for evacuation of renewable power etc. under Green Energy Corridor scheme for evacuation of renewable energy
  - » **Sectoral Initiatives:**
    - **National Solar Mission**
      - Setting up of ultra-mega renewable energy parks to provide land and transmission to renewable energy developers on a plug and play basis.
      - **Pradhan Mantri Kisan Urja Surakha Evam Utthaan Mahabhiyan (PM-KUSUM):** It is aimed a de-dieselization of the farm sector along with providing energy security and increased income for farmers.
    - **National Hydrogen Mission:** It aims to make India a green hydrogen hub, aiding to fulfill its target of production of five million tonnes of green hydrogen by 2030 along with allied development of renewable energy capaacity.
      - In Aug 2022, India's first indigenously developed Hydrogen Fuel Cell Bus developed by KPIT-CSIR was launched.
    - **Steps to promote wind Energy:**
      - National Offshore Wind Energy Policy notified in 2015
      - National Wind Solar Hybrid Policy was adopted in 2018
    - **Steps to promote bioenergy:**
      - National Policy on Biofuels

- Scheme to support promotion of Biomass based cogeneration in sugar mills and other industries
  - Program on Energy from Urban, Industrial and Agricultural Wastes/Residues
  - Biogas Power (Off-Grid) Generation and Thermal Application Program (BPGTP)
- » **International Collaboration:**
  - International Solar Alliance
  - Global Biofuel Alliance announced during 2023 G20 Summit in India.
- **Electricity (Promoting Renewable Energy through Green Energy Open Access) Rules, 2022** notified (June 2022) - It is aimed at ensuring access to affordable, reliable, sustainable and green energy for all.
  - **Electricity (Promoting Renewable Energy Through Green Energy Open Access) Amendment Rules, 2023 (Jan 2023)**
- **Problems faced by Renewable Energy Sector**
  - i. **Mobilization of Finance and investments:** India is a developing country with limited resources and renewable energy sector is a capital-intensive sector.
  - ii. **Land Acquisition:** Solar and wind Power projects require large land areas, which has in recent years emerged amongst the biggest challenges faced by the sector.
    - For e.g., windmills and Solar plants are impacting the habitats of critically endangered the Great Indian Bustard.
  - iii. **Intermittent Nature of Renewable, Lack of energy storage, and wastage (15-20%)**
    - This makes grid integration difficult.
    - The absence of storage facilities leads to wastage to the tune of 15-20% of electricity generated.
  - iv. **Poor Manufacturing Ecosystem** in the country leads to import dependency for wind mills and solar power panels.
  - v. **Lack of Skilled Manpower:** India still has not been able to attract youth towards this sector. Moreover, the opportunity to train in the sector is also negligible
  - vi. The **financial conditions of our distribution companies (discoms)** is another hindrance.
    - The additional solar and wind capacity will come from private sector and developers would be discouraged if they are not assured of market and timely payments.
  - vii. **International Trade Rules**
    - WTO trade rules have sometimes hindered our local manufacturing.
- **What further needs to be done?**
  - » **For increasing Finance**
    1. More government investment
    2. Creating mandates for provident funds to invest in infrastructure and environmentally sustainable projects.
    3. Increasing the priority sector lending limit for bank loans under solar energy from a meagre Rs 15 crore.
    4. Mobilizing retail savings by way of tax exemption on the lines of Section 80CCF
    5. Promote Green Bonds.
  - » Standardizing the definition of green to be able to target government efforts in the direction.
  - » Promoting more R&D on Green sector
  - » Promoting local manufacturing

- » **Dealing with intermittency and wastage** (due to variability and lack of storage facilities)
  - Focus more research towards storage technology -> use tax incentives and VGF.
  - Promoting use of smart grid, net metering and storage devices.
  - Redesign power markets to reflect the new feed for flexible supply and demand
  - **Options available for storage:** Hydrogen based storage, lithium ion batteries, and pump storage plants.
    - Hydrogen based storage is used for long term
    - Lithium-ion batteries are suitable for day-to-day storage
- » **Dealing with Land Acquisition Issues:**
  1. **Minimising total land-use requirements** for renewable energy by promoting offshore wind, rooftop solar and solar on water bodies
  2. **Identification and assessment of land for renewable generation** by limiting undue regional concentration and developing environmental and social standards for rating potential sites.
  3. **Attention on Indian agri-voltaics sector** — securing benefits to farmers and incentivising agri voltaics uptake where crops, soils and conditions are suitable and yields can be maintained or improved.
- » **Ensure Greater Synergy among all the concerned stakeholders** through a participatory approach and awareness generation, can further help to fasten the pace of shift towards renewable sources of energy.
- » **International Cooperation:**
  - Renewable Energy Technology should be declared as a global public good, including removing of IPR barriers to technology transfer.
  - Improve global access to supply chains for renewable energy technologies, components and raw material.
- **Conclusion1:** Time is not on our side and our climate is changing before our eyes. We need a complete transformation of the global energy system.
- **Conclusion2:** By addressing these challenges and implementing these measures, India can further accelerate its transition to renewable energy, promoting sustainable economic development while reducing its environmental footprint.

## 2. PROBLEM OF STORAGE IN RENEWABLE ENERGY

- **Introduction:**
  - » India is emerging as a renewable energy powerhouse with a target of 450 GW of installed RE capacity by 2030. However, the country faces a major challenge in the form of lack of storage capacity.
- **Why is storage needed in renewable energy sector?**
  - » **Handling Intermittency and variability problem** of renewable due to sudden cloud cover and decreased wind velocity.
  - » **Providing energy in non-solar/wind hours**

- India's doesn't feel the pinch right now because we have more than 200 GW of coal based capacity which is managing the show by backing renewables in case of variability. So, decarbonization will be difficult without finding an alternative.
- **Various Storage options and their benefits and Limitations**
  - i. **Hydrogen based storage:**
    - It is found feasible for long-term storage (cross seasons)
  - ii. **Lithium-ion batteries:** They are the ideal source for day-today storage.
    - **Concerns:** Though the cost of batteries have declined by 80% over the last decade, it is still quite expensive as the levelized cost of battery is about Rs 8 to Rs 10 per unit.
  - iii. **Pump Storage Plants:**
    - India has a total capacity of about 4.7 GW (out of a worldwide capacity of 149 GW). The CEA estimates that India's storage potential is of 100 GW.
    - **Concerns:**
      - High investment cost
      - Long Gestation Periods
      - Non-remunerative pricing models
      - Lack of adequate sites having the required topography
      - India's expertise in pump storage plants is somewhat a suspect with the Tehri pump storage project yet to be commissioned though construction began in 2011 and was to be complemented in 4.5 hours.
      - There may be environmental concerns associated with this kind of storage.
- In general, we can say that there are two main reasons for lack of storage capacities:
  - » **Cost** of storage technologies is still relatively high.
  - » **Regulatory Framework** for storage is not yet fully developed.
- Some initiatives to deal with these challenges:
  - i. **Budget 2023:**
    - Pumped Storage Projects have received a push with a detailed framework to be formulated.
    - **4 GWh Battery Energy Storage Systems supported through Viability Gap Funding (VGF)**.
  - ii. **National Storage Mission** launched in 2020 and wants to develop 100 GW of storage capacity by 2030.
  - iii. **The Green Energy Corridor:** These are corridors which will be used to transmit electricity from renewable energy projects to load centres. These will also include storage facilities.
  - iv. The **National Battery Manufacturing Policy**, launched in 2020, aims to promote the manufacturing of batteries in India. This will help to reduce the cost of storage technologies.
- These are steps in the right direction, however, more efforts needs to be put to expand the capacities in parallel with the expansion of the renewable energy.
  - i. **More R&D in battery storage** to reduce the cost: Government should increase the financial incentive and subsidies to development and adopt more advanced energy storage technologies.

- ii. **Grid Modernization:** To accommodate energy storage and intermittent renewable energy sources effectively. Implement smart grid technologies to enhance grid flexibility.
  - iii. **Finalize a regulatory framework** which would help investors to develop and deploy storage projects.
  - iv. **Public Private Partnerships** - It can be used to develop and deploy storage projects.
  - v. **Demand Side measures** to reduce the need of storage e.g. smart metering, smart grid, energy efficiency etc.
  - vi. **Skill Development (Human Resource Creation):** To develop workforce capable of designing, installing and maintaining energy storage systems.
  - vii. **International Collaboration** bilaterally and multilaterally to leverage best practices and sharing knowledge on energy storage solutions.
- **Conclusion:** These steps have the potential to increase the storage capacity for renewable energy sector and to help to make renewable energy a more reliable and affordable source of electricity.

### 3. DECENTRALIZED (DISTRIBUTED) RENEWABLE ENERGY

- **Example Question:**
  - » "Decentralized renewable energy play a vital role in transitioning towards a more sustainable and resilient energy future, particularly in areas where centralized grid infrastructure is inadequate or non-existent" Critically Analyze [10 marks, 150 words]
- **Decentralized Renewable energy** refers to generation and distribution of renewable energy at a small and localized level, typically closer to the point of consumption. It can be generated via several renewable energy sources, including solar, wind, hydro and bioenergy.
  - » Currently, India has 12 mature technologies powered by DRE. These include high capacity irrigation pumps, as well as micro-pumps, silk reeling machines, dryers, charkhas, small horticulture processors, small refrigerators/deep freezers, cold storages, vertical fodder growing institutions units, grain milling machines etc.
  - » The DRE technologies include solar run textile manufacturing units, biomass powered cold solar storages and micro solar pumps etc.
- **Key characteristics** include localized generation, distributed energy resource, Off-Grid or Mini-Grid Solutions;
- **Advantages:**
  - » **Environmentally sustainable:** DRE doesn't lead to environmental damages which are caused by large scale hydropower plants, large scale solar parks etc.
  - » **Energy Security:** Technologies like rooftop solar, micro hydel power plants etc. can lead to sustainable energy production and thus can ensure long term energy security.
  - » **Inclusive Growth:** DRE can ensure energy supply and thus other associated services in remote, under-developed regions.
  - » **Scalability and Flexibility:** DRE can be scaled gradually depending on the local needs.
  - » **Job Creations:** DRE will stimulate local job opportunities in manufacturing sector, installation, operations etc.
    - As per MNRE, DRE has a market potential of Rs 4 lakh in rural and peri-urban communities in India.
- **Challenges and way forward**

- » **Repairing** remained a challenge: Enough human resource and contact with manufacturers is still poor, especially in remote areas.
    - Skill development can not only improve the repair services but can also provide increased job opportunities.
  - » **Increasing Affordability** - For a lot of people, affordability is a major concern and increased access to loans/government incentives is crucial for accessing the DREs.
    - At the same time, development of DRE industries in India, more R&D, etc. would be important for reducing the cost of the technology.
  - » **Policy supports** especially at state level: In India state level policy schemes are incapable of effectively supporting DRE technologies, especially when it comes to enabling affordable financing for entrepreneurs and end-users.
  - » **International Cooperation** across sectors for an equitable exchange of knowledge and resources is essential for scaling DRE technologies.
- **Conclusion:**
- » DRE can play a vital role in transitioning towards a more sustainable and resilient energy future, particularly in areas where centralized grid infrastructure is inadequate or non-existent.

## 4. SOLAR

- **Introduction:**
  - » Though India missed the ambitious target of 100 GW of solar power generation capacity by 2022, we still need to keep working on expanding Solar Energy Capacity.
  - » As per the National Electricity Plan, India aims to reach a target of 185.6 gigawatts of solar capacity by the FY27.
- **Advantages of Solar Energy**
  - » **Renewable Energy Advantages**
    - (climate change, pollution, Energy Security, Economic Opportunities, Inclusive growth, cost competitiveness, reduce import deficiency etc.)
  - » **Solar's advantage over other renewable energy:**
    - Available during office hours
    - Longer life equipment
    - Low running cost
    - India's tropical climate is suitable for solar energy
    - Less damaging than other renewables
      - A new study by WWF and IRENA found that wind and solar power are significantly less damaging than other renewable pathways.
  - » **Solar Energy is becoming more and more competitive**
- **Government Efforts to promote Solar Energy**
  - i. **Jawaharlal Nehru National Solar Mission (JNNSM)** - aimed at achieving 100 GW of solar power by 2022 (60 GW through large and medium scale solar power projects and 40 GW of rooftop solar)

- ii. **Pradhan Mantri Kisan Urja Suraksha Evan Uttham Mahabhiyan (PM Kusum)** aims at providing water and energy security to farmers and enhancing their income by making *Annadata* also a *Urjadata*. It focuses on creation of **3 things** - Grid Connected Renewable solar power plants; Installation of 20 lakh standalone Solar powered agri pumps; Solarization of 10 lakh grid connected agri pumps.
  - iii. **Steps to ensure easy finance for Solar energy.**
    - **Increased government spending:** For e.g., the Budget 2023 allocated Rs 10,222 crore to MNRE which is 45% higher than the previous allocation.
      - 'Off-Grid' solar projects have seen an increase in allocation to 360 crore which is 6 times higher than last year.
    - **Financial Incentives:** Generation based incentives (GBIs), capital and interest subsidies, viability gap funding, concessional finance, fiscal incentives etc for providing financial support for various schemes have been initiated.
    - **New tax-free solar bonds.**
    - Making roof top solar as part of housing loan by banks/NHB.
  - iv. **International Cooperation:** International Solar Alliance, One World One Grid etc.
  - v. **New Innovations: Floating Solar Power Plant** (for e.g., the 100 MW plant at NTPC Ramagundam commissioned in July 2022) is being set up in various parts of the countries. It brings advantages like no land acquisition requirements, water conservation (less evaporation of water), less dust on power panel etc.
  - vi. **Other steps to promote solar sector.**
    - **Amendments to Electricity Act and Tariff Policy**
      - For strong enforcement for Renewable Purchase Obligations and for providing Renewable Generation Obligations (RGO).
    - Evacuation of renewable energy through Green Energy Corridor project.
    - Amendment to building by laws for mandatory provision of roof top solar for new construction or higher floor area ratio.
    - Infrastructure status to Solar projects.
    - Provision of rooftop solar and 10% renewable energy as mandatory under mission statements and guidelines for development of smart cities.
  - vii. **Promoting Domestic Manufacturing of Solar PV cells and various components**
    1. **National Programme on High Efficiency Solar PV Modules**
      - It is a PLI scheme which aims to build an ecosystem for manufacturing of high efficiency solar PV modules in India, and thus reduce import dependence in the area of Renewable energy. It will strengthen Atmanirbhar Bharat initiative and generate employment.
  - viii. **Promoting Competition among States:** SARAL index by MNRE ranks states in terms of their efforts to incentivize rooftop solar.
  - ix. **Skill Development:** Focus on skill development of workforce: "Surya Mitra Scheme" launched in May 2015. To create 50,000 trained personnel within a period of five years
- **Some Problems faced by Solar Energy Sector**
- i. General Problems faced by renewable energy sectors like finance, technology, human resource, land, Global Trade Rules etc.

- ii. **Substandard Equipment and Lack of Accountability**: For e.g. in Assam, under DDUGJY, Solar kit was distributed to ensure rural electrification, but when problems occurred either in the panel or the batteries, even within the contract period, the replacements haven't happened.
- iii. **Poor Performance of Rooftop Solar Power Projects**
  - » A parliamentary panel (March 2023) has attributed low installation of solar rooftop and wind energy projects as key reasons for the shortfall in achieving India's renewable energy capacity target of 175 GW by 2022.
  - » **Key Reasons**
    - a. **Residential Roof top policy** wasn't very effective. Government's policy was primarily focused on industrial rooftop.
    - b. **Lack of cooperation from state electricity utilities and distribution companies** across India as it could hurt their finances.
    - c. **India still doesn't have uniform policies around net metering**.
    - d. **Lack of awareness amongst public**
      - For e.g., not many people are aware that with their home loans they can get loans for solar rooftops too.
      - Further, people are not aware of the financial incentives and attractive return on investment that taking up rooftop solar power solutions can achieve.
- iv. **Import Dependency:**
  - » Much of India's solar PV manufacturing uses imported components with parts mostly sourced from China. In the Budget announced in Feb 2022, government has announced a Basic Customs Duty of 40% on modules and 25% on solar cell imports from 1st April.
- v. **Intermittency -> Lack of energy storage facilities.**

- **Some Limitations of expanding Renewable Energy:**
  - i. **Land Acquisition -> Ecological and biodiversity losses**: Even dry regions support native vegetation such as grass, herbs and shrubs. They are diverse, ranging from woodland savannas, scrubland and grasslands, to rocky outcrops, ravines and dunes. They have some protected species like black buck and Great Indian Bustard.
  - ii. **Loss of Ecological services** - like sequestering of more carbon than if trees were planted on them. Grazing based livelihoods also support millions in India.
  - iii. **Displacement**: In Kutch, communities displaced from their traditional grazing lands by renewable energy projects have been protesting these projects.
  - iv. **Emerging E-Waste Challenge**: As per a report by International Renewable Energy Agency (IREA), India could be generating more than 4 million tonnes of photovoltaic waste by 2050.
    - Currently, India is recovering about 20% of the photovoltaic waste, rest is dealt with informally. This waste gets accumulated at landfills which in turn cause leaching of toxic metals in soil and water.

- **Way Forwards**
  - i. **Increased focus on Rooftop Solar**: Development of positive retail led ecosystem to promote rooftop solar.
    - » **Improved policy of rooftop solar** - Increased focus on awareness generation.
    - » **Prioritize smart grid and net metering**.

- » **Incentivize discoms** by providing them with performance linked incentives.
- » **Improving Tender Process** under DDUGJY: Tender process should be based on a '**Quality Cost Based System**', a well-accepted methodology for vendor selection globally which evaluates bidders based on technical and quality scores before looking at cost.
- » **More focus on creating skilled workforce:** Government tenders for solar rooftops should have clause for training locals in maintenance by teaching them the required skill sets and generating job opportunities for them.
- ii. **Agri-Voltaics** - Deploying solar panel in a manner which allows agriculture below it.
  - » **Advantages:** Reduces evapo-transpiration and saves water; cooling effect of plants improves the efficiency of the solar power panels.
- iii. **Ensure effective implementation of Social Impact Assessment and Environmental Impact Assessment** in large scale projects.
- iv. **Deal with photovoltaic waste:**
  - » **Formulate and implement provisions specific to photovoltaics waste treatment** (rather than clubbing it with e-waste). This should also include EPR.
  - » Pan India sensitization drive about photovoltaic waste.
  - » More R&D in development of better recycling mechanisms.
- v. Other steps discussed under Renewable Energy Section above.

## 5. WIND

### 1) WIND ENERGY

- **Current Wind Energy Situation in India**
  - » India has made significant progress in the development of wind energy and has emerged as the fourth largest producer in the world with a total capacity of 42 GW as of Feb 2023.
  - » But India **did miss the target of achieving 60GW** capacity by 2022.
- **Target:**
  - » 140 GW by 2030
- **India's Potential:**
  - » As per National Institute of Wind Energy (NIWE) in Chennai, India has a much higher wind power potential. At a hub height of 120 meters, the potential is of 602 GW of onshore and 100 GW of fixed and floating offshore. A very remarkable fact is that half of the potential is located in wastelands.
- **Recent Steps taken by Government.**
  - i. **National Wind Mission (NWM)** - launched in 2015 as part of NAPCC -> To achieve the target of 60 GW by 2022 with an investment of 10 lakh crore.
  - ii. **Scheme for Procurement of Blended Wind Power from 2500 MW ISTS connected projects.**
    - The objective of the Scheme is to provide a framework for procurement of electricity from 2500 MW ISTS Grid Connected Wind Power Projects with up to 20% blending with Solar PV Power through a transparent process of bidding.

- **Why did India miss its wind energy target?**
  - **Inconsistent policy environments** also discourage investment in the sector.
    - For e.g. In 2016, the government decided to withdraw 50 percent of accelerated depreciation benefit to industry from 2017.
  - **Legacy challenges** - infrastructure and transmission bottlenecks, financial conditions of discoms etc.
  - **Moving from feed in tariff system to e-reverse auction in 2017.**
    - Competitive bidding at low tariffs led to wind energy exploitation only remaining feasible in Gujarat and TN. In these two states plant Load Factor (PLF) is higher due to high wind speed.
    - The overemphasis on low tariff meant that tariff caps set for centrally sponsored auctioned projects are often too low to make the projects bankable or economically viable.
    - In 2022, MNRE has said that it would be doing away with the practice of reverse auction. This is expected to bring some relief to the wind energy sector.
  - **Cost Escalation:** Due to increased commodity prices
  - **Competition:** especially from cheaper photovoltaic power
  - **Reduced Policy Attention:** Government's policy focus has been on solar energy and wind energy has been reduced to playing a second fiddle, despite the fact that it was an early mover in the renewable energy sector.
  - **Land Acquisition** is emerging as another major issue.
- **What Further needs to be done?**
  - i. **Clear, well-defined policy**
    - Perhaps the keenly awaited Renewable Energy Law that has been in the making for quite some time now.
    - This would bring policy clarity and remove uncertainties in the sector.
  - ii. **Repowering** - i.e., upgrading the capacity of the existing wind turbines to produce more energy: It can increase productivity and spur socio-economic benefits.
  - iii. **Work on solving legacy challenges.**
    - Strengthening transmission infrastructure, DISCOMS and Changing State land policies to simplify land acquisition.
  - iv. **Develop Offshore wind roadmaps:**
    - The offshore wind measurement campaign can yield LiDAR data to identify bankable offshore wind zones.
    - Promote engagement among decision-makers at the federal, state and local levels of government, civil society organizations, and local stakeholder communities to align offshore wind development strategies and promote a collective understanding of offshore wind's socioeconomic benefits.
  - v. **Creating Export Potential for wind energy equipment**
    - Develop a technology exchange program and align Indian manufacturing based with global wind supply chain to create export-oriented opportunities.
    - Including these components in FTAs
  - vi. **Focus on modular and micro-wind turbines:** These can produce electricity at low wind speeds (5-6 kmph).
    - These micro-turbines could be fixed on terrace like a TV aerial; on street and highway lights; agricultural pumps; traffic signals etc.
    - It will reduce the land acquisition problem and would be suitable for regions which get continuous slow wind speed.

## 2) OFFSHORE WIND ENERGY

- **What is offshore wind energy?**
  - » It refers to deployment of wind farms inside the water bodies. They utilize the sea wind to generate electricity. These wind farms either use fixed foundation turbines or floating wind turbines.
    - A **fixed foundation turbine** is built on shallow water, whereas a **floating wind turbine** is built in deeper waters where its foundation is anchored in seabed. Floating wind farms are still in infancy.
- **Target:** MNRE has set a target of installing 5GW of offshore capacity by 2022 and 30GW by 2030.
- **India's offshore wind energy potential:**
  - » **MNRE:** India can generate 127 GW of offshore wind energy with its 7,600 km of coastline. Other sources mention it to be (World Bank Report - 195 GW (112 fixed and 83 floating);
- **Advantages of offshore wind energy parks:**
  - » Renewable Energy
  - » No land acquisition and land scarcity issues
  - » Offshore wind turbines are more efficient compared to onshore ones (wind speed over water bodies is high and is consistent in direction)
- **Steps Taken**
  1. **National Offshore Wind Energy Policy, 2015**
    - Nodal Ministry MNRE has been authorized for use of offshore areas within EEZ of the country
    - National Institute of Wind Energy (NIWE) has been authorized as Nodal agency for development of offshore wind energy in the country and to carry out allocation of offshore wind energy blocks, coordination and allied functions with related ministries and agencies.
    - National Targets for offshore wind energy capacity has been set at 5 GW by 2022 and 30 GW by 2030.
  2. In June 2022, MNRE has decided to bid out offshore wind energy blocks.
- **Challenges:**
  1. **General challenges of wind energy** as discussed above.
  2. **Technological and Engineering challenges:** High sea breeze, corrosive saltwater and challenging seabed conditions require technological and engineering advancements.
  3. **Local substructure manufacturers, installations vessels and trained workers** are lacking in India. Offshore wind turbines require stronger structures and foundations than onshore wind farms. This can cause higher infrastructure cost.
  4. **Maintenance** of offshore wind farms are more costly due to problems like cyclones.
  5. **Grid Infrastructure and Integration** will be challenges as the power generated at sea has to be transmitted to the onshore grid.
  6. **Environmental concerns:** Environmentalists are worried that noise from offshore wind farms could impact fish habitats.
- **Way forward to promote offshore wind energy:**

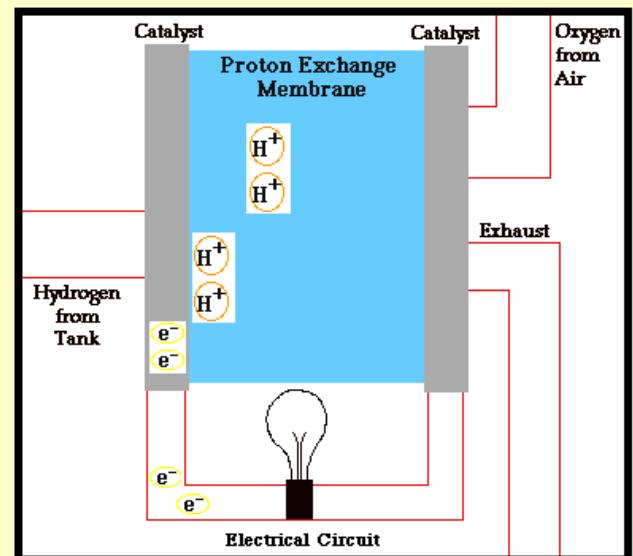
- » MNRE should set up a specific Renewable Purchase obligation (RPO) targets for each state just like it does for solar.
  - Note: Currently, there are two types of RPOs - Solar and Non-Solar
- » **Feed in Tariffs:** Discoms can adopt feed-in tariff (FiT) regulations and make offshore wind power procurement mandatory.
- » **Skill Development** - Capacity building programs, vocational training, and educational initiatives should be implemented to develop a skill workforce for offshore wind energy.
- » **Infrastructure Building:** Initiatives to promote domestic manufacturing and supply chain management.
- » **Environmental Impact Assessment and mitigation** to prevent environmental degradation and protect biodiversity.

## 6. HYDROGEN ENERGY

### 1) HYDROGEN FUEL CELL

- **Introduction**
  - » Hydrogen is the simplest fuel. A fuel cell combines hydrogen and oxygen to produce electricity, heat and water.
- **Fuel Cell**
  - » A fuel cell is a device that **converts chemical potential energy (energy stored in the molecular bonds) into electrical energy.**
    - A Proton Exchange Membrane (PEM) cell uses hydrogen (H<sub>2</sub>), and Oxygen (O<sub>2</sub>) as fuel.
    - The products of the reaction are water, electricity and heat.
  - » **Key Elements of a fuel cell**
    - **The anode**, the negative electrode of the fuel cell, conducts the electrons that are fed from the hydrogen molecule so that they can be used in the external circuit.
    - **The Cathode**, the positive post of the fuel cell, has channels etched into that distribute the oxygen to all surface of the catalyst. It also conducts electrons back from the external circuit to the catalyst, where they can recombine with hydrogen ion and oxygen to form water.
    - The **electrolyte** is a **proton exchange membrane**. This specially treated material, which looks something like ordinary kitchen plastic wrap, only conducts positively charged ions. The **membrane blocks electrons**.
    - **The catalyst** is a special material that facilitates the reaction of oxygen & hydrogen. It is usually made up of platinum nano particles very thinly coated onto carbon paper or clothe.
- **How does a fuel cell work?**

- » Hydrogen from a tank onboard the vehicle, enters into anode side of the fuel cell.
- » Oxygen pulled from air enters from cathode side
- » **As the hydrogen molecule encounters the membrane, a catalyst forces it to split into electron and proton.**
  - The proton moves through fuel cell stack and the electron follows an external circuit, delivering current to the electric motor and other vehicle components.
  - At cathode side, the proton and electron join again, and they combine with oxygen to form the vehicle's only tailpipe emission, water.



#### - Advantages of Hydrogen Fuel Cell

- » Fuel cell avoids the "thermal bottleneck" (a consequence of 2nd law of thermodynamics) and are thus inherently **more efficient than combustion engines**, which must first convert chemical potential energy into heat, and then mechanical energy.
- » Hydrogen is high in energy.
- » Fuel cells **don't have any moving part** and thus are more reliable than traditional engines.
- » **No pollution** (Only steam (H<sub>2</sub>O) emitted as by product)
- » **No Greenhouse gas and Climate Change** (since no GHG are produced as bi-products)
- » **Ends dependency of Li-Ion batteries** (Please note for Lithium we are almost completely import dependent)

#### - Limitation

- » Complex and difficult to build
- » Still mostly in research phase
- » Extracting hydrogen is difficult and expensive - **catalyst used is Platinum-** which is very expensive.

### A) FUEL-CELL ELECTRIC VEHICLES (FCEVs)

- » FCEV combine hydrogen and oxygen to produce electricity which runs the motor.
  - E.g.s of cars using FCEV: Toyota's Mirai, Honda's Clarity, and Hyundai's Nexo.
- » Since they are powered entirely by electricity, **FCEVs are considered EVs**, but unlike BEVs, their range and refueling processes are comparable to conventional cars and trucks.
  - The **major difference** between a BEV and a refueling time of just five minutes, compared to 30-45 mins charging for a BEV.

- Also, consumers get five times better energy storage per unit volume and weight, which frees up a lot of space for other things, while allowing the rider to go farther.
- » India's first indigenously developed Hydrogen Fuel Cell (HFC) technology bus was unveiled in Aug 2023, with the fuel cell - which uses hydrogen and air to generate electricity onboard to power the bus - being developed jointly by CSIR and Pune based automotive software company KPIT Ltd (Aug 2023)

## B) TYPES OF ELECTRIC VEHICLES: EV/BEV, HEV, PHEV, FCEV

- **Electric Vehicles:** The standard EV is also known as **Battery powered EV (BEV):**
  - » They don't have an internal combustion engine and instead of an petrol/diesel, these vehicles run solely on battery power. These can be charged at home or commercial charging stations.
- **Hybrid Electric Vehicles (HEVs):** They run on both Internal Combustion Engines and electric motor that uses energy stored in a battery. However, unlike other EVs, HEV cars battery is charged by regenerative braking.
  - » **Micro (or mild) Hybrid** uses both battery and electric motor to make the car run. Though they can't run solely on electric power, they maximize fuel economy by shutting off the internal combustion engine during complete stops.
- **Plug-in Hybrid Electric Vehicles (PHEV):** They expand the concept of HEVs. They have both an internal combustion engine and a battery powered electric motor. This allows the battery to store enough power to feed the electric motor and in turn decrease the gas usage by as much as 60%. They can travel around 60 kms on electric power, rather than 2-3 kms with a standard HEVs.
- **FCEV:** already discussed above.

## 2) HYDROGEN ENERGY

- **Hydrogen Energy** is a clean and efficient form of energy derived from Hydrogen (H<sub>2</sub>). It has the potential to replace fossil fuels.
  - » Hydrogen can be produced from variety of sources including water, natural gas, and biomass.
  - » There are two main ways to produce Hydrogen:
    1. **Steam Reforming:** This process uses heat and steam to break down natural gas into hydrogen and carbon mono-oxide.
    2. **Electrolysis:** This process uses electricity to split water molecules into hydrogen and oxygen.
  - » **Cost of producing hydrogen** varies depending on the various methods used.
- It can be used in two primary ways:
  - » **Direct Burning** to produce heat and water.
  - » **Fuel Cell Route** to directly produce electricity.
- **Advantages of Hydrogen Fuel:**
  - » **Abundance:** It is the most abundant element in the Universe.

- » **Energy Density** -> High
- » **Can contribute to achieving Net Zero by 2050**
- » **No Pollution** (only releases water)
- » **Leading options for storing energy from renewables.**
- » **Advantages of Hydrogen Vehicles (Fuel cell Stack) over other Electric Vehicles (Lithium-ion batteries))**
  - A fuel cell electric vehicle can be refueled in just 5 minutes. EV takes 30-45 minutes for charging.
  - **Energy storage per unit volume and weight is higher** in fuel cells than other types of electric vehicles.
  - **EV battery materials are controlled by a few larger players**. Scaled up hydrogen fuel cell will bring countries on equal footing.
  - **EV batteries** (like Lithium ion batteries) have still not been found viable for heavy vehicles like trucks.
- To get support in **Regulatory Framework** - the MoRTH in 2020 have issued a notification proposing amendments to the Central Motor Vehicle Rules, 1989, to include safety evaluation standards for hydrogen fuel cell-based vehicles.
- **Some limitations of Hydrogen fuel**
  - » **Hydrogen molecule is not available in abundance** on earth and is found in combination with other elements.
    - Thus, **external energy source** is required to isolate hydrogen. If coal or other fossil fuel is used for this extraction, it is called grey hydrogen and has carbon footprint.
  - » Hydrogen technology is "yet to be scaled up". Tesla CEO Elon Musk has called fuel cell technology "mind-bogglingly stupid".
  - » **Lack of fueling station infrastructure**
    - There are fewer than 500 operational hydrogen stations in the world today, mostly in Europe.
  - » **Safety is a concern.**
    - Hydrogen is pressurized and stored in a cryogenic engine. Some companies like Toyota and Hyundai have said that safety and reliability of hydrogen fuel tanks is similar to that of standard CNG engines.
- **Note: Various types of Hydrogen:** The most common element in nature is not found freely. It exists only combined with other elements and has to be extracted from naturally occurring compounds like water (which is a combination of two hydrogen atoms and one oxygen atom). This process is energy intensive.
  - » **Grey Hydrogen**
    - Hydrogen produced from fossil fuels. This constitutes a bulk of hydrogen produced today.
  - » **Blue Hydrogen**
    - Hydrogen generated from fossil fuels with carbon capture and storage options.
  - » **Green Hydrogen**

- Hydrogen generated entirely from renewable power sources. Here electricity generated from renewable energy is used to split water into hydrogen and oxygen.
- For e.g., a IIT-Madras team generated hydrogen from seawater using solar energy. (June 2023)

## A) NATIONAL GREEN HYDROGEN MISSION

- **Ministry:** MNRE
  - With a vision to make India an energy independent nation, and to decarbonize critical sectors, the Government approved National Green Hydrogen Mission on Jan 4, 2023 with an initial outlay of Rs 19744 crores upto 2029-30.
  - The mission will facilitate demand creation, production, utilization, and export of Green Hydrogen and mobilization of Rs 8 lakh crores of investment by 2030.
  - **Likely Outcomes by 2030:**
    1. **Green Hydrogen Production Capacity** of at least 5 MMT (Million Metric Tonne) per annum.
    2. **Reduction in fossil fuel imports** by over Rs 1 lakh crores and creation of over 6 lakh jobs.
    3. **Renewable Energy Capacity Addition** of about 125 GW and abatement of nearly 50 MMT of annual GHG emissions.
  - **Interventions:**
    1. Under the **Strategic Interventions of Green Hydrogen Transition (SIGHT) Program**, two distinct financial incentive mechanisms - targeting domestic manufacturing of electrolyzers and production of Green Hydrogen - will be provided under the mission.
    2. **Regions capable of supporting large scale** production and/or utilization of hydrogen to be developed as Green Hydrogen Hubs.
  - **Policy Framework:**
    1. **Development of an enabling policy framework** to support establishment of Green Hydrogen Ecosystem.
    2. **Robust Standards and Regulations Framework**
    3. **Public Private Partnership** framework for R&D (**Strategic Hydrogen Innovation Partnership - SHIP**) will also be facilitated under the mission.
    4. **Skill Development Program**
- » **Several Pilot Projects** by PSUs like OIL, NTPC etc. have been initiated for the production of Green Hydrogen.

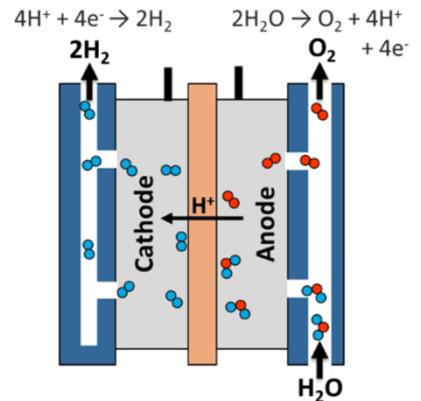
## B) GOVERNMENT UNVEILS GREEN HYDROGEN STANDARDS (AUG 2023)

- It outlines the emission threshold for production of hydrogen that can be classified as 'green'.

- » Well-to-gate emission of not more than 2 kg CO<sub>2</sub> for per Kg H<sub>2</sub>.
  - The well-to-gate emission include water treatment, electrolysis, gas purification, drying and compression of Hydrogen.
  - The scope of the definition encompasses both electrolysis based and biomass-based hydrogen production methods.
- » A detailed methodology of measurement, reporting, monitoring, on-site verification and certification of green hydrogen and its derivatives will be specified by the Ministry of new and renewable energy.
- » Bureau of Energy Efficiency (BEE) under the MoP will be the nodal authority for accreditation of agencies for the monitoring, verification, and certification of green hydrogen production projects.
- **Significance:**
  - » The definition of green hydrogen brings a lot of clarity to the mission of making India a global green hydrogen hub.

### C) ELECTROLYSERS:

- Electrolysers are a critical technology for the production of low-emission hydrogen from renewable or nuclear electricity.
  - **Note:** Electrolysis is the process of using electricity to split water into hydrogen and oxygen. This reaction takes place in a unit called an Electrolysers.
- **How does it work?**
  - Like fuel cells, Electrolysers consist of an anode and a cathode separated by electrolyte. Different electrolyzers function in different ways, mainly due to the different type of electrolyte material involved in the iconic species it conducts.
  - The cost of electrolyzers and electricity (fuel) make up the largest share of the production cost, and thus developing more efficient electrolyzers will give a major boost to green hydrogen generation in India.
- **Some Recent Developments:**
  - IIT Madras develops a cost-effective way to electrolyze sea water to generate hydrogen:
    - **Challenges of traditional electrolyzers:**
      - Energy Intensive
      - Use of expensive oxide-polymer separator
      - Wastage of fresh water
    - **IIT Madras team** has addressed all these challenges by developing simple, scalable and cost effective alternatives that are highly efficient in splitting seawater and generating hydrogen.
      - They use alkaline sea water.



- They use carbon based support material for the electrodes instead of metals to almost eliminate the possibility of corrosion.
- They have developed a cellulose based separator that is very economic and serves the purpose of allowing hydroxide ions to pass through put prevent oxygen and hydrogen that are generated from crossing over.

#### D) HYDROGEN-CNG (H-CNG)

- In Sep 2020, MoRT&H has notified hydrogen-enriched compressed natural gas (CNG) as an automobile fuel.
- In Oct 2020, **Delhi became the first city in India to operate buses running on hydrogen spiked compressed natural gas (H-CNG)** in a six-month pilot project.
  - » The buses are running on a new technology patented by Indian Oil Cooperation for producing **H-CNG - 18% hydrogen in CNG - directly from natural gas** without resorting to conventional blending.
- **What is H-CNG?**
  - » It is an hydrogen enriched compressed natural gas. The ideal hydrogen concentration is 18%.
    - In **Delhi**, instead of physically blending hydrogen with CNG, hydrogen spiked CNG will be produced using a compact reforming process patented by IOC.
- **Advantages of H-CNG over CNG**
  - » **Less Air Pollution**
    - Emits 70% less CO<sub>2</sub>
    - Reduces total hydrocarbons emissions by around 15% and increases fuel efficiency by 3-4%.
  - » **Increases fuel efficiency**
  - » **Higher power output**
- **Updates in Sep 2021**
  - » **CNG to HCNG model 'Capital intensive'**; Delhi government unlikely to scale up pilot project.
- **Way Forward: Following are the essential actions to ensure the launch of hydrogen economy in India**
  - » **Promote Demand**
    - Identify high demand sectors like green ammonia, oil-refining, heavy duty transport etc. where initial demand can be catalysed via public incentives.
    - **Pioneer voluntary purchase mechanisms** for green hydrogen embedded products such as green steel or green fertilizers similar to RE100 initiatives, where corporates like Infosys or google pledged to run completely on green energy.
  - » **Reduce cost of production of green hydrogen:**
    - **Work towards reducing renewable energy tariffs** -> 70% of the cost of production of green hydrogen is the cost of renewable energy.
    - **Scale:** India should strive to **incentivise the giga-scale production of green hydrogen components**, like electrolyzers, to take advantage of the global demand-supply gap and reduce the local green hydrogen prices.

- » India should **identify hydrogen production clusters closer to the renewable parks** to utilise near-zero cost excess peak power which can be diverted to hydrogen plants
- » **Promote R&D:** Policymakers must facilitate investments in early-stage piloting and the research and development needed to advance the technology for use in India.
- » **Focus on Domestic Manufacturing:**
  - Establishing an end-to-end electrolyser manufacturing facility will require more steps than just an PLI scheme. India needs to secure the supply of raw material that are needed for this technology.
- » **In the initial phase, Blend Green Hydrogen with Grey Hydrogen** (as grey hydrogen is much cheaper to produce)
- » **Plan for large scale refuelling network**
- » **Start on pilot basis for gated infrastructure like airports, ports, warehouses.**

#### - Conclusion1

- » Scaling up the technology and achieving critical mass remains a big challenge. More vehicles on the road and more supporting infrastructure can lower costs. **India's proposed mission** is seen a step in that direction.

#### - Conclusion2:

- » Even before it has reached any scale, green hydrogen has been anointed the flag-bearer of India's low-carbon transition. Hydrogen may be lighter than air, but it will take some heavy lifting to get the ecosystem in place.

## 7. BIOFUELS

### 1) BIO-FUEL BASICS

- Example Questions
  - i. Discuss the key advantages of Biogas. What are the key initiatives by government of India to promote the creation of biogas plants in the country. [10 marks, 150 words]
  - ii. '*Promoting biofuels in India is of strategic importance*' Discuss in light of the National Biofuel Policy 2018. [15 marks, 250 words]
  - iii. Discuss the 3 generations of biofuels and their advantages and disadvantages. [10 marks, 150 words]
  - iv. "National Biofuel Policy is trying to balance India's food security & energy security with farmer's income security". Discuss. [12.5 marks, 200 words]
- Introduction
  - Biofuel is a fuel that is produced through contemporary biological processes, such as agriculture and anaerobic digestion, rather than fuel produced by geological processes such as those involved in the formation of fossil fuels.
  - They are made from recently grown biomass (plant or animal matter). They are **renewable** because the source is continuously replenished.
    - E.g., Biogas, bioethanol, biodiesel etc.
  - **Biogas** is the biofuel produced through anaerobic digestion of organic waste.

- **Bioethanol** is an alcohol made by fermentation, mostly from carbohydrates produced in sugar or starch crops such as corn, sugarcane, or sweet sorghum.
  - **Cellulosic biomass**, derived from non-food sources, such as trees and grasses, is also being developed as a feedstock for ethanol production.
  - **Ethanol** can be used as a fuel for vehicles in its pure form, but it is usually used as a gasoline additive to increase octane and improve vehicle emission.

- **Generations of Biofuel (3 important)**

- i. **1G Biofuel:** They are produced directly from food crops such as wheat, sugar, vegetable oil and even animal fat etc.
  - Advantages includes known simple tech, cost competitiveness with fossil fuels etc.
  - Criticisms include food vs fuel debate etc.
  - They are also known as conventional biofuels. Most common first generation bio fuels include:
    - **Biodiesel:** Extraction of vegetable oils (both edible and non-edible), with or without esterification, from seeds of plants like soybean, rape (canola) and sunflower.
    - **Bioethanol:** Fermentation of simple sugar from sugar crops (sugarcane) or starch crops (corn, wheat etc).
      - It accounts for around 2/3rd of total biofuel production in the country.
    - **Biogas:** Anaerobic fermentation of organic waste and crop residue as energy crops.
- ii. **2G Biofuels:** Produced from non-food organic crops such as wood, organic waste, food crop waste and specific biomass crops. It includes use of non-food-crops technologies like jatropha-based fuels.
  - The advantages include use of wasteland, less impact on food security.
  - There are some limitations including high capital cost, advanced conversion technologies etc.
  - One well known second-generation technology is Lignocellulosic processing which uses forest material.
- iii. **3G Biofuels:** The source is based on improvements in the production of biomass.
  - They are produced from micro-organisms like algae
  - Algae act as low cost, high-energy and entirely renewable feedstock. It has impressive diversity and higher yield. Advantages include the ease of generating the biomass anywhere where sunlight and carbon is present.
  - Third generation biofuel has the potential to be more sustainable and have a lower environmental impact than first and second generation biofuels.
  - Some limitations include still developing tech, high technology cost, some poisonous algae etc.
- iv. **4th and 5th Generation Biofuels**
  - A. **Fourth Generation:**
    - It takes the advantage of biotechnology to engineer special crops such as algae (sometimes called oilgae) for biomass production. The aim is to engineer

microorganisms to produce biofuels more efficiently, with higher yields, and with lower environmental impacts.

#### B. 5th Generation Biofuels

- They are known as **electro fuels**. They are produced from microbial synthesis using renewable energy sources. In this process, micro-organisms use electricity as an energy source to convert carbondioxide into liquid fuels, such as ethanol or butanol.

**Note:** 4th Generation and 5th Generation Biofuels are in the early stage of development.

#### - Current Capabilities:

- As of Feb 2023, India has a biofuel power generation capacity of 10.77 GW.
- According to International Energy Agency (IEA), India is expected to overtake China to become third largest producer of ethanol by 2023.
  - Note: USA is the largest ethanol producer in the world accounting for 46% of global production and 2nd largest in biodiesel production accounting for 19% of the production.

#### - Targets:

- **National Biofuel Policy, 2018** (as amended in 2022): Country wide blending target of 20% ethanol by 2025 and 5% biodiesel by 2030

#### - Why growth of biofuel sector in India?

- The spurt in ethanol production in India is almost entirely policy driven. Initiatives like Ethanol Blending Program, National Biofuel Policy etc. have created conditions for the growth in the sector.

#### - Advantages of Biofuels

- i. **Renewable and Energy Security:** Biofuels reduce dependency on imports and thus also reduces India's vulnerabilities to price fluctuations.
- ii. **Fighting Pollution:**
  - Ethanol blended petrol reduces emission of pollutants like carbon monoxide.
  - Biogas is a much better fuel than cow-dung cake. It can also reduce the problems of poor sanitation.
  - Further, bio fuels helps in moving towards newer vehicle emission targets (BS-IV and BS-VI).
- iii. **Reduction in Greenhouse gases:**
  - A report by NITI Aayog quotes potential reduction of GHG emission at the point of use, i.e. from the tailpipe of the vehicle.
- iv. **Lesser impact on climate change**
  - Biogas also reduces the emission of GHGs such as methane and Carbondioxide.
- v. **Can Promote sustainable agriculture:**
  - Government is promoting farmers to move from water intensive crops like wheat and rice to Maize which is suitable for biofuel production.
- vi. **Increase farmer's income**

- By providing them another way to use their surplus crops.

vii. **Sanitation**

- Some biofuels like biogas can play an important role in dealing with the problems of open defecation and sanitation in rural and semi-urban areas.

viii. **Social impacts**

- Biofuels like biogas can reduce the drudgery of women involved in collecting fuel wood and thus plays a role in women empowerment.

ix. **Reduces Import Dependency and saving foreign exchange**

- **Some Criticisms:**

- **Land Use Change** to grow biofuel crops may have its own negative impact.
  - For e.g. the constant increase in demand from sugarcane based ethanol from Brazil has meant extensive deforestation of rainforests resulting in GHG emissions from Brazilian ethanol use that was about 60% higher than petrol.
- **Food Security Issues:** The argument that only surplus sugarcane and rice are diverted to fuel production may not hold in the longer term.
- **Water Challenges** - Sugarcane is a water intensive crop.

- **Steps taken by government to support biofuels**

- National Policy on Biofuels, 2018**
- Pradhan Mantri Ji-Van Yojana (PMJY)**
- Oil CPSEs are setting up 2G ethanol bio-refineries** in the country at Panipat (Haryana), Bathinda (Punjab), Numaligarh (Assam), Bargarh (Odisha) and one demonstration project at Panipat..
- EBP and associated steps**
- National Bio-Energy Program (FY 2021-22 to 2025-26):**
  - It comprises of the following schemes:
    - Waste to Energy Programme (Program on Energy from Urban, Industrial, and Agricultural Wastes/ Residues)** to support setting up of large biogas, BioCNG, and Power Plants (excluding MSW to Power projects)
    - Biomass Programme (Scheme to support manufacturing of Briquettes & Pellets and Promotion of Biomass (non-bagasse) based congregation in Industries)** to support setting up of pellets and briquettes for use in power generation and non-bagasse based power generation projects.
    - Biogas Programme** to support setting up family and medium Biogas in rural areas.

vi. **Biogas Promotion**

vii. **Advisory to carmakers to introduce flexible fuel engines in Vehicles:**

viii. **International Collaboration:** For e.g. the Global Biofuel Alliance (GBA) is one of the top priorities under India's G20 presidency.

- Brazil, India and the USA, as leading biofuel producers and consumers of the world have agreed to work together towards the development of this alliance along with other interested countries.
- This alliance will work towards facilitating cooperation and intensifying the use of sustainable biofuels, including in the transportation sector.

- **Way forward:**

- The proposed expansion of 1G biofuel need to think about broader land use strategies by developing clear and detailed criteria for identifying land suitable for energy crops.
    - Crucial factors like GHG emissions, local pollution, food security, land laws, and resource availability must also be considered.
  - For 2G Biofuels -
    - Locating the industries near feedstock availability: It is important to map feedstock location and then plan biofuel production capabilities.
    - More R&D: Scope for the schemes like Pradhan Mantri JI-VAN Yojana needs to be expanded, and international grants and loans should be redirected towards 2G fuels.
  - India also needs to develop alternative feedstock for biodiesel production.
    - Millions of tonnes used cooking oil can be channelized here.
- Conclusion:
- Thus, the expansion of the biofuel sector needs to be multipronged and rooted in sustainability.

## 2) ETHANOL BLENDING

- Process of mixing ethanol with Petrol is called Ethanol blending. The mixture is called as Ethanol Fuel/Gasohol which is considered as a quasi-renewable energy.
- In India, the practice of blending ethanol was started in 2001. Ethanol blending was first time mentioned in the Auto Fuel Policy of 2003.
- Benefits of Ethanol Blending
  - Reduces vehicular emissions especially CO (Carbon Monoxides) emissions.
  - It is cheaper than petrol as it is easier to manufacture.
  - It reduces our import dependency.
    - Trade balance, foreign exchange etc.
  - Ethanol has higher octane rating than ethanol-free petrol
  - In case of India Ethanol production can generate higher sugarcane prices for farmers.
- Ethanol Blended Petrol (EBP) Program was launched by the Government in 2003, and was aimed at promoting 5% blending of molasses-based ethanol with petrol, to promote the use of alternative and environment friendly fuels, to reduce import dependency for energy requirements and to increase value addition to Sugar industry enabling them to clear cane price arrears of farmers.
- Central Financial Assistance (CFA) for biomass power projects includes installations from biomass combustion, biomass gasification and bagasse co-generation.
- Allowing conversion of surplus stock of rice with FCI and Maize to Ethanol.
  - In June 2021, central government allocated 78,000 tonnes of rice from FCI for ethanol production.
- Cabinet keeps on reviewing the prices for procurement of ethanol by public sector Oil Marketing Companies, to ensure better prices for farmers.

### 3) NATIONAL POLICY ON BIOFUELS

- **Aims**
  - » Reduce India's oil import dependency.
  - » Provide better income opportunities to farmers by helping them dispose of their surplus stock in economic manner.
- **Key Highlights**
  - » **Aim (as amended in 2022):** Country wide blending target of 20% ethanol by 2025 and 5% biodiesel by 2030.
  - » **Categorization of Biofuels to enable extension of appropriate financial and fiscal incentives under each category.**
    1. **Basic Biofuels** viz. First Generation (1G) bioethanol and biodiesel
    2. **Advanced Biofuels** - Second Generation (2G) Ethanol, Municipal Solid Waste to drop-in fuels, Third Generation (3G biofuels), bio-CNG etc.
  - » **Expands the scope of raw material for ethanol production**
    1. Allowing use of sugarcane juice, sugar containing materials like Sugar Beet, Sweet Sorghum, starch containing materials like Corn, Cassava, Damaged Food grains like wheat, broken rice, Rotten Potatoes unfit for human consumption for ethanol production.
  - » **Allows use of surplus food grains for production of ethanol** for blending with petrol
  - » **A VGF for 2G Ethanol bio-refineries of Rs 5,000 crore in 6 years** in addition to additional tax incentives, higher purchase price as compared to 1G biofuels.
  - » The new policy encourages setting up of supply chain mechanisms for biodiesel production from non-edible oilseeds, used cooking oil, short gestation crops.
  - » **Specifies the role of all the concerned ministries/ Departments** with respect to biofuels
- **2022 Amendment:**
  - » Advance the deadline to reach the blending target of 20% bioethanol in petrol, from 2030 to 2025-26.
    - It will promote the production of biofuels in the country, under the Make in India program, by units located in SEZs/Export Oriented Units (EOUs).
  - » Make additional feedstocks eligible for the production of biofuels.
- **Analysis: Expected Benefits**
  - The new policy addresses **the supply side issues** that had discouraged the production of biofuels within the country.
- **Conclusion**
  - Biofuels in India are of strategic importance as it augurs well with the ongoing initiatives of the Government such as Make in India, Swachh Bharat Abhiyan, Skill Development and offers great opportunities to integrate with ambitious target of doubling farmers' income, import reduction, employment generation, waste to energy creation.

### 4) BIO-CNG (COMPRESSED BIOGAS)

- It is an upgraded version of biogas (the dung-based version of which serves as cooking fuel in many villages in India).
- **How Bio-CNG is produced?**
  - » **Pre-Treatment:** The waste is passed through a filter to remove hard material like Coconut shells and pieces of wood.
  - » **Shredding:** the waste is shredded in a hammer mill and made into a slurry with water.
  - » **Hydrolysis:** The slurry is kept in the pre-digestor tank in aerobic conditions for one-two days to attract microbes - the process is called **hydrolysis**.
  - » **Methanogenesis:** After hydrolysis the slurry is transferred to anaerobic digester where it is retained for 20-25 days. It is during methanogenesis that biogas is generated. This gas contains 65% methane, while the rest is Hydrogen Sulphide, carbondioxide, and water vapour.
  - » **Purification:** The above gas is passed through a wet and dry scrubber to remove hydrogen sulphide and CO<sub>2</sub>. Methane, purified upto 95% is obtained here which is then compressed at high pressure in cylinders and send to filling stations. This highly purified methane is similar in chemical properties to CNG derived from petroleum sources and can thus be used in vehicles.
- **Advantages:**
  - » **Renewable:** The energy source is renewable and thus reduces India's import dependency while ensuring **Atmanirbharta and Make in India**.
  - » **Swatch Bharat:** The production of Bio-CNG from biodegradable waste, agricultural residue, cow dung and chicken litter etc. can contribute to sanitation goals.
  - » **Fighting Air Pollution:**
    - Bio-CNG helps deal with air pollution on three levels - curtail methane emission, ward-off waste burning and phase out fossil fuel powered vehicles.
    - For e.g. the CBG plant inaugurated in Sangrur, Punjab will soon be processing 300 tons per day of paddy straw and produce 33 tonnes per day of CBG.
  - » **Strengthening Rural Economy, organic farming** -> **More income to farmers and More jobs in rural areas**
  - » **Decentralized energy** as it is produced closest to the point of consumption.
  - » **No Intermittency** like solar and wind as CBG could be produced at all hours.
- **Limitation:**
  - » **Maintenance cost** of Bio-CNG based vehicles is higher.
  - » Further, users have complained that calorific value of Bio-CNG is lower than CNG as it contains moisture.
  - » **Biogas plants** are also sometimes seen as methane bombs as any emission or leak from digestor or pipelines can contribute to climate change significantly.
- **Government Initiatives:**
  - » **SATAT (Sustainable Alternative Towards Affordable Transport)** Initiative:
    - Launched in 2018, it aims to promote production and use of Bio-CNG (Compressed Bio-GAS) in India. Under it, government sets up compressed Biogas (CBG) production plants and make available CBG in the market for use in automotive sector.
  - » **National Bio-Energy Program** (FY 2021-22 to 2025-26)
  - » Asia's largest compressed biogas plant was inaugurated in Sangrur by Union Minister Hardeep S. Puri.



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### OCT 2023: BOOKLET-1

### NOBEL PRIZES, 2023

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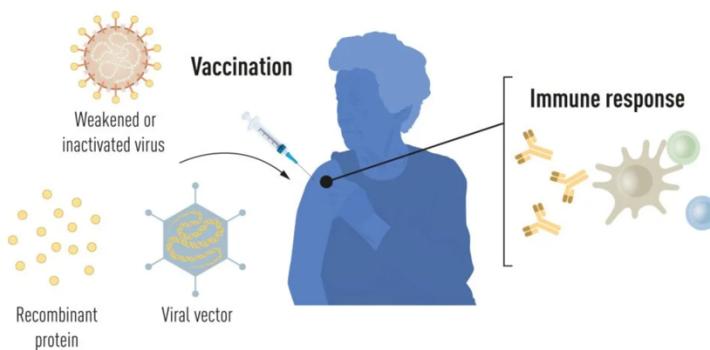
## 1) NOBEL AWARDS, 2023

- Nobel prizes are regarded as most prestigious awards given for intellectual achievement in the world. These are a set of six international awards.
  - » The will of Swedish Scientist Alfred Nobel established these prizes in 1895 and the first Nobel prize in Physics, Chemistry, Medicine, Literature and Peace were awarded in 1901.
  - » In 1968, Sweden's Central Bank Sveriges Riksbank established the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel, which although not being a Nobel Prize, has become commonly known as the Nobel Prize in Economics.
- **About Alfred Nobel:**
  - » He is a 19th century businessman and chemist from Sweden. He held more than 300 patents. His most popular invention was dynamite which he created by mixing nitroglycerine with a compound that made the explosive more stable. The dynamite soon started getting used in construction as well as defence industry which made Nobel very rich.
  - » It perhaps also made him think about his legacy, because towards the end of his life he decided to use his vast fortune to fund annual prize "to those who, during the preceding year, have conferred the greatest benefit to humankind".
  - » For reasons that are not entirely clear, Nobel decided that peace prize should be awarded in Norway and other prizes in Sweden. Nobel historians suspect that Sweden's history of militarism may have been a factor.
- **Who awards these prizes?**
  - » The Royal Swedish Academy of Sciences awards the Nobel Prize in Physics, the Nobel Prize in Chemistry, and the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel.
  - » The Nobel Assembly, consisting of 50 professors at the Karolinska Institute, Stockholm, Sweden awards the Nobel Prize in Physiology or Medicine.
  - » The Swedish Academy grants the Nobel Prize in Literature.
  - » The Norwegian Nobel Committee awards the Nobel Peace Prize.
- **Nobel Prizes in 2023:**
  - » In Physiology or Medicine, the prize has gone to scientists Katalin Kariko and Drew Weissman, whose work enabled the development of mRNA vaccine against COVID-19.
  - » In Physics, the Nobel Prize has been awarded to Anne L'Huillier, Pierre Agostini, and Ferenc Krausz in the field of attophysics for developing flashes of light short enough to take snapshots of electrons.

- » In **Chemistry**, the Nobel Prize has gone to Moungi G. Bawendi, Louis E. Brus, and Alexei I. Ekimov for the discovery and synthesis of **Quantum Dots**.
  - » The Nobel prize in **Literature** has been awarded to Job Fosse, "for his innovative plays and prose which give voice to the unsayable".
  - » The Nobel Prize in **Economic Sciences** has been awarded to Claudia Goldin for research on the **workplace gender gap**.
  - » The **Nobel Peace Prize for 2023** has been awarded to Iranian activist Narges Mohammadi for her relentless fight against the oppression of women in Iran and her unwavering commitment to promoting human rights and freedom.
- Prizes:
- » \$1 million; 18-carat gold medal; and diploma

## 2) S&T: UNDERSTANDING VARIOUS TYPES OF VACCINES

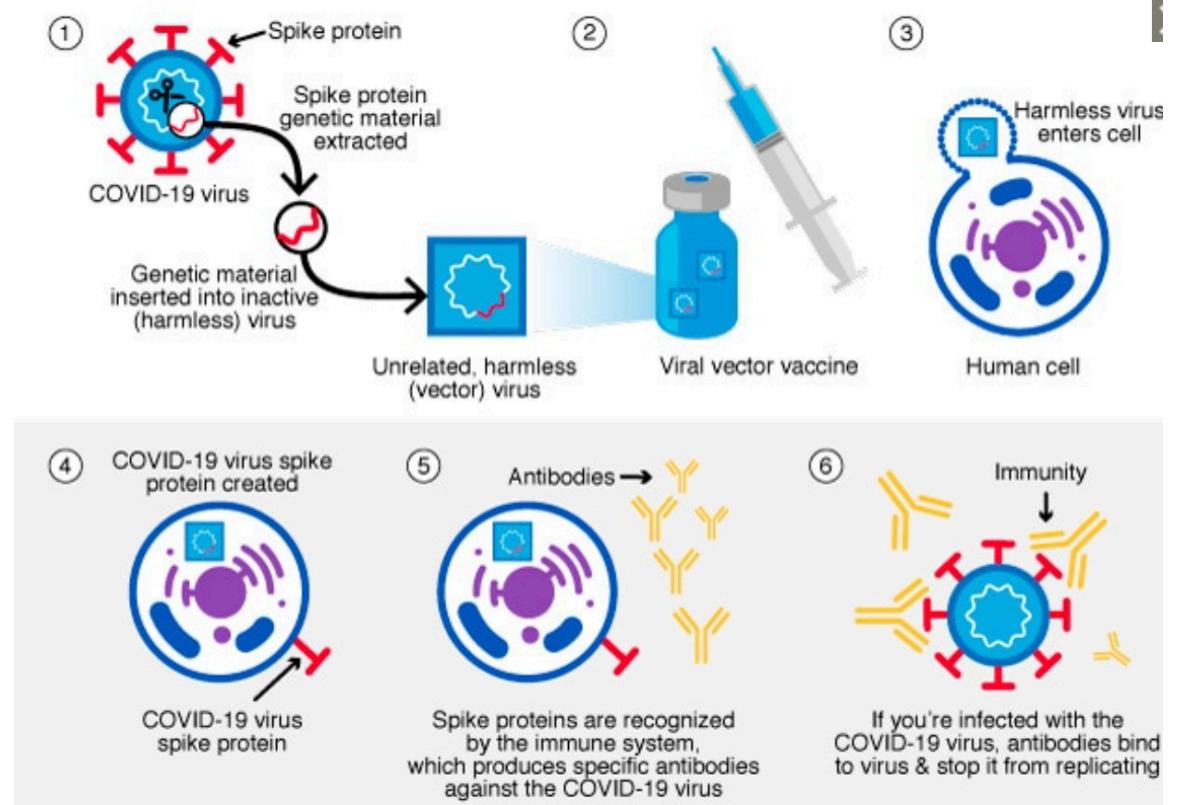
- **Live Attenuated virus vaccines** such as the combined rubella-mumps-measles vaccines and the yellow fever virus vaccine, induce robust and long-lived antibody and T-cell mediated immunity.
  - » **Note:** For the development of yellow fever vaccine, Max Theiler was awarded the Nobel Prize in Physiology or Medicine in 1951.
  - » These vaccines induce effective but transient immune responses, requiring repeated boosting.
  - » COVID-19 vaccine developed using this mechanism - Covaxin developed by Bharat biotech.
- **Viral Vector Vaccines:** It uses a safe virus (not harmful) which serves as a platform to produce target proteins to generate immune response.
  - » Such viral vector efficiently enters cells where the encoded antigen are produced by the bodies protein synthesis machinery.
    - The first example of a licensed viral vector vaccine was the Vesicular stomatitis virus - based vaccine against Ebola, approved in 2019, which was soon followed by an adenovirus-based Ebola vaccine.



- During **COVID-19** various vaccines
  - » **Oxford-AstraZeneca** (ChAdOx1 nCoV-19) used adenovirus route.

- Covishield used in India is a version of this.

» Sputnik V Vaccine also has gone adenovirus route.



- Both the above methods (live attenuated virus or viral vector vaccine) used **cell culture-based manufacturing facilities** which is **resource intensive**. Further they **may also introduce diseases** and is safer and stable than vaccine containing whole pathogens.
- Therefore, **researchers have focused upon sub-unit vaccines** that circumvent the need of large-scale cell cultures by delivering nucleic acid (DNA or mRNA) directly to vaccine recipients, exploiting the body's own capacity to produce proteins.
- **Subunit Vaccines:** (Protein subunit vaccines)
  - » Protein subunit vaccines **include only the parts of virus that best stimulate immune system**. These vaccines contain **single protein components** of the respective virus and are referred as subunit vaccine.
    - It includes **Hepatitis B Vaccine (HBV)** and **Human papillomavirus (HPV)** vaccine.
  - » **advantages:**
    - No risk of introducing the disease and is **safer and stable than vaccine containing whole pathogens**.
    - Suitable for **immunocompromised individuals**.
    - **Well established tech**

- » **Disadvantage**
  - Relatively complex to manufacture (compared to other vaccines like RNA vaccines)
  - May require multiple doses.
  
- » **COVID-19 vaccine** developed using this method:
  - **Corbevax** is a protein subunit COVID-19 vaccine developed by Texas Children hospital. It delivers spike protein to the body directly.
    - **How was protein manufactured?**
      - Add gene of spike protein into yeast to produce large number of proteins. After isolating the virus spike protein from the yeast and adding an adjuvant, which helps trigger an immune response, the vaccine was ready.
  
- **DNA and RNA subunit vaccines:**
  - » **Advantages** of subunit vaccines (DNA or mRNA vaccines)
    - **Less Resource intensive** and thus easy to manufacture.
    - **More flexibility** - Since the sequence can be easily changed to encode different antigens.
    - This also makes iterative testing of new candidate vaccines and generation of updated vaccines rapid and efficient.
  
  - » **Initially DNA vaccine was thought to be more promising** but didn't translate into success. A likely reason for it was that injected DNA must cross two barriers, the plasma membrane and the nuclear membrane, to reach the cellular compartment where transcription takes place (DNA conversion to mRNA). In contrast, mRNA-based vaccines only need to gain access to the cell cytoplasm where translation takes place (mRNA conversion to protein)
  
  - » **Another advantage of mRNA vaccine:** Delivered nucleic acid can't integrate into the host genome. This is an additional safety aspect of this method.
    - **E.g of DNA vaccine** (developed for COVID-19):
    - **E.g for mRNA vaccine** (developed for COVID-19): Moderna COVID-19 (mRNA-1273) vaccine.

### 3) S&T: BIOLOGY/PHYSIOLOGY NOBEL PRIZE, 2023

- The 2023 Nobel Prize in Physiology or Medicine has been awarded to **Katalin Kariko (Hungary)** and **Drew Weissman (USA)** for their discoveries concerning nucleoside base modifications that enabled the development of effective mRNA vaccine against COVID-19. Through their groundbreaking findings, which have fundamentally changed our understanding of how mRNA interacts with our immune system, the laureates contributed to the unprecedented rate of vaccine development during the COVID-19 crisis.
  
- **Background:**
  - » **Other methods of vaccine development** - Whole Virus -, protein-, and vector- based vaccines requires large scale cell culture. It is a resource intensive process and limits the possibilities for

rapid vaccine production in response to outbreaks and pandemics. **mRNA based vaccines** solved these problems.

- During the 1980s, efficient methods of producing mRNA without cell culture were introduced, called in-vitro transcription. Ideas of using mRNA technologies for vaccine and therapeutic purposes also took off, but roadblocks lay ahead.
  - » In vitro transcribed mRNA was considered unstable and challenging to deliver. It required development of sophisticated carrier lipid systems to encapsulate the mRNA.
  - » This mRNA also gave rise to inflammatory reactions.
  - » These problems limited the enthusiasm for developing the mRNA technology for clinical purposes.
- **Contributions:**
  - » In 1990s, Kariko was an assistant professor at the University of Pennsylvania and met immunologist Drew Weissman there.
  - » They worked together to prevent the immune system from launching an inflammatory reaction against lab-made mRNA, previously seen as a major hurdle against therapeutic use of mRNA.
    - They found that inflammatory response was almost abolished when base modification was included in the mRNA. Therefore, in 2015 they published that adjustments (modifications) to nucleosides, can keep the mRNA under the immune system's radar.
    - Later, they also showed that the delivery of mRNA generated with base modification markedly increased protein production compared to unmodified mRNA. This effect was due to the reduced activation of an enzyme that regulates protein production.

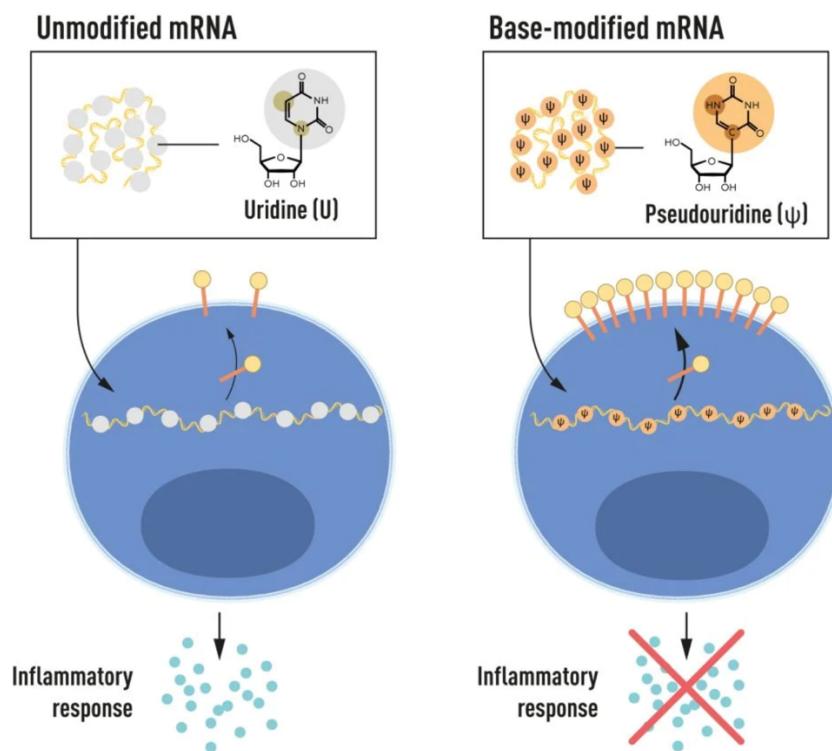
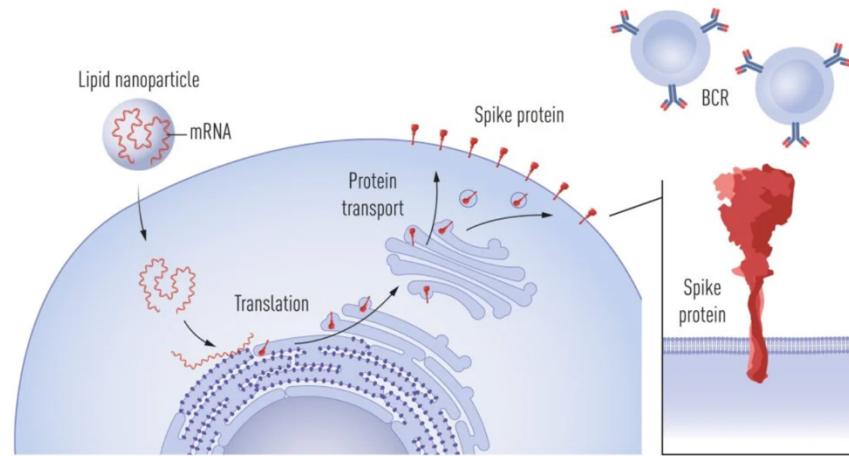


Figure 2. mRNA contains four different bases, abbreviated A, U, G, and C. The Nobel Laureates discovered that base-modified mRNA can be used to block activation of inflammatory reactions (secretion of signaling molecules) and increase protein production when mRNA is delivered to cells.

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- **Development of Vaccines:**

- After the above discoveries, interest in mRNA technology picked up. Vaccines for Zika and MERS-CoV were pursued.
- After the outbreak of COVID-19 pandemic, two base-modified mRNA vaccines encoding the SARS-CoV-2 surface protein were developed at record speed. Protective effects of around 95% were reported, and both vaccines were approved as early as Dec 2020.
- The impressive flexibility and speed with which mRNA vaccines can be developed pave the way for using the new platform also for vaccine against other infectious diseases.
- In the future, the technology may also be used to deliver therapeutic proteins and treat some cancer types.
- **How mRNA vaccine protects you against COVID-19:**



**Figure 4. Spike production following mRNA vaccination and recognition of spike by B cells.**

Following uptake of mRNA into cells, facilitated by lipid nanoparticles, the mRNA acts as a template for spike protein production. Spike is then transiently expressed on the cell surface, where it is recognized by B cells via their B cell receptors (BCRs), stimulating the secretion of spike-specific antibodies.

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- Through their fundamental discoveries of the importance of base modification in mRNA, this year's Nobel Laureates critically contributed to this transformative development during one of the biggest health crises of our time.

## 4) S&T: PHYSICS NOBEL PRIZE 2023

- **Quick Summary:**

- » Anne L'Huillier, Pierre Agostini and Ferenc Krausz have been awarded Nobel Prize in Physics, 2023.
- » **What did they do?**
  - Through their experiments, they have created flashes of light that are short enough to take snapshots of electrons' extremely rapid movements.
  - **Anne L'Huillier** discovered a new effect from laser light's interaction with atoms in a gas.
  - **Pierre Agostini** and **Ferenc Krausz** demonstrated that this effect can be used to create shorter pulses of light than were previously possible.

- **Background: Understanding the Problem:**

- » Human eyes cannot clearly see hummingbird's beating its wings which can be around 80 times per second. We are only able to perceive this as a whirring sound and blurred movement. It is because extremely short events are impossible to observe by human eyes.
- **High Speed photography** can capture detailed images of fleeting (short) phenomena. **A highly focused photograph of a hummingbird in flight requires an exposure time that is much shorter than a single wingbeat.**
- **The faster the event, the faster the picture needs to be taken if it is to capture the instant.**
- **Atom's** natural timescale is that of femtoseconds ( $10^{-15}$  sec). These movements can be studied with the very shortest pulses that can be produced with a laser.
  - A femtosecond was, in the 1980s, regarded as the limit for the flashes of light it was possible to produce.
- But, electrons natural timescale is further lower in **attoseconds (10<sup>-18</sup> sec)** i.e. in the world of electrons, positions and energies change at speeds of between one and a few hundred attoseconds. Therefore, flashes of light produced at femtosecond was not enough to see processes occurring on the timescale of electrons.
- **Development of Attosecond Pulses:**
  - » The mathematics that describes waves demonstrate that any wave form can be built if enough waves of the right sizes, wavelengths, and amplitudes (distance between peaks and troughs) are used. The **trick to attosecond pulses** is that it is possible to make shorter pulses by combining more and shorter wavelengths.
  - » In 1987, Anne L' Huillier and her colleagues at a French laboratory passed an infrared laser beam through a noble gas. The beam's interaction with atoms in the gas produced overtones (overtones are waves of light whose wavelength was an integer fraction of the beam. For e.g, if the beam had a wavelength of 100, the overtones would have wavelength of 10, 25, 50 etc.)
    - By finetuning the setup used to produce the overtones, scientists realized that it should be possible to create intense pulses of light each a few attosecond long.
  - » In 2001, Pierre Agostini and his research group in France successfully produced and investigated a series of 250-attosecond light pulses, or a pulse train.
  - » At the same time, Ferenc Krausz and his team in Australia developed a technique to separate an individual 650 second pulse from a pulse train.
    - Using this researcher were able to measure the energy of some electrons released by some krypton atoms.
- **Applications of attosecond physics:**
  - » It allows scientists to capture images of activities that happen in incredible short spans. This can be used for exploring short-lived atomic and molecular processes implicated in fields like material, science, electronics, and catalysis.
  - » In **medical diagnostics**, attosecond pulses can be used to check for the presence of certain molecules based on their fleeting signatures.
  - » These pulses could also be used to develop faster electronic devices, and better telecommunication, imaging and spectroscopy.

## 5) S&T: CHEMISTRY NOBEL PRIZE: QUANTUM DOTS

- **Quick Summary:**

- » The **Royal Swedish Academy of Sciences** has decided to award the Nobel Prize in Chemistry, 2023 to:
  - Moungi G. Bawendi** (MIT, USA)
  - Louis E. Brus** (Columbia University, USA)
  - Alexei I. Ekimov** (Nanocrystals Technology Inc., New York, NY, USA)

"For the discovery and synthesis of "Quantum Dots".

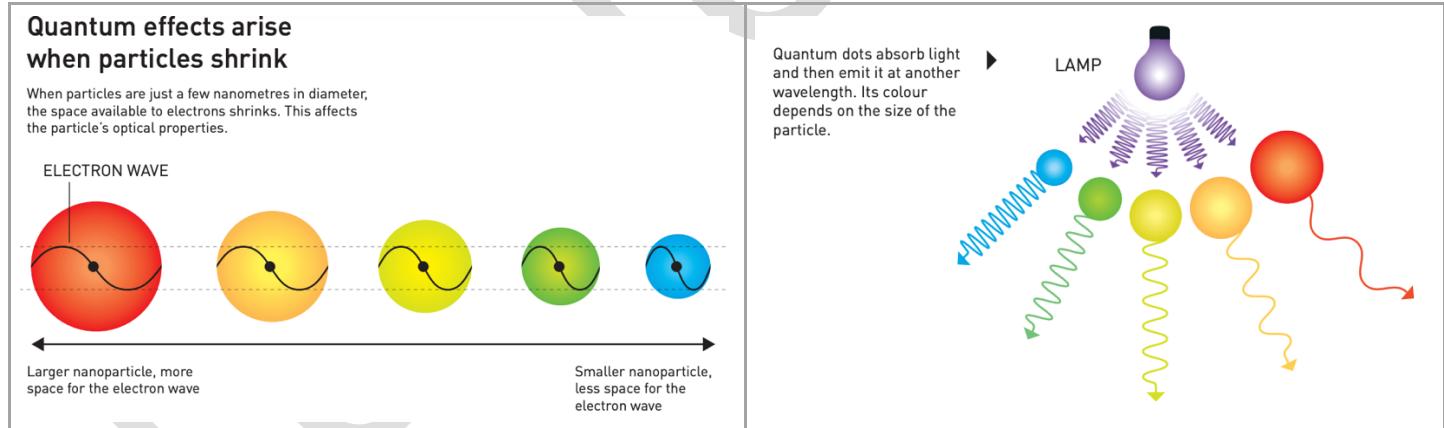
- **Details:**

- » **Quantum Dots** are nanoparticles so tiny that their size determines their properties.
  - **Understanding Size of Quantum Dots:**



A quantum dot is a crystal that often consists of just a few thousand atoms. In terms of size, it has the same relationship to a football as a football has to the size of the Earth.

- » **Understanding Properties:** They have many fascinating and unusual properties. Importantly, they have different colors depending on their size.



- **For decades**, Quantum phenomena in the nanoworld were just a prediction.

- **Contributions:**

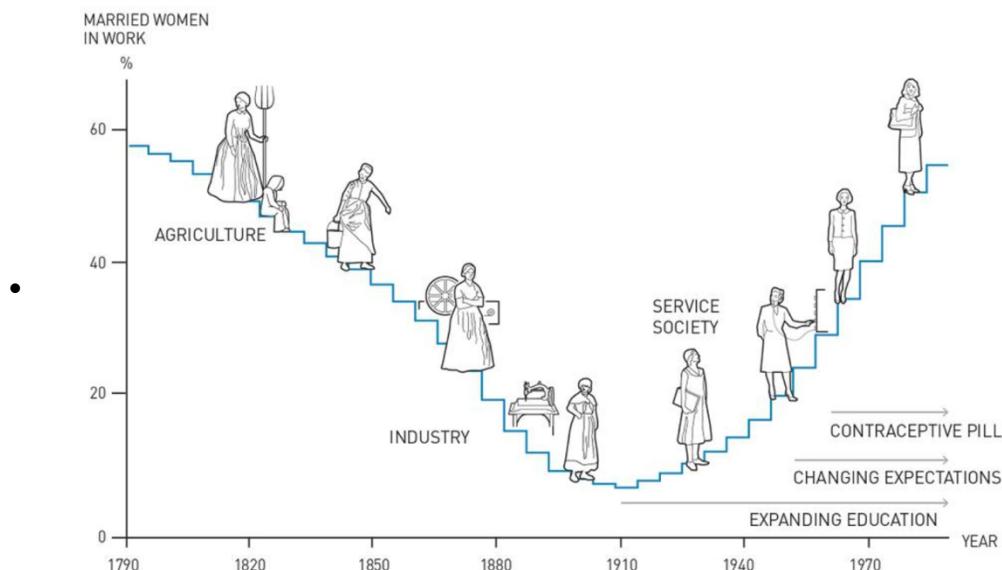
- » **In the early 1980s**, Alexie Ekimov and Louis Brus succeeded in creating - independently of each other - quantum dots, which are nanoparticles so tiny that quantum effects determine their characteristics.
  - **Alexie Ekimov**, in early 1980s, succeeded in creating size-dependent quantum effects in colored glasses.

- The color came from nanoparticles of copper chloride and Ekimov demonstrated that the particle size affected the color of the glass via quantum effects.
  - This was the first time someone had succeeded in deliberately producing quantum dots - nanoparticles that cause size-dependent quantum effects.
  - Louis Brus, a few years later, was the first scientist in the world to prove size-dependent quantum effects in particles floating freely in a fluid.
- » **Moungi Bawendi**, in 1993, revolutionized the chemical production of quantum dots, resulting in almost perfect particles. This high quality was necessary for them to be utilized in applications.
- **Applications:**
  - » Researchers have primarily utilized quantum dots to create colored light.
    - The luminous property of quantum dots is utilized in computer and television screens based on QLED technology, where the Q stands for quantum dot.
    - In these screens blue light is produced using the energy-efficient diodes that were recognized with the Nobel Prize in Physics 2014. Quantum dots are used to change the color of some of the blue light, transforming it into red or green. This makes it possible to produce three primary colors of light needed in a television screen.
  - » **LED Lamps**: Quantum dots are used in LED lamps to adjust the cold light of the diodes. The light can then become as energizing as daylight or as calming as the warm glow from a dimmed bulb.
  - » **Biochemistry and Biomedicine**: Biochemists attach quantum dots to biomolecules to map cell and organs. Doctors are also investigating the potential use of quantum dots to track tumour tissue in the body. Chemists instead use the catalytic properties of quantum dots to drive chemical reactions.
    - **Surgeries**: These can guide surgeons when they remove tumour tissues, among many other things.
  - » **Future Applications**: Researchers believe that in the future they could contribute to flexible electronics, tiny sensors, thinner solar cells, and quantum cryptography.
- **Conclusion:**
  - » Quantum Dots are bringing great benefits to humankind, and we have just begun to explore their potential.

## 6) ECONOMY NOBEL: WORKPLACE GENDER GAP

- **Why in news?**
  - » 2023 Nobel Prize in Economic Sciences awarded to U.S. economist Claudia Goldin for research on the workplace Gender Gap (Oct 2023)
- **Details:**
  - » **Claudia Goldin**, a professor at Harvard is only the third woman to ever be awarded the economic prize.
    - Earlier, Elinor Ostrom was awarded this in 2009 and Esther Duflo was awarded in 2019.
- **Key Contribution:**

- » She has studied 200 years of women participation in workplace in USA. Her work is the "first comprehensive account of women's earning and labour market participation through the centuries".
- » As per her, the most important in the unequal paradigm "is that both lose". Men are able to have the family and step up because women step back in terms of their jobs, but both are deprived. Men forgo family time and women often forego their career.
- » The most significant of her observation was that female participation in the labor market didn't exhibit an upward trend over the entire period, but rather a **U-Shaped curve**. In other words, economic growth ensuing in varied periods didn't translate to reducing gender differences in the labour market.



- How did female participation move between the agrarian and industrial era?
  - » The participation of married women decreased with the transition from an agrarian to an industrial society in the early nineteenth century.
    - The female participation in labor force was incorrectly assessed and stated in census and public data.
      - For e.g, a standard practice entailed categorizing women's occupation as "wife" in records. This was wrong because this identification didn't account for activities other than domestic labor such as working alongside husband in farms or family businesses, in cottage industry etc.
      - Thus, proportion of females in labor force was considerably greater at the end of the 1790s than was shown in the official stats.
    - Prior to advent of industrialization in the 19th century, women were more likely to participate in the labor force. This was because industrialization had made it harder for married women to work from home since they wouldn't be able to balance the demand of their family.

- The beginning of the 20th century marked the upward trajectory for female participation in the labor force:
  - Technological progress, the growth of the service sector and increased levels of education brought an increasing demand for more labor.
    - However, Social Stigma, legislation and other institutional barriers limited their influence.
    - Marriage Bars and Prevalent Expectations were two factors of importance there.
      - Marriage Bars refer to the practice of firing and not hiring women once married. This peaked during the 1930s Great Depression and the ensuing years - preventing women from continuing as teachers or officer workers.
      - Prevalent Expectations about their future careers. Women at varied points were subject to different circumstances when deciding on their life choices. Their decisions could be based on an assessment of expectations that might not come to fruition.
        - In the early 20th century for example, women were expected to exit the labor force upon marriage. When things turned marginally in the second half of the century, married women would return to the labor force once their children were older. However, this meant a reliance on educational choices that were made previously, as the author notes, at a time when they were not expected to have a career. The "underestimation" was overcome in the 1970s when young women invested more in education.
  - Introduction of birth control pills played a crucial role in creating conditions for women to plan their careers better. Though this influenced educational and career choices positively, it didn't translate into disappearance of the earning gap between men and women, though it became significantly smaller since the 1970s.
  - Pay Discrimination (i.e., employees being paid differently because of factors such as color, religion, or sex, among others) increased significantly with the growth of the services sector in the 20th century.
  - Source of Gap:
    - » Needing to combine paid work and family care needs.
    - » Decisions (and expectations) related to pursuing education and raising children.
    - » Technical Innovations
    - » Laws and norms
    - » Structural transformation in an economy.
  - Nobel laureate Claudia Goldin's hope for the future is that women have a career as well as a spouse who wants what they want.



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### OCT 2023: BOOKLET-2

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## 1. GENERAL STUDIES-2

### 1) SOCIAL JUSTICE: CASTE CENSUS

- **Why in news?**
  - » The Bihar government has released the results of its "Comprehensive Caste Survey" in the state (Oct 2023)
- **Background and Survey:**
  - » The Bihar legislature unanimously passed a resolution agreeing to a caste census, twice: first on Feb 18, 2019 and then on Feb 27, 2020. The Government of Bihar, in June 2022, issued a notification for conducting a caste survey in the state on its own and subsequently allocated Rs 500 crore from its contingency fund for the exercise.
  - » More than 3 Lakh people, mainly teachers, went from door to door with a 17 question form on caste, religion, and economic status. An app was used to collect the data for tabulation and processing.
- **Key findings of the survey Bihar Caste Census:**
  - » **Total Population:** 13.07 crores (10.41 crores in 2011 census)
  - » **Population Distribution** on the basis of Religion:

Group	% of Population
Hindus	81.99%
Muslims	17.72%
Buddhists, Christians, Sikhs, Jains, and other groups	Minuscule

- **Population Distribution** on the basis of Caste:

Group	Percentage Population
Backward Classes (EBCs (36.01%) + OBCs (27.12%))	63%
Scheduled Castes	19.65%
Scheduled Tribes	1.68%
Unreserved Category ("Forward Castes")	15.5%

- **Significance of Caste Census in Bihar:**

- » **Political Significance:** The results may present political parties like JD(U)-RJD with an opportunity for renewed backward class mobilization.
- » It is first such large scale exercise where results have been made public.
  - The states of TN and Karnataka, as well as Union Government itself (in an ill-fated SECC 2011), have collected comprehensive caste data in the past, but for reasons that remain unclear, never revealed it.
- » The survey results will amplify the clamor for increasing OBC quota beyond 27%, and for a quota within quota for the EBCs.
  - The Justice Rohini Commission, which had been examining the question of "sub-categorization" since 2017, submitted its report in last July - its recommendations are not public yet.
  - **Reopen debate on 50% ceiling on reservation:**

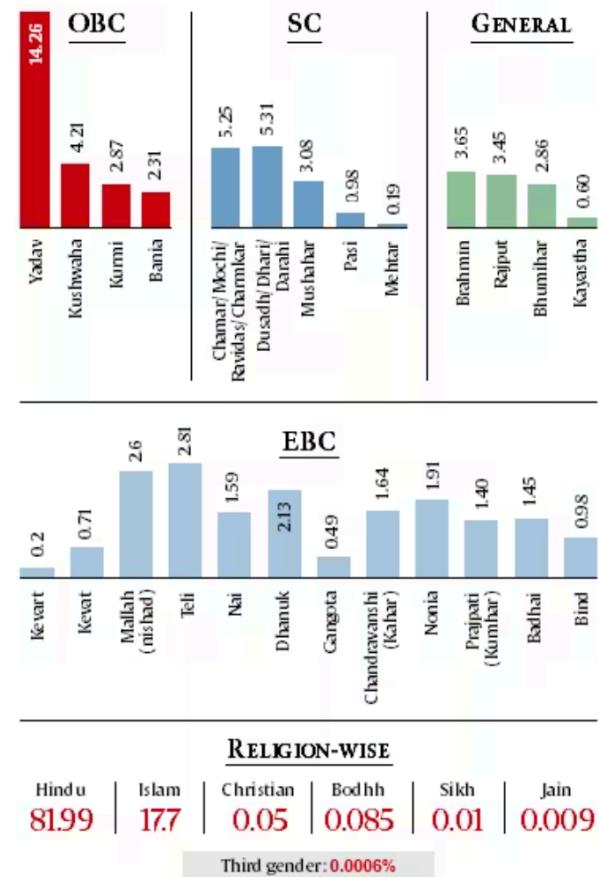
- **Need of a caste census/ Advantages of Caste Census:**

- » **Sociologist Satish Deshpande** says that the realities of caste inequalities in the present must be acknowledged and addressed before we can arrive at a cast-free future. To censor caste division is not to overcome them.
  - **Caste must be counted because it counts** - it is arguably the most important regulatory of life chances today. This means that the caste differences are real differences. To call for "unity" without addressing these differences is to practice dishonest politics.
- » A caste-based census can help in recognizing and quantifying the extent of historical injustices and disparities that exist in society. Recognizing these disparities is a critical step towards addressing them.
- » **Granular socio-economic profile of each caste** should help settle intractable question: Has caste ceased to be a key vector in inequality? Should reservation be based only on caste or on economic status or both? Have a few castes captured the quota? Should there be sub-quotas within the quotas? What should be the cutoff for creamy layer?
- » **Better Targeting of Social Justice initiatives:** It may enhance the demand for quota within quota to ensure benefits reach to extremely backward classes (and not only the dominant OBC

## TELLING NUMBERS

### How major groups stack up in Bihar

(figures in %)



groups). It will also force political parties to announce and initiate more welfare schemes for the poor and marginalized sections of society.

- » **Caste census will not just be headcount**, it will be a storehouse of **multi-dimensional and multi-layered information** which will be very useful for policy makers and designer of social welfare schemes.
- » **Regular caste-based census data can help track the progress of different caste group over time**, helping better evaluation of policies for social justice.
- » **Constitutional Mandate:** Article 340 of the Constitution of India provides for the appointment of a commission to investigate the conditions for the improvement of socially and educationally backward classes.

- **Limitations/Criticism of Caste Census:**

- » **Deepening of Faultline and Increasing Polarization** - It will lead to delay or prevent the movement towards casteless society.
  - **Criticism of this argument by Yogendra Yadav:** Everyone in a village or Basti knows everyone's caste and that every politician walks with an unofficial caste count of each polling booth.

- **Way forward:**

- » **Preventing the deepening of faultlines:**
  - Articulate the demand for caste census as an element in a larger multi-dimensional ideology of social justice that includes gender, class and location.
  - **Develop a cross party consensus**
  - **Concede it quietly**, rather than create a national row about it. Anyways, the limited side effects cannot outweigh all the benefits outlined above.

- **Conclusion1:**

- » **Caste must be counted in order to strengthen efforts to transcend it.** In a changing India, in which education and technology are important equalizing forces, caste-based affirmative action, fine-tuned with the help of caste numbers, can spur larger conversations on aspiration and ambition, freedom and opportunity, and the need for an eco-system in which citizens are neither unfairly privileged nor straitjacketed by their identities.

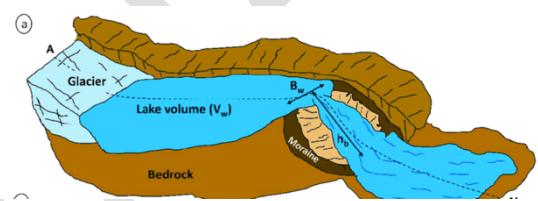
- **Conclusion2:**

- » 'The counting of caste is not a magical wand that will wave away the evils of caste inequality and oppression. Instead, it is a messy, contentious, complex exercise that is sure to have its flaws and inadequacies. But it is also inescapable first step towards an honest political engagement with the real differences and disparities of caste. And for that reason, it is imperative that India no longer evade this.' : **SATISH DESHPANDEY**

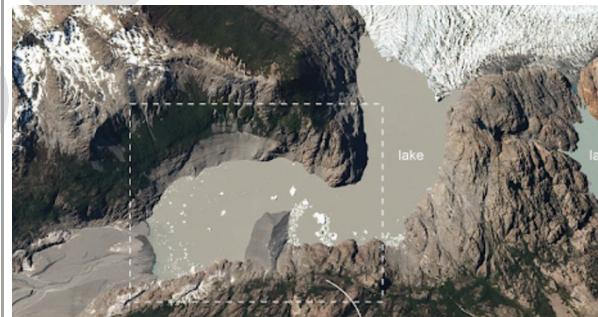
## 1) DISASTER MANAGEMENT: GLACIAL LAKE OUTBURST FLOOD (GLOF)

- Example Questions
  - » Discuss the key factors which is making Himalayan region more vulnerable to Glacial Lake Outburst floods (GLOF). In light of the recent NDMA guidelines, suggest measures to reduce risks of GLOF disasters (15 marks, 250 words)
- Introduction
  - » GLOFs are sudden fast flowing release of glacial lake water that move downslopes as a result of dam failure. They are recognized in the National Disaster Management Plan (NDMP) 2019 of India as a **potential climatological disaster**.
- Glacial lakes are either moraine dammed or ice margin dammed.

**Moraine Dam Glacial Lakes** are formed due to the retreating of glaciers, which leave behind soil and rocks and lead to an increase in capacity of lake, making it prone to bursting.



**ICE Dam Lakes** are created when ice from upper parts of glaciers fall and block passing rivers, giving rise to glacial lakes.



- Different types of lakes may have different hazard potential:
  - For e.g. Moraine-dammed lakes have high probability of breach and hazard potential, whereas the rock dammed lake have little chance of breach and low hazard potential.
- Current Situation:
  - A study, 'Glacial lake outburst floods threaten million globally' published in the journal **Nature** in Feb 2023 highlights that:
    - Around 15 million people globally face the risk of GLOF.
    - Around 20% of them (3 million) live in India.
    - India, Pakistan, Peru and China have more than 50% of the vulnerable people.
- Causes of increasing GLOF
  - Global Warming -> Climate Change
    - Increasing number of Glacial Lakes due to acceleration of glacier melt in recent decades.
    - Increased water pressure due to more water being available due to Global Warming.
  - Ice or rock avalanches, Erosions or other natural disruptions

- **Earthquakes** - Himalayan region is especially prone to earthquakes
- **Human Activities** -> increased tourism, expansion of roads and hydropower projects, deforestation etc have also increased the vulnerability of burst in these lakes.

- **Recent Examples:**

- » **Flash Floods in Sikkim in Oct 2023** which killed 90+ people, destroyed infrastructure like bridges and roads, and damaged state's largest hydropower project, the 1.2 GW Teesta-III.

- The flash floods were caused by access rainfall and **Glacial Lake Outburst Floods (GLOF)**.
- **South Lhonak lake**, the site of GLOF in Sikkim, was already recognized as potentially hazardous and scientists at the National Remote Sensing Centre had warned of a 42% chance of GLOF in as early as 2013.
- **How it happened in Oct 2023:**



- The GLOF overflowed into **Teesta river**, creating flash floods that destroyed the **Chungthang dam** which is the key component of the state's largest hydro-electric project, and washed away highways, villages and towns. The worst affected districts are Mangan, Gangtok, Pakyong and Namchi.
  - The economic loss will be thousands of crores. Chungthang dam itself cost about Rs 14,000 crores.
- **Note:** Scientists have said that **Sikkim's Glacial Lake is still at risk of GLOF, floods** as there is a slight reduction in the ice area but almost half of the glacier hasn't deglaciated yet. Thus, the lake will further increase in size due to glacier melting and inflow from the North Lhonak glacier.
  - Therefore, it should be monitored to prevent another GLOF.

- » The **Chamoli Flash floods of 2021** may have caused economic damages worth Rs 4,000 crore. It swept away the Rishiganga Hydel Power Project and inflicted substantial damage on the Tapovan Power Project.
- » **2013 Kedarnath** flash floods was also result of GLOF.

- **Adverse Impact**

- » These floods pose **severe geomorphological hazards and risks**
  - It can wreck havoc on all man made structures located along the path and thus endanger people, infrastructure, fields and livestock.
- » **Long term Climate Impact** may be caused by large glacial lake as they would increase the amount of water in ocean and reduce it in Himalayas.

- **Steps taken so far:**

- » **CWC** has done some work towards identification of such lakes;
  - Some other aspects are still work in progress including a robust early warning system, and a broad framework for infrastructure development, construction and excavation in vulnerable zones.
- » **Geological Survey of India (GSI)** carries out assessment of the GLOF threats and provide input to the National Disaster Management Authority (NDMA) for developing risk mitigation strategies.
- » **National Disaster Management Authority (NDMA)** have prepared Guidelines on the Management of Glacial Lake Outburst Floods (GLOFs) which are aimed at improving the administrative responses, drawing on international best practices; and bringing together the relevant scientific capabilities of the nation to eliminate potential losses from glacial hazards.

- **Key Highlight of the NDMA Guidelines**

i. **Inventorization: Hazard and Risk Mapping**

- » Regular monitoring of glacial lakes using satellite observations.
- » Cooperation with neighbouring countries (Nepal, Bhutan and China) to identify transboundary threats and manage it properly.

ii. **Reduction of Hazards**

- **Short term actions** - lowering the lake level through siphoning
  - For instance, high density PVC pipes were installed in **South Lhonak lake in Sikkim**, to reduce the pressure on the lake
- **Long Term Actions**
  - **Artificial drainage channels** to lower lake levels
  - Reinforcement of dam
  - Enhancement of river cross section/ protection from erosion
- **Restricting constructions and development** in GLOF prone areas is a very efficient means to reduce risks at no cost.
- **Develop regulation for Land Use Planning** in GLOF areas.

iii. **Reduction of Exposure**

- Establishment of Early Warning System.
- **Comprehensive alarm system** - including classical alarming infrastructure as well as modern technology using smart phone notifications etc.
- Evacuation based on EWS
- Involve local population closely from the beginning in the design, planning and implementation of risk reduction and management strategies in a transparent collaboration mechanism.

iv. **Awareness and Preparedness** through posters, social media, apps etc.

v. **Capacity Development** -

- Apart from specialized forces such as NDRF, ITBP, and the ARMY, the guidelines emphasize on need for trained local manpower.
- Training of professionals and practitioners;
- Strengthening Academic Education in relevant disciplines from natural and social sciences.
- **Heavy earthmoving and search and rescue equipment**, as well as motor launches, country boats, inflatable rubber boats, life jackets etc.
- Setting up **Quick Reaction Medical Teams, mobile field hospitals, Accident Relief Medical Vans, and heli-ambulances** in areas inaccessible by roads.

vi. **Promote R&D in GLOF Management**

- Promote development of **Modelling tools** to simulate the entire chain of mass movement and outburst process
- **Historical records** should be effectively used to understand flood processes.
- Expand the use of local knowledge, experience of local people. Engaging the local population in **joint-knowledge production** is considered indispensable for effective community based disaster risk management.

vii. **Regulation and Enforcement**

- A well drafted techno-legal regime is necessary to prevent future development of GLOF and protect existing Glaciers.
- The regime should include a Himalaya GLOF mitigation Policy, no habitation and construction zones; and provisions for strict implementation.

- **Other steps which needs to be taken:**

- » **Institutional Improvement:** Need of a **nodal agency** to coordinate all the researches related to glaciers in the region .
- » **Sustainable Development**
  - Restricting Tourism in these areas or promoting only sustainable tourism
  - **Detailed Project Reports and Environmental and Social Impact Assessment** needs to take into account the **Glaciology study** to better understand the impact of these projects on glaciers and glacial lakes.

- **Urgently re-evaluate the Environmental Impact Assessment (EIA) and Environment Clearance Procedure (EAC)** as the existing EIA/EC framework has repeatedly shown inadequacies in handling the high risk projects.
- » **International Cooperation:** GLOF risk is transboundary in nature, thus there is an urgent need for a comprehensive regional risk governance framework including India, Nepal, Bhutan etc.
- » **Fighting Climate Change:** Eventually, a major core reason for GLOF is CC and rising sizes of the lakes. This in long term can only be solved if the global community can work together to achieve Paris Climate Change Targets.

## 2) ECONOMY: AGRICULTURE – MILLETS

- **Why in news?**
  - » Shifting to millets increases groundwater recharge more than drip irrigation in India's northern plains: Study (Oct 2023: Source - DTE)
- **Question:**
  - » Discuss the potential of millets in climate resilient agriculture and the conservation of agro-biodiversity [10 marks, 150 words]
  - » How has the emphasis on certain crops brought about changes in cropping patterns in recent past? Elaborate the emphasis on millets production and consumption. [Mains 2018, 15 marks, 250 words]
- **Introduction (Current Affairs/Context Based)**
  - » **International Year of Millet (IYM):** The United Nations General Assembly has declared the year 2023 'International Year of Millets'. It will help in creating awareness throughout the world about the significant role of millets in sustainable agriculture and its benefits as a smart food and superfood.
  - » IYM 2023 aims to contribute to the UN 2030 Agenda for Sustainable Development, particularly SDG 2 (Zero Hunger), SDG 3 (Good health and well-being), SDG 8 (Decent work and economic growth), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate action) and SDG 15 (Life on Land)



#### - Definitions:

- » Millets include Jowar, Bajra, Ragi, little millets including Kutki, Kodo, Sawa, Kangni and Cheena.

#### - Cropping:

- » They are generally cultivated in low-fertile land, mountains, tribal and rain-fed areas.
  - These areas include Andhra, Chhattisgarh, Gujarat, Haryana, MP, Rajasthan, MHA, KAR, UP, TN and Telangana.
- » India is the **largest producer and second largest exporter of millet** and in 2022 India produced around 50.9 million tonnes. This accounts for 80% of Asia's and 20% of global production. India is followed by African countries like Nigeria and Niger in production.

#### - Decreased Production over the years:

- » In pre green revolution era (1965-66), millets were cultivated in 36.90 million hectares of the country. In 2016-17, the area reduced to 14.72 million hectares.

##### ▪ Why?

- **Green Revolution** increased the productivity of wheat and rice.
- Expansion in irrigation.
- MSP Policy
- **Changes in consumption pattern, dietary habits etc**: Socio-economic dynamics resulting from the hardy nature of the crop, relegated them to be the grain of the poor.

- But recent studies have highlighted various significance of millets for healthy life and sustainable economic development:
  - » **Agri-Sustainability:**
    - **Climate Resilience:** Millets are tolerant to droughts, intensive to excess sunlight etc.
    - **Water Efficient:** Millets can survive in less water conditions and can solve the problem of over-extraction of water resources.
      - A new study published in the journal ***Nature Water*** in Oct 2023 highlights that shifting to millets increases groundwater recharge more than drip irrigation in India's northern plains.
  - » **Better Health:**
    - **Food Security:** In arid areas, millets are often the only crops that can be harvested in the dry regions and are a crucial part of household food basket.
    - **Nutrition:** Millets are smart food which are rich in nutrients like protein, vitamin-A, iron, calcium, iodine etc.
      - For e.g., just 100 gm of daily cereals (rice) intake with finger millets (ragi) will increase the daily iron intake by 50% and calcium by 350%.
- **Government Initiatives to promote Nutri-Cereals:**
  - » **Union Budget for FY24** announced an initiative focused on 'Making India a Global Hub for Millets' (Shree Anna).
    - The Indian Institute of Millet Research, Hyderabad, will be supported as the Centre of Excellence for sharing the best practices, research and technologies at the international level.
  - » **MAHARISHI Initiative** i.e., Millets and OtHer Ancient Grains International ReSeArch initiative. This international initiative will focus on research and awareness via agro-biodiversity, food security and nutrition aligning with the International Year of Millets.
  - » **India had declared year 2018 as the Year of Millets:**
    - Spreading awareness about nutritional benefits of nutrients which will help in increasing the demand resulting in remunerative prices for poor and marginal farmers.
  - » Under the **Sub Mission on National Food Security Mission (NFSM) - Nutri Cereals** is creating awareness among farmers for Nutri Cereals (Millets).
    - NFSM - Coarse Cereals are divided into two components.
      - NFSM (Makka and Jau)
      - Sub Mission on Nutri-Cereals covering Jowar, Bajra, Ragi and little millets like Kutki, Kodo, Sawa, Kangni and Cheena
- Although significant strides have been made by many stakeholders in the promotion of millets there are still several aspects that need to be strengthened from both the demand as well as supply side.
  - » **Increasing Demand:**
    - i. **Consumer Awareness:** To increase demand and make them a regular food option, mission mode campaigning is required which not only encourages people to move towards millets but also counters myths and misconceptions as well as demystifies their cooking.
    - ii. **Promote startups** supporting innovative and functional products with millets.

- iii. **Glutten Free** value added products made from millet can be developed for the export market.
- » **Supply Side:** Production as well as Processing needs to be supported and encouraged in different states.
  - i. **Revise traditional methods** of cultivation.
    - For e.g. Systems like Barahnaja (twelve seeds) from Uttarakhand and other mixed cropping practices in different states not only contributed to food security and soil fertility but also to diet and nutrition diversity by including millets, legumes and other nutritious crops in diet.
  - ii. **Provide increased support to farmers** - Increased procurement under MSP
  - iii. **Increased market linkage** can encourage farmers to grow millets.
  - iv. **Increased R&D** for development of High Yielding Varieties.
- **Other Practice Questions:**
  - Critically assess the current status and future prospects of millet cultivation and consumption in India. Discuss the necessary policy interventions and strategies to promote millets as a viable and sustainable food crop.

### 3. PRELIMS FACTS

#### 1) BIODIVERSITY: DRAGONFLIES

Dragonflies belong to the order Odonata, characterized by large multifaceted eyes, two pairs of strong transparent wings and an elongated body.

They are mostly found in Wetlands – in areas like lakes, ponds, streams – because their **larva called nymphs** are aquatic.

They spend a larger part of their life under water and as an aquatic predator feed on fish, tadpoles, and other aquatic insects.

They were among the very first winged insects to have evolved over 300 million years ago.

Grasshoppers also act as **bio-indicators** and studying their life-cycle gives us an idea about our wetlands and ecology as a whole.

They also act as important bio-control agent as adult Odantes feed on mosquitoes, blackflies and other blood sucking flies. They eat a large number of mosquitoes in their larval stage.



#### A) NATIONAL DRAGONFLY FESTIVAL

The National Dragonfly Festival, being conducted across 11 states in India by the WWF-India in collaboration with several other organizations like BNHS, aims to create awareness for the conservation of these insects. This festival was first observed in 2018. It is citizen science movement that has been running for the past five years. This festival will continue till December (Oct 2023)

#### B) RECENTLY DISCOVERED SPECIES

**Red rumped hawklet** (*Epithemis wayanadensis*): It is a new species of dragonfly that was discovered by naturalist Davind Raju at Wayanad in Kerala. A paper related to this was published in 2023.



## 2) S&T: DEFENCE: ASTRA MISSILE

- More about ASTRA
  - » It is India's first indigenously developed active radar homing beyond-visual-range air-to-air missile (BVRAAM) with a range of over 100 km.
  - » It is designed and developed by the Defence Research and Development Laboratory (DRDL), Research Centre Imarat (RCI) and other DRDO laboratories.
  - » It is intended to engage and destroy aerial targets with high maneuverability and supersonic speeds. The missile's advanced air combat capabilities allow it to engage multiple high-performance targets.
- Fighter planes which are planned to carry this missile.
  - » Su-30 MKI, Mirage 2000 multi-role combat fighters, and Mig-29 and MiG-21 Bison fighter jet platforms, as well as Indian Navy's Sea Harrier jet fighter.
  - » In Aug 2023, it was successfully test-fired from the LCA Tejas off the coast of Goa during which the missile was released from the aircraft at an altitude of about 20,000 feet.
- IAF is expected to induct ASTRA missile by end-2023 (Oct 2023)
  - » In May 2022, the Defence Ministry signed a contract with BDL for the supply of ASTRA Mk-1 missiles and associated equipment for the IAF and the NAVY at a cost of Rs 2,971 crores.
  - » Bharat Dynamics Limited (BDL) has already received Bulk Production Clearance from the manufacturers of the Astra-Mk1 missiles from the Centre for Military Airworthiness and Certification (CEMILAC) and IAF will complete proof firing and induction this financial year.
  - » The IAF plans to arm its frontline fighters with the Astra-MK1 and officials have said that the Astra-2 would become the mainstay of the IAF's BVR missile arsenal, reducing import dependency.
- Key Advanced Features
  - » Smokeless propulsion system of ASTRA lets it kill its target without giving any clue about the location of launching aircraft.
  - » It is very versatile as it is an all aspect, all weather weapon. This enables the missile to be launched irrespective of relative position of the target with respect to the missile.
  - » ASTRA has highly effective multi-target scenario.
- Significance
  - » Reaffirmation of R&D competence of our defence scientists. Only a handful of other countries, US, Russia, Europe and China have mastered the technologies that go into air-to-air missiles.
  - » Strengthens aircrafts and from the most potent weapon systems for such aircraft in modern aerial warfare and are needed in large numbers by any Air force.
- Understanding some key terms:
  - i. **Active Radar homing (ARH)** is a missile guidance method in which missile contains a radar transceiver (in contrast to semi-active radar homing, which uses only a receiver) and the electronics necessary for it to find and track its target autonomously.
  - ii. **Beyond Visible Range (BVR)** is an air-to-air missile that is capable of engaging in ranges of 20 nmi (37 kms) or beyond.

### 3) OPERATIONAL AJAY

- It is a major operation to evacuate Indian citizens who wish to return from conflict-hit Israel.
- As of 14th Oct 2023, four flights have come from Israel bringing back a total of more than 900+ Indian citizens.
- **Note:** there are about 18000 Indian nationals living and working in Israel, including caregivers, students, several IT professionals, and diamond traders.



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### OCT 2023: BOOKLET-3

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## 1. GENERAL STUDIES-2

### 1) IR: MALDIVES

#### A) SOME FACTS USEFUL FOR PRELIMS (MALDIVES GEOGRAPHY)

- Officially the Republic of Maldives, is a sovereign island country and archipelago in Indian Ocean. It is located southwest of India and Sri Lanka in the Laccadive Sea.
- The capital and largest city is **Male**, traditionally called the "King's Island".
- It is the **Smallest Asian country** both in terms of land area and population (around 4,00,000). It has recently transitioned from Least Developed Country to Middle income group.
- The island is located atop the Chagos-Maldives-Laccadive Ridge, a vast submarine mountain range in the Indian Ocean.
- It is planet's lowest country, with an average height 1.5 meters above sea level. Also, the country has the lowest natural high point in the world, at 2.4 meters.
- **8-degree channel** separates India (Lakshadweep) and Maldives.
- **Note:** Maldives is located both in the northern hemisphere and southern hemisphere i.e., Equator passes through it.
- **Independence:** In 1965 from British Empire.
- **Multilateral Body Membership**
  - » **SAARC** founding member.
  - » Commonwealth of Nations (left in 2016)
  - » The Organization of Islamic Cooperation



#### B) POLITICAL DEVELOPMENTS IN MALDIVES

- **Key Political Parties and leadership**
  - » **Progressive Party of Maldives** - PPM - main leaders include Abdulla Yameen, Mohammed Muizzu etc.
  - » **Maldivian Democratic Party** - MDP - Mohammed Nasheed's (now formed a new Party the Democrats) and Mohammed Solih's.
- **Background**
  - » **Maumoon Abdul Gayoom** (half-brother of Abdulla Yameen Gayoom of Progressive Party of Maldives) ruled as an autocratic President from 1978 to 2008.
  - » In 2008, Maldives became a multiparty democracy and **Mohammed Nasheed** (Of Maldivian Democratic Party), became the first directly elected President.

- **2011-12 Crisis**
  - Mohammed Nasheed (the first democratically elected President), under a brief multiparty democratic system, was President till 2012 when he was controversially ousted.
  - Nasheed, later, lost the presidential election in 2013 paving way for **Abdulla Yameen Gayoom** to become President.
    - **Anti-democratic measures under Abdullah Yameen:**
      - Maldives lost much of the democratic gain; stifling of dissent, imprisonment of opposition, control over institutions like judiciary and police were some common affairs.
      - In 2015, Mohammed Nasheed was jailed for 13 years after being found guilty of terrorism charges.
      - **Maldives** even announced its leaving of Commonwealth in 2016. This was because the commonwealth had earlier warned Maldives that it risked suspension if it didn't show progress on democracy.
  - **Abdullah Yameen** has been the most-Pro China president so far.
    - Yameen gave opportunities to China to increase its influence in Maldives.
    - One primary reason for it was that Yameen perceived that Nasheed was helped a lot by India.
  - **Feb 2018 Crisis: the 45 days emergency**
    - President Yameen declared emergency and ordered arrest of 2 senior judges who had ordered release and re-instate of 12 lawmakers who were arrested in politically motivated cases.
    - This move was criticized globally as another attempt to suppress any kind of dissent and killing democratic institutions.

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#### **SEP 2018 DEMOCRATIC TRANSITION: DEFEAT OF YAMEEN AND IBRAHIM MOHAMMED SOLIH BECAME THE PRESIDENT**

- **Ibrahim Mohammed Solih** was a joint candidate of Maldivian Democratic Party, The Jumhooree Party and the Adhaalath Party.
- **Impact:**
  - » A moment of joy for democracy lovers
    - Political prisoners were released.
  - » Solih made rebuilding strong relations with India a priority.
    - Both countries have tried to align their respective policies of SAGAR (Security and Growth for All in the Region), India's "Neighborhood First" approach and Maldives' "India First" approach.
    - During PM Modi's 2019 Maldives visit, Solih reiterated his government's "India First" approach and "pledged his government's full support towards deepening the multifaceted, mutually beneficial partnership between India and Maldives,

which has traditionally been characterized by trust, transparency, mutual understanding and sensitivity.

- India has also been involved in **Infrastructure and Connectivity Project** including the Greater Male Connectivity Project (GMCP)
- India also provided assistance during COVID-19 crisis and helped Maldives during the campaign to move Maldives foreign minister Abdullah Shahid elected President of UNGA.

### **2023 ELECTIONS:**

- **Mohamed Muizzu** was elected President of Maldives as he defeated the incumbent, Ibrahim Mohamed Solih. (Oct 2023)
  - » He was the joint candidate of the **opposition coalition** (People's National Congress - **Progressive Party of Maldives**).
  - » **What were the key reasons for defeat of Ibrahim Mohammed Solih:**
    - Heavy anti-incumbency sentiment
    - Concerns over the post-Covid-19 economy that is dependent on tourism.
    - **The rift within Solih's Party**, the MDP, due to a rupture in his old friendship with former President Mohammed Nasheed.
      - With Mr Nasheed, a communicator par excellence gone, the MDP could not effectively counter the disinformation campaign launched by the opposition alliance, which inserted, unnecessarily, the issue of geopolitics in a domestic campaign.
    - **Concerns over Sovereignty** issues, whipped up by Mr. Muizzu's PPM that is behind an "**India Out**" campaign to oust Indian military personnel.
  - **Impact:**
    - » The latest Presidential election in Maldives showed that **democracy is thriving**. The holding of yet another free and fair election enhance the country's international Prestige.
    - » **People's National Congress and Progressive Party of Maldives** are known for their pro-China stance.
      - For e.g., after his election, Muizzu has said that he will stick to his campaign promise to remove Indian military personnel stationed in archipelago state.
      - Therefore, it is assumed that Maldives will soon have a pro-China shift in its foreign policy.
    - » At the request of President-elect Muizzu, President Solih agreed to shift former President Yameen from Prison to house arrest. Mr. Yameen is serving long sentence for corruption. He is seen as Mr. Muizzu's mentor.
  - **Key challenges ahead for Mohamed Muizzu:**
    - » How to balance between India and China

- » Dealing with challenges of mounting debt, dwindling foreign reserves, and heightening climate risks.

### C) CHINA'S INCREASING INFLUENCE IN MALDIVES AND INDIA'S CONCERNs

- Maldives was not always a priority for China's Foreign Policy; Till 2011, Beijing didn't even have an embassy in Male.
- However, since Sep 2014, Xi Jingping's visit, Maldives had increasingly moved into Chinese Orbit especially under Abdulla Yameen's presidency (2013-18)
- **Why is China Vying for expanding its influence in Maldives?**
  1. **Maldives' strategic location** in the Indian Ocean
    - Maldives is located between India and Diego Garcia - making it a preferred destination for operating a military base and maritime surveillance.
  2. **Presence of several International Sea lines of communications (SLOCs)** is an additional imperative.
- **During President Abdullah Yameen Gayoom Yameen's Presidency (2013 - 2018), the increasing influence of China was manifested** in the following steps:
  1. **Maldives entering into an FTA with China:** This was the first FTA of Maldives with any country.
  2. Maldives also signed an MoU to join Maritime Silk Road (a component of China's ambitious BRI).
  3. Maldives under Yameen had also eagerly embraced Chinese Investment and loans for infrastructure development.
  4. A **constitutional amendment** allowing foreign ownership of freehold land was passed in 2015. This is allowed provided minimum investment is \$1 billion and 70% of the land is reclaimed region. This also gave China the opportunity to enhance its military presence on the island nation. China's Naval ships frequently visited Male.
- **This had made India worried:**
  - » **Increased Chinese presence** in India's neighborhood had negative implications for India's security.
  - » **India** is also apprehensive of Maldives falling in China's debt trap as it will make Maldives vulnerable to China's demands and pressures. This could already be seen in the form of 2015 Constitutional Amendment and increased Chinese Naval Presence in Maldives.
- **After election of Muizzu as President in 2023**, these worries have re-emerged for India.

### D) INDIA-MALDIVES RELATIONS

- **Background**
  - » Relations between India and Maldives go back several centuries. This relation further grew in decades following Maldives independence from Britain in 1965 and strengthened in 1980s and 1990s with India readily available to help Maldives on all fronts.
  - » India has played a critical role in building Maldives' economy and ensuring political stability then. Delhi supported authoritarian rule of Abdul Gayoom and enabled him to remain in power

for three decades. Delhi also helped Maldives to avert a coup attempt to oust Gayoom in 1988 and protect its territorial integrity (**Operation Cactus, 1988**).

- » India's relations with Maldives continued to grow even under the first democratically elected President **Mohammed Nasheed**.
- » In 2014, when there was a drinking water shortage in Maldives due to dysfunction of the only desalination plant there, Indian Navy had rushed the drinking water to Male.
- » Both the countries share strong geographical, cultural and religious bonds.
- » Maldives has also been an important component in India's Maritime strategy.

- **But during Yameen's Presidency (2013-2018) ties between Delhi and Male had nosedived.**

- » The political situation forced PM Modi to cancel his 2015 visit to Male.
- » Maldives annulled the \$500 million contract of GMR Group to develop a modern international airport near Male and gave it to a Chinese company.
- » Relations reached at its lowest point after the Feb 2018 Emergency imposition by Yameen government to curb all kinds of dissent including from judiciary.
- » India's influence reduced in Maldives:
  - **Changing Political dynamics of Maldives**
    - India was perceived as close to Mohammed Nasheed and thus **Abdul Yameen moved away from India**.
  - **Increasing Chinese Influence in the region**
    - Debts, Infra Projects, FTA etc.
  - **Reducing dependence on India:** With its booming tourism sectors, Maldives now is less and less dependent on assistants from India.
  - **Increasing role of Pak and Saudi Arabia and growing radicalisation**
    - Maldives is a moderate Islamic Country. In recent years, Saudi Arabia has opened many Madarsas to spread Wahabism.
    - Scholarships are being provided for studying in Pak.
    - Religious fundamentalism played an important role in ouster of Nasheed who had a secular ideology and had allowed Israeli tourists to visit Maldives and establishment of Buddha's statue in Male.

- **But things started changing in 2018 when Solih came to power: India's influence increased:**

- » Already discussed in the impact section of Political development.

- **Why Maldives is Significant for India**

i. **Strategic Location**

- It is located around 700 km from India's Lakshadweep island chain and around 12,00 km from the Indian mainland.
- Its proximity to international sea lane through which 2/3rd of the World's oil and half of its container shipment pass also makes Maldives very important for Geo-political reasons.

ii. **Countering China's String of Pearls strategy**

- Increased Chinese presence in Maldives will negatively impact India's strategic interest. To counter China's String of Pearl strategy we have to have good relations in Maldives.

iii. **Securing Sea Lanes**

- Maldives can play a significant role in dealing with Piracy and building stability in the Indian Ocean region.

**iv. Protecting Interest of Indian Diaspora**

- More than 20,000 Indians live in Maldives. They form the second largest expatriate community there.

**v. Preventing further radicalization of youth in Maldives.**

**vi. Enhancing the traditional strong relations**

**- Way Forward: Change in Political Situation in Maldives:**

» **India must engage with new government in Maldives** and deepen ties. India's cooperation with Maldives is based on jointly addressing shared challenges and priorities. The assistance and platforms that India's has provided have contributed to areas like people's welfare, humanitarian assistance, disaster relief, and combating illegal maritime activities like Piracy, smuggling etc.

- Other Steps that can be taken are:

▪ **Strengthen Colombo Security Conclave:**

- Colombo Security Conclave comprise of India, Sri Lanka, Maldives, Mauritius, Bangladesh and Seychelles. It should be strengthened showing tangible outcomes in maritime security and the development of the Blue Economy.

▪ **Invite Maldives as observer in BIMSTEC Grouping:**

- This will be a bold-reimagination of post SAARC south Asia.

▪ **Perennial need of additional Resources** to be invested in Maldives.

- This will provide India's strategic community and media organizations take more interest in the small but vital neighbor, building bridges of mutual understanding and trust.

» New Delhi must **avoid the impression that it has favorites within the Maldivian Polity**. It should be perceived as working for the people of Maldives. This will ensure that no matter which party comes to power in future, India's influence in Maldives wouldn't wane.

» **India is significant for Maldives and the entire political spectrum (including Progressive Alliance) understand this.**

- **Despite political posturing by the Progressive Alliance** - there is an hard realization in the Maldives that India is the biggest security partner in the region and makes up for Male's scarce maritime capacity and capabilities.

- It is no coincidence that even Yameen continued defence cooperation with India during the roughest phase of bilateral relations.

- India is also Maldives' biggest trade partner, a top export destination and a traditional donor.

» **World has changed since Mr. Yameen's time and China and Pakistan may not be able to have so much influence now.**

- The BRI which Maldives had accepted, is in serious trouble.

- **Sri Lankan Financial Crisis** showed the impact of China's debt trap and how India's steady help to Sri Lanka was beneficial.
  - **Islamist constituency in Maldives** which is not very friendly with India will also notice the changed equation between India and the gulf states. It is reflected in the waning influence of West Asia in a bankrupt Pakistan, which has long nurtured extremism in Maldives.
- » But India still needs to keep an eye on China's expanding influence in Maldives especially after Muizzu coming to power.
- **Conclusion1:**
    - » One is likely to see a continuation of the China-India political competition in Maldives, as it has been in the rest of the Indian neighborhood. The election of Muizzu as President may give China some advantage, but Male surely recognizes that it is also not in Maldives' interest to put all its eggs in Beijing's basket.
  - **Conclusion2:**
    - » India too is likely to show pragmatism and flexibility with the administration as long as the incoming Maldivian government respects India's sensitivities and security concern.

## 2. GENERAL STUDIES-3

### 1) ECONOMY: FOOD SECURITY

#### A) FOOD SECURITY

- **Why in news?**
  - » World Food Day is celebrated on Oct 16 each year. (Oct 2023)
    - The FAO of UN created this in 1979. It was established to raise awareness of world hunger and encourage action to combat it and recalls the **FAO's foundation in 1945**.
    - The theme for 2023 is "**Safe Food Today for a Healthy Tomorrow.**"
- **Practice Questions:**
  - » "There is an urgent need for sustainable and resilient food systems to guarantee sustainable diets that are nutritious and aligned with the evolving ecosystem and climate change" Elaborate [15 marks, 250 words]
- **What is Food Security?**
  - » As per the Committee on World Food Security, the food security exists when all people, at all times, have physical, social and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life.
  - » The **Four Pillars** of food security are availability, access, utilization, and stability (both price and supply).
- **Situation in India:**
  - » The 'State of Food Security and Nutrition in the World' of the FAO estimates that in 2021 around 74% of the population in India cannot afford a healthy diet. This number may be an overestimation, but still shows that a substantial number of people in India are not able to afford health food.
  - » **Other Reports:**
    - In 2022, Global Food Security Index ranked India at 68/113 major countries of the world.
    - As per Global Hunger Index, 2023, India's rank was 111/125 countries.
- **Key Initiatives to Promote Food Security in India:**
  - » **National Food Security Act, 2013:** It seeks to provide subsidized food grains to approximately 2/3rd of India's population.
    - Other than this, Mid-Day Meal Scheme, Integrated Child Development Program, and the PDS system are focused on ensuring nutritional security.
  - » **Various initiatives at state level include:**
    - '**Indira Canteen**' initiative by the state of Karnataka, which serves breakfast, lunch and dinner at very low prices.
    - '**Amma Unavagam**' (Mother's Canteen) is an initiative by TN.
  - » **Government also takes** several initiatives to control food inflation:
    - **Maintaining Buffer stocks**

- **Controlling Exports** in case of scarcity
- **Using MSP mechanism** to encourage farmers to grow crops which are in shortage.

- **Key factors which threaten Food Security:**

» **Poor Governance and Geo-Strategic Conflicts**

- Inadequate governance structures to ensure institutional stability, transparency, accountability etc. may lead to poor food supply situation.
  - For e.g. - Corruption in PDS system leads to diversion of food grains meant for poor people.
- **Poor state services in rural areas** - For e.g., people in remote areas not being able to get PDS services because of lack of documentation.
- **War, conflict and lack of security** may create food security challenges: E.g., Russia-Ukraine war impacted the supply of food grains and led to higher inflation.

» **Economic and Production Factors:**

- **Poverty, unemployment, inadequate social protection system** etc hampers availability of good and nutritious food.
- **Lack of focus on reforms in agriculture sector** - Less than the actual potential production.
- **Insufficient farm income** of small and marginal farmers
- **High Post harvest losses** - due to inadequate infrastructure for storage and market access.

» **Unsustainable Agriculture Practices:**

- **Increased dependency on wheat and rice** has led to excess irrigation which has led to water table going down and soil salination.
- **Land Fragmentation** is also making agriculture unsustainable which may impact food security in long term.
- **Deteriorating Soil health:**
  - **Access use of chemical inputs** like fertilizers and pesticides is hampering the soil quality.
  - 2023 Soil Health Survey shows that almost half of the cultivable land in India has become deficient in organic carbon, which is an essential indicator of soil health.

» **Climate/ Environmental Challenges:**

- Increased cases of droughts, heatwaves, unpredictable rainfall pattern etc. causing damage to food systems.
  - Increase in number of days with extreme temperatures or rain has caused a decline in quality and size of seeds across India.
- **Biodiversity Loss** for e.g. reduction in population of pollinators also has the potential to impact large majority of food crops.
- **Environmental damage in forests** is reducing the food supply their causing wild animals to attack human's food system (for e.g. the blue bull trouble in India)

» **Demographic and Social Issues:**

- **Insufficient attention** paid to the **role and contribution of women** and their special vulnerabilities in regard to malnutrition, and many other forms of **legal and cultural discrimination they suffer**.
- **Inadequate social protection system**, including safety nets.
- **Marginalization and discrimination against vulnerable groups** such as internally displaced people, refugees etc.
- **Poor availability** of **safe water, sanitation, maternal and child health facilities**.
- **Inappropriate consumption** and **Over consumption of food**, often with a lack of essential macronutrients, can cause serious problems to health, including malnutrition and obesity.
- **Low level of education and literacy** leads to **detrimental feeding/ behavioral practices etc.**

- **Way Forward:**

» **Good Governance:**

- Increasing transparency and accountability through effective implementation of initiatives like social audit, RTI and e-governance.

» **Consumers side reforms:**

- **Demand** needs to **change towards healthy and sustainable diets**.
  - Corporations can **mainstream locally grown millets** through innovative breakfast products.
- **Civil Society and health community** can partner with **social media influencers** who can shape healthier and sustainable consumption for millions.
- **Government** through initiatives like **PDS, mid-day meals, railway catering, urban canteens, and public and institutional procurement**, can help improve what at least 70% of Indians are consuming.
- **Religious institutions** can also influence food habits.
  - E.g. **Tirumala Tirupati Devasthanam**, which serve **nearly 70,000 people daily**, has started procuring **naturally grown food items**.

» **Promoting Agricultural Sustainability:**

- **More R&D on organic farming and natural farming**: The National Mission on natural farming is a step in this direction, but the overall funding for sustainable agriculture is **less than 1% of the agri budget**.
- **Shift agri-subsidy from input subsidies to cash transfer**: It would promote **efficient use of inputs**, while enabling levelplaying field for agro-ecological practices to thrive.
- **Consolidation of landholding** for e.g. by **bringing farmers under an FPO, or through contract farming etc.** is crucial to deal with challenges of land fragmentation.
- **Second Agricultural Revolution** with special focus on east India can be crucial in promoting agri-productivity in India.

» **Shift farm-to-fork value chains** towards **more sustainable and inclusive ones**.

- **Enable more value addition of agri-produce** in rural areas
- **Strengthening FPOs**

» **Dealing with Climate Change related challenges:**

- **Working on Paris Climate targets**
    - Global community needs to work on Paris Climate targets to ensure mitigation of climate change which is emerging as one of the biggest threats to food security.
  - **Working towards Adaptation in Agriculture sector:**
    - Development of drought and flood resistant variety of crops.
- » **Focus on Demographic and Social Issues**
- **Gender Equality and Women empowerment** is crucial to limit the culture of women eating in the last and prioritizing special food requirement of women specially during pregnancy.
  - **Special focus on vulnerable groups** in rural and remote areas. Prioritize Aadhaar and ONORC initiative for these people so that they are able to enjoy the benefit of all government benefits.
- **Conclusion:**
- » The urgency of addressing the above discussed pressing issues through the transformation of food production and distribution systems that harmonize environmental, social, and economic dimensions is imperative.

## B) NATIONAL FOOD SECURITY ACT, 2013

- **Why in news?**
  - NITI Aayog seeks detailed evaluation of the National Food Security Act and LPG Subsidy (Oct 2023)
    - The NITI Aayog has invited bid for a central coordinating agency that can study effectiveness of NFSA and LPG Subsidy Scheme. The agency will hold mandate to suggest ways to better the schemes. It will also suggest whether, and how, these schemes can be rationalized or closed.
- **Past Year Questions:**
  - » What are the salient features of the National Food Security Act, 2013? How has the Food Security Bill helped in eliminating hunger and malnutrition in India [Mains 2021, 15 marks, 250 words]
  - » Food Security Bill is expected to eliminate hunger and malnutrition in India. Critically discuss various apprehension in its effective implementation along with concerns that it has generated at WTO [Mains 2013, 12.5 marks, 200 words]
- **Introduction:**
  - » The NFSA, 2013 seeks to provide for food and nutritional security in human lifecycle approach, by ensuring adequate quantity and quality of food at affordable prices to people to live a life with dignity and for matters connected therewith and incidental thereto.
- **Salient Features of the Act are:**
  - » It gives legal entitlement to 75% rural and 50% of the urban population (which come to 2/3rd of country's population) for subsidized grains under TPDS.

- » It moves from '**household food entitlement**' to '**individual food entitlement**'. Every individual is entitled to 5 kg of rice, wheat, or coarse cereals a month at Rs 3, Rs 2 and Rs 1 per kg. The beneficiary is identified by the state government based on the parameters decided by centre.
- » The entitlement for Antyodaya Anna Yojna (AAY) will remain at Rs 35 kg per household.
- » **For pregnant and lactating mothers**, the act provides for free meal at the local anganwadi (during pregnancy and upto six months after child birth) as well as maternity benefits of Rs 6,000 in instalments.
- » **For Children:**
  - Below 6 months: 'Exclusive breast feeding shall be promoted)
  - **Six months to six years:** The age guarantees an age appropriate meal, free of charge, through the local anganwadis.
  - **Six years to 14 years:** One free mid-day meal, shall be provided everyday (except on school holidays) in all school run by local bodies, government and government aided schools, upto Class VIII.
- » The act also provides for the Creation of State Food Commissions which will monitor and evaluate the implementation of the act, give advice to state governments and will enquire into violations of entitlement.
- » **Food Security Allowance** in case of non-supply of the entitled quantities of foodgrains or meals to entitled persons under the act.
- » **Schedule 3 of the act** also lists various provisions for advancing food security, under three broad categories:
  - Revitalization of Agriculture; reforming procurement, storage and movement; other provisions like drinking water, sanitation, health care, adequate pensions for senior citizens, persons with disability and single women.

- **Progress:**

- » NFSA has been implemented in all 36 states/Uts covering more than 80 crore persons.
- » Direct Benefit Transfer: In Chandigarh, Puducherry, and Urban areas of Dadra and Nagar Haveli, the act is being implemented in the cash transfer mode.

- **How has it contributed to reducing Hunger:**

- » The act has led to increases food availability for weaker section. It is visible in increased government food subsidy burden.
- » By continuing with special provisions AAY, the act ensures that the most vulnerable household get special support.
- » By taking a lifecycle approach, it has ensured the right from the time women get pregnant to the death of a person, if the person is vulnerable, she would get food security support.
- » With improved used of technology, like Aadhar based authentication, leakage has reduced.
- » **One Nation One Ration Card (ONORC)** will also ensure that migrants are able to enjoy the benefits of NFSA.

- **Challenges:**

- » **Fiscal Burden:** Since the introduction of PMGKAY, the subsidy burden on food for government has remained above Rs 2 lakh crores.
- » **Leakages and Siphoning:** Leakages are still unacceptably high in states where PDS reforms are slow.

- **Steps being taken:**
      - Doorstep delivery, computerization, effective grievance redressal mechanism etc.
      - The leakage trend has been declining from 54% in 2004-05 to 44% in 2007-08 to 35% in 2011-12. It is estimated to have gone down further.
  - » **Identification of Beneficiaries:** This is a serious issue as many very vulnerable sections are not enjoying the benefits of NFSA.
  - » **Infrastructural issues** like lack of adequate storage, poor transportation infrastructure. This leads to delay, spoilage of food grains, and inefficient distribution.
  - » **Aadhar Related Issues:** Use of Aadhar-based authentication for targeting beneficiaries has its own set of challenges. This includes authentication failures, discrepancy in Aadhar data etc.
  - » **Social and Cultural Factors:** Factors like caste-based discrimination, low literacy rates etc can impact the implementation of NFSA.
- **Way Forward:**
- » **Reducing Fiscal Burden:** TPDS targeting can be made more focused and only the most vulnerable ones should be provided the NFSA benefits. Shanta Kumar committee had also recommended that the coverage should reduce from 67% of the population to 40%.
  - » **Better Identification:** Instead of trying to identify the poor, it would be better to adopt an 'exclusion approach' under which the rich are kept out and all the rest are covered.
    - Chhattisgarh Food Security Act (CFSA) which proposes four criteria - excluding income tax payees, households owning a pucca house in urban areas that has a carpet area of more than 4 hectares of irrigated land or more than 8 hectares of non-irrigated land.
  - » **Combating Leaks:**
    - Automate procedures; impose strict penalties for corrupt practices etc.
  - » **Improving Infrastructure:**
    - Attract private investment in agri-infrastructure, including storage facilities.
    - Promote decentralized procurement.
    - Encourage local farmers and cooperative.
  - » **Address Aadhar Issues:**
    - Achieve universal Aadhar coverage by a focused approach on most vulnerable groups.
    - For the time being establish alternative authentication mechanism.
    - Ensure robust data security measures to protect personal information.
  - » **Addressing Social and Cultural Factors:** Run a sensitization campaign to raise awareness about the rights and entitlements of marginalized communities.
- **Conclusion:**
- » The NFSA is an important step in meeting the problem of hunger and malnutrition. By implementing the above suggested improvements, and by fostering collaborative efforts among government agencies, Civil Society Organization, and local communities, it is possible to overcome the challenges and strengthen the implementation of NFSA.

## 2) S&T: CONTRIBUTION OF SCIENTISTS: MS SWAMINATHAN

- **Why in news?**

- » MS Swaminathan, the Doyen of India's Green Revolution passed away on 28th Sep 2023 in his residence in Chennai. He was 98.

- **Brief Timeline:**

- » **Aug 7, 1925:** Mankombu Sambasivan Swaminathan was born to M.K. Sambasivan, a surgeon, and Parvati Thangammal in Kumbakonam in the then Madras Presidency.
- » **1940s Education:** He pursued higher education in zoology from Maharaja's College in Trivandrum. With a keen interest in Agriculture, farming and moved by the plight of farmers, he later completed a BSc degree in Agriculture Science from University of Madras in 1944.
- » **1947-49:** Swaminathan had witnessed the 1943 famine and after that dedicated his life for improving India's farming methods and battling shortage of food. He joined IARI after Independence to focus on plant genetic and breeding.
- » **1949-54:** Swaminathan by now had specialized in genus Solanum of the potato and was offered a fellowship by UNESCO to research ways to combat parasite affecting potato crops - which were then in high demand. He then moved to University of Cambridge and earned his PhD. After this he spent time in the Laboratory of genetics in the University of Wisconsin to set up a US Government potato research station as part of his post doctorate.
- » **1954:** As a scientist at IARI he learned about Dr. Norman Borlaug's newly developed Mexican dwarf wheat variety which could higher yield and develop stronger stalk structures to support the increased biomass.
  - Both scientists worked to produce improved crop varieties in India.
  - He also researched on fertilizers conducive to the Indian Soil for growing wheat, different high yielding wheat varities.
- » **1965-70:** Continuing his research with Dr Borlaug on wheat varities, he modified grains in labs to better suit the Indian Soil, giving higher yield and free from infestation. He then convinced farmers mainly in northern rural belt - Punjab, Haryana and UP to set up small demonstration and test plots to cultivate these wheat varieties. Working with Union Agriculture Ministers C. Subramaniam and Jagjivan Ram, he pioneered Green Revolution. His work ushered India's golden age in farming technology - transforming the nation from a 'begging bowl' to the 'bread basket of the world'.
  - During his tenure at IARI he also contributed to Nuclear Agriculture by setting up Nuclear Research Laboratory and development of mutated varieties.
- » **1979-82:**
  - As the Director General of ICAR, he worked to educate farmers on weather and crop patterns by setting up thousands of ICAR centres across India.
  - In 1979-80, he was appointed as Principle Secretary of the Ministry of Agriculture to establish agriculture policies to maintain India's long term food sufficiency.
  - 1980-82: he was made in charge of agricultural and rural development in India's Planning Commission.

- In 1982, he became Director General of International Rice Research Institute in the Phillipines - the first Asian to hold the post - and worked to promote the participation of women farmers on rice cultivation.
- **1987-2000:**
  - He was awarded the first World Food Prize in 1987. Using the award money he set up MS Swaminathan Research Foundation in 1988 to provide collaborative platforms for global leaders, rural farmers to coordinate research on various issues.
  - **In 2004**, he was made the chairperson of National Commission on Farmers which was constituted to address rising farmer suicide in India.
  - **2013 Onwards:** In this phase he was part of various initiatives which were focused on nutrition, access to internet in rural India etc.
- **International Accolades throughout his life:**
  - The Ramon Magsaysay Award in 1971
  - Albert Einstein World Science Award in 1986
  - UNEP Sasakawa Environment Prize in 1994
  - UNESCO Gandhi Gold Medal in 1999
  - Indira Gandhi Prize for Peace, Disarmament and Development in 1999
- He has also been awarded with Padm Shri in 1967, Padma Bhushan in 1972, and Padma Vibhushan in 1989.

### 3. PRELIMS FACTS

#### 1) ART & CULTURE: PROJECT UDBHAV BY INDIAN ARMY

- **Details:**
  - » Project Udbhav is an initiative set in motion by Indian Army to rediscover the profound Indic heritage of statecraft and strategic thoughts derived from ancient Indian texts of statecraft, warcraft, diplomacy and grand strategy.
  - » It focuses on broad spectrum including Indigenous Military Systems, Historical texts, Regional Texts and Kingdoms, Thematic studies and intricate Kautilya Studies.
  - » The **goal** is to understand the profound depths of indigenous military systems, their evolution, strategies that have been passed down through the ages, and the strategic thought process that have governed the land for millennia.
  - » The aim is not only rediscovery, but also to develop an indigenous strategic vocabulary, which is deeply rooted in India's multifaceted philosophical and cultural tapestry. Overall aim is to integrate age old wisdom with modern military pedagogy.
  - » The project seeks to bridge the historical and contemporary.
- **Some related work has been going on since 2021**, and a book was released under the project which lists 75 aphorisms selected from ancient texts. However, the first scholarly outcome of the initiative is the 2022 publication titled 'Paramparik Bhartiya Darshan... Ranniti aur Netriyta ke Shashwat Niyam" meant to be read by all ranks of the Indian Army. English translation of the title being "**Traditional Indian Philosophy... Eternal Rules of Warfare and Leadership**".
- **In Sep 2023**, an inaugural panel discussion was conducted under the Project Udbhav. The scope of the discussion encompassed discussions on the study of ancient texts from the 4th century BCE to the 8th century CE, with the focus on Kautilya, Kamandaka, and the Kural. It sparked interest, engagement and further research into India's traditional strategic thought.

#### A) KAUTILYA'S ARTHASHASTRA

- **Arthashastra** is a treatise on statecraft. It is a branch of learning that deals with the means of acquisition and protection of earth, which is the source of people's livelihood. Thus, Arthashastra is a science of statecraft.
  - » It consists of **15 books** (Adhikarans) - the **first five** deal with internal administration (tantra), the next eight with inter-state relations (avapa), and the last two with miscellaneous topics.

#### B) KAMANDAKA'S NITISARA

- **Nitisara** (Essence of Statesmanship) is an Ancient Indian Treatise on Politics and Statecraft.
  - » It was authored by Kamandaka, who was a disciple of Chanakya.
  - » It is traditionally dated to the 4th-3rd Century BCE, though modern scholarship various dates it between the 3rd and 7th century CE between Gupta and Harsha period.

- » **Structure:** It contains 20 Sargas (Chapters) and 36 Prakarans. It is based on Arthashastra of Kautilya and deals with various social elements such as theories of social order, structure of the state, obligations of the ruler etc.

### C) KURAL (OR TIRUKKURAL) BY TIRUVALLUVAR

- It is a classic Tamil language text consisting of 1330 short couplets, or kurals of seven words each. It is considered as one of the greatest works ever written on ethics and morality, and is widely acknowledged for its universal values.
- Tirukkural is divided into **three books**, each with teachings on **Virtue (Dharma)**, **Wealth (Artha)** and **love (Kama)**
- **Date:** The text has been variously dated between 300 BCE to 5th century CE.
- **The issue of statecraft, governance, and related topics** embedded in the Kural are less known, understudied and not theorized for modern times. Therefore, Focus on Project Udbhav on study and revival of political wisdom and statecraft in the Kural will be an important contribution for contemporary times

### 2) CRICKET'S GETS APPROVAL FOR 2028 LA OLYMPICS

- Cricket, squash, baseball/softball, lacrosse and flag football have been included as part of 2028 LA Olympics.
- With this Cricket will be returning to Olympics after 128 years.
  - » It will be played in 20-20 format and will be a six-team affair. IOC or the ICC is yet to decide on the qualifier format.
- **Lot of Backchannel work was needed.**
  - » Cricket's inclusion was made possible by two years of intense backchannel work between the IOC and ICC with Nita Ambani, an IOC member from India since 2016, playing a key role in building a consensus for the sport among the Olympic community.

### 3) BIODIVERSITY: NEW FISH SPECIES: BADIS LIMAAKUMI (SOURCE: DTE)

Scientists have recently discovered a new fish species from Milak River, Nagaland. It has been named *Badis limaakumi*, after Limaakun, assistant professor and head of the zoology department at Fazl Ali College, nagaland.

It belongs to family Badidae, a small freshwater fish found in streams with slow or moderate water flow. These are edible fish and are also found in ponds and stagnant water.



The new species differs from other members of the genus due to its larger size and other physical characteristics.

Fish from the Badis family are also known as chameleon fish for their ability to change color. This helps them blend with the surrounding when under stress.

#### 4) BIODIVERSITY: INVASIVE EXOTICS: CANOCARPUS TREES

- **Concerns over the management of invasive Conocarpus species of trees have recently led to Gujarat (2023) and Telangana (2022) banning their use. Several other states may follow suit - which is likely to discourage horticulturalists and nurseries from multiplying the species and using lakhs of its saplings in afforestation and landscaping projects across the country over the next year.**
- **Problem with Exotic Plants:**
  - » Many species which were introduced in India for greening or ornamental purposes eventually turned invasive.
  - » Native species which were not able to compete for resources were driven to extinction and huge cost was incurred in the management of invasive species.
    - Some popular species include Eucalyptus, Proposis Juliflora (Vilayati Kikkar), Acacia mangium, and Lantana Camara.
  - » Further, they are also known for causing pollen allergies. Human immune system coevolve with local pollen calendar and this new type of pollen becomes a problem.
- **About Canocarpus Trees:**
  - » There are two species of Canocarpus (buttonwood) trees, with several varieties of hybrids - Canocarpus erectus, which is widely used in India (and is native to South America) and Canocarpus lacifolius is native to East Africa.
  - » They are easily propagated and multiplied in nurseries through stem cuttings.
  - » They have also been known to cause pollen allergies and respiratory problems in the vicinity of plantation.
- **Why do urban green initiatives end up deploying them in the first place?**
  - » Since they are non-native species - they face very few or no pests or pathogens in new habitats, which makes their proliferation easy. They often require very little aftercare.
  - » Some species like Canocarpus are not browsed by livestock and are thus favored for horticultural and landscaping projects.
- **What should be done?**
  - » Landscape manager should choose from amongst the native species pool, species that are ecologically appropriate and also meet aesthetic needs.

- » The import and use of horticultural plants need to be monitored by maintaining a watch list of plants that are known to harm native species and ecosystems and raise public health concerns.

LevelupIAS



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### OCT 2023: BOOKLET-4

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## 1. GENERAL STUDIES-2

### 1) ISSUE OF CHILD SEXUAL ABUSE:

#### About Child Sexual Abuse:

- Child sexual abuse is defined as **sexual activity with a child by an adult, adolescent or older child.**
  - ✓ If any adult engages in sexual activity with a child, that is sexual abuse.
  - ✓ If another child or adolescent engages in sexual activity with a child, a grey area enters where some sexual behaviour is innocent exploration rather than abuse.
- The **World Health Organisation** has defined '*child sexual abuse as the involvement of a child in sexual activity as he or she does not fully comprehend, is unable to give informed consent to, or for which the child is not developmentally prepared and cannot give consent, or that violates the laws or social taboos of society*'.

#### Data/Facts:

- Crimes against children **increased in India by 16.2% between 2020 and 2021**, according to **the latest National Crime Records Bureau (NCRB) data**:
  - ✓ There were just **under 1.5 lakh cases of crimes against children** registered last year across all states and Union Territories. This includes child sexual abuse, abduction, murder, child marriage among other crimes.
  - ✓ **Madhya Pradesh registered the maximum number of crimes** against children, with Maharashtra and Uttar Pradesh in the second and third places. Among the **Union Territories, Delhi recorded the highest number of crimes** against children (7,118).
  - ✓ The report noted that in percentage terms, **major crime heads under 'Crime Against Children' during 2020 were Kidnapping & Abduction (45.0%)** and Protection of Children from Sexual Offences Act (**POCSO), 2012 (38.1%)**, including child rape.

#### Constitutional provisions wrt Children:

- **Article 21 A:** The State shall provide free and compulsory education to all children of the age 6- 14 years.
- **Article 24:** Prohibits employment of Children below the age of 14 years in any factory or mine or in any other hazardous activity.
- **Article 39(f):** Directs that children are given opportunities and facilities to develop in a healthy manner and in conditions of freedom and dignity and that childhood and youth are protected against exploitation and against moral and material abandonment.
- **Article 45:** The State shall endeavour to provide early childhood care and education for all children until they complete the age of six years.
- **Article 243G:** Provides for institutionalisation of childcare by seeking to entrust programmes of women and child development to Panchayat (item 25 of Schedule 11).

#### Policies:

- **Protection of children from sexual offences Act, 2012 (POSCO Act):** The Act was enacted to protect the children from various types of sexual offences and to establish Special Court for providing speedy disposal of cases.
- **The Juvenile Justice (Care and Protection of Children) Act, 2015:** This Act was enacted to consolidate and amend the law regarding juvenile in conflict with law and children in need of care and protection by providing proper care, protection and treatment.

#### **Some International Efforts:**

- **The Global Partnership and Fund to End Violence Against Children** were launched in July 2016 by the UN Secretary-General. The Partnership is the only global entity focused solely on Sustainable Development Goal 16.2: ending all forms of violence against children by 2030.
- **Together for Girls** is a global partnership working to end sexual violence against children and adolescents.
- **We Protect Global Alliance** brings together governments, the private sector, civil society and intergovernmental organisations to develop policies and solutions to protect children from sexual exploitation and abuse online.
- **We PROTECT**, established by the UK Government as a global multi-stakeholder response to combating online child sexual abuse.

#### **WAY FORWARD:**

- **Comprehensive Sex Education:** Implement age-appropriate and comprehensive sex education programs in schools. E.g., Good Touch and Bad Touch, etc.
- **Community Awareness Campaigns:** Conduct widespread awareness campaigns to educate communities about the signs of child sexual abuse, the importance of reporting, and available support services.
- **Strengthen Legal Framework:** Enhance and strictly enforce laws related to child sexual abuse, ensuring swift justice and stringent penalties for offenders.
- **Technology Regulation:** Regulate online platforms and monitor online activities to prevent the exploitation of children through the internet.
- **Parental Education Programs:** Conduct programs to educate parents on recognizing signs of abuse, communicating with children about safety, and fostering open dialogue at home.
- **Victim-Centric Approach:** Adopt a victim-centric approach in legal proceedings, providing protection and support for the child throughout the investigative and judicial processes.

## **2) THE PROTECTION OF CHILDREN FROM SEXUAL OFFENCES (POCSO) ACT, 2012:**

- This law represents **the first comprehensive effort to safeguard children from sexual assault, sexual harassment, and pornographic violations**. It also entails the **establishment of special courts** dedicated to the trials of such cases.

#### **Key features:**

- **Protecting victim's identity:** The Act strictly prohibits the disclosure of a victim's identity through any form of media, except when authorized by the special courts established under the Act.
- **Gender-neutral legislation:** The Act provides a gender-neutral definition of a child, encompassing 'any person' under the age of 18.
- **No reporting time limit for abuse:** Under this Act, victims are entitled to report an offense at any time, even if years have passed since the abuse occurred.
- **Non-reporting as a crime:** Any individual responsible for an institution (excluding children) who neglects to report a sexual offense involving a subordinate is liable to face legal consequences.

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#### A) PROTECTION OF CHILDREN FROM SEXUAL OFFENCES (AMENDMENT) ACT, 2019

POCSO amendment Act, 2019, defines what 'child pornography' is; 'using a child for pornographic purposes' and for 'possessing or storing pornography involving a child' is punishable. It has also widened the ambit of 'aggravated sexual assault'.

- The act seeks to provide more stringent punishment, **including death penalty**, for sexual crimes against children.
- It refers to the judgments of the Supreme Court in ***Machhi Singh (1983)*** and ***Devender Pal Singh (2002)*** in which the court had held that the death penalty can be awarded only in rarest of rare cases.

#### Concerns over death penalty

- The Justice **J.S. Verma Committee**, which was constituted in 2013 in the aftermath of the Nirbhaya case, after due deliberations found itself against the imposition of death penalty in rape cases.
- The **262<sup>nd</sup> Report of the Law Commission of India, 2015**, also provides for abolition of the death penalty except in terror cases.

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#### B) POCSO RULES 2020:

- **Interim Compensation and Relief (POCSO Rule-9):** Rule-9 allows the Special Court to order interim compensation for a child's relief or rehabilitation needs after FIR registration.
- **Immediate Special Relief Payment:** POCSO Rules empower the Child Welfare Committee (CWC) to recommend immediate payment from District Legal Services Authority (DLSA) or District Child Protection Unit (DCPU) funds for essential needs like food, clothes, and transportation. Payment must be made within a week of CWC's recommendation.

- **Support Person Provision (POCSO Rules):** CWC has the authority to appoint a support person to assist the child during investigation and trial, ensuring the child's well-being, access to medical care, counseling, education, and keeping the child and guardians informed about court proceedings.

#### **Shortcomings of the POCSO Act:**

- **Problem with the application of the last seen theory:** The last seen theory can lead to wrongful conviction in several cases and therefore, it cannot be applied without circumstantial evidence.
  - ✓ It was held by the **Supreme Court in the case of Anjan Kumar Sarma v. State of Assam** that the last seen theory is a weak piece of evidence and cannot be relied upon single-handedly.
- **Unprepared investigation machinery:** The investigation machinery in the child sexual abuse cases is not well acquainted with the procedure which leads to a faulty investigation.
  - Low Women Police Representation
  - Despite the act's one-month investigation timeline, delays occur due to resource constraints, forensic evidence acquisition delays, and case complexities.
- **Silent on consensual sexual activities:** In case of sexual intercourse with consent, one of which is minor, the partner who is not minor can be prosecuted under the POCSO Act as the consent of a minor is not considered relevant under this Act.
- **False complaints by children are not punishable:** Section 22 of the POCSO Act provides for the punishment to the persons who file a false complaint to humiliate, extort, threaten, or defame another person.
  - ✓ However, a child is exempted from any such punishment which is a loophole as many people take advantage of this exemption and misuse this provision.
- **Pending cases:** Although, the POCSO Act specifies that "the Special Court shall complete the trial, as far as possible, within a period of one year from the date of taking cognizance of the offence" under Section 35(2) but the number of pending cases is rising which is creating a huge problem in making the justice mechanism effective.

#### **Way forward/Suggestions:**

- Nationwide awareness programs on the POCSO Act will encourage reporting and educate investigating agencies for better implementation.
- Special Police Units for POCSO crimes in each district, with counsellors and child welfare experts will facilitate sensitive handling of cases.
- Fast Track Special Courts under the Act must be set up in each district for time-bound trials and increased conviction rates.
- Provisions on rehabilitation of victims through education, vocational training must be incorporated.
- The Act should be amended to cover consensual sexual relations between children aged 16-18 years and recognize male child abuse victims.
- Timelines must be defined for medical examination and collection of forensic evidence after complaint filing for better results.

### C) LAW COMMISSION REPORT: AGE OF CONSENT UNDER THE POCSO ACT, 2012

Recently, Law commission has recently come up with Report #283 Titled: Age of Consent Under the POCSO Act, 2012, in which it has **advised against changing the present age of consent under POCSO act which is 18 years.** (Section 2(1)(d) of POCSO act defines: 'child' means any person below the age of eighteen years). Issues related to age of consent under POCSO Act:

- The POCSO Act mandates a minimum sentence of 10 years for statutory rape, disregarding the consent of minors aged 16-18. The act maintains a gender-neutral stance.
- Since the enactment of the POCSO Act in 2012, there has been a **rise in the age of consent from 16 to 18 years.** This led to an **increase in the prosecution of adolescents** engaged in consensual sexual activities among minors.

This has following concerns:

- Leads to **shame and stigma associated with criminalization** of consensual sexual activity.
- While these cases do not necessarily lead to conviction, the stringent law **results into denial of bail** and prolonged incarceration.
- Most people adversely affected with this provision are youth from poor and marginalized population.
- A **UNICEF India study conducted** in West Bengal, Assam, and Maharashtra revealed that **one in every four cases under the POCSO Act involved 'romantic cases and consensual relationships.**
- Often when the children (below 18) who elope or marry, **the male partner is sent to jail and the women is usually pushed towards a life of poverty** and destitution (**observed in Veekesh Kalawat vs State of MP**)
- The state is not obligated under POCSO to provide the basic minimum required for the survival of the female and/or her child.

Views of Law Commission against reducing age of consent:

- Existing age of consent (18 years) **should not be tinkered due to dangers of child abuse, trafficking, and prostitution.**
- Consent can be manipulated, thus a lot of genuine cases falling under POCSO might not see trial on account of agencies declaring them to be cases of consensual romantic relationships.
- In many cases, '**consent' arises after the occurrence of alleged offence**, thus reducing age of consent can provide escape to child abusers.
- Can lead to negative fallout on fight against child marriages.
- **Emerging trends of grooming and cybercrimes such as sextortion against women**, increase vulnerability of children to sexual exploitation necessitate a need for stringent protection.
- Provide a **gateway to abuse of law leading to coercion of minor girls into subjugation, marital rape, and trafficking.**

Way forward/Suggestion:

- Law Commission has suggested for introducing guided judicial discretion to deal with situation in case where there is tacit approval on part of child aged between 16 to 18 years.
- However, scholars have emphasized placing the child at the centre while formulating laws, while POCSO serves protection of young from sexual abuse, equally important is to protect young from being shamed, punished and jailed for exploring what is developmentally appropriate for their age.
- Age-appropriate sexuality education should be given in schools.
- Access to confidential medical counselling.
- Prohibiting laws from criminalizing consensual sexual activity with peers.
- Courts to address these matters with sensitivity and increased public dialogue.
- 'Close-in age' exception in case of consensual relationships as followed in USA and Canada can be looked into.

## 2. GENERAL STUDIES-3

### 1) ECONOMY: DEVELOPING CORPORATE BOND MARKET IN INDIA

#### About Bonds:

- A bond is a debt instrument signifying a loan extended by an investor to a borrower, usually a corporation or government entity.
- Governments and corporations frequently utilize bonds as a means of borrowing funds for various purposes.
- Governments, at all levels, use bonds to finance infrastructure projects like roads, schools, dams, and to address sudden expenses related to emergency such as pandemic, wars, etc.
- Similarly, Large organizations often require amounts beyond what typical banks can provide, leading them to issue bonds and borrow from both institutional and retail investors.

#### Present status of corporate bond market in India:

- India's corporate debt to GDP ratio was 17%, contrasting with 123% in the US and 19% in China.
- A larger proportion of Indian firms rely on banks as their primary source of working capital compared to many other developed nations.
- The underdeveloped nature of the corporate bond market in India is evident from these trends.

#### Need for developing corporate bond market:

- **Meet investment needs:** Economic Survey 2018-19 has highlighted that India needs to shift gears from consumption-driven economy to investment-led economy wherein private sector investment has to become key driver.
- **Reduce pressure on government and banks:** In India, given the **absence of a well-functioning corporate bond market**, the burden of financing infrastructure projects such as roads, ports, and airports are more on banks and the government.
- **Asset-Liability mismatch:** Banks use short-term deposits (3-5 years maturity period) to fund long term infrastructure projects with long gestation period leading to asset-liability mismatch.

- **Reduce foreign currency exposures:** Corporate bond market enables firms to borrow for longer maturity periods in local currency to meet their investment needs and avoid foreign currency exposures.
- **Provide long term financial assets:** An active corporate bond market could provide institutional investors such as insurance companies and provident and pension funds with quality long term financial assets.
- **Diversified Funding Sources:** Developing the corporate bond market in India provides companies with an alternative and diversified funding source beyond traditional bank loans.
- **Lower Financing Costs:** A well-functioning bond market can potentially lead to lower borrowing costs for companies, making capital more accessible at competitive rates.
- **Infrastructure Development Support:** A thriving bond market facilitates funding for large-scale infrastructure projects, aligning with the country's developmental goals.
- **Global Competitiveness:** A well-established bond market enhances India's global competitiveness by providing a sophisticated financial infrastructure attractive to international investors.
- **Risk Management:** Corporate bonds offer effective risk management tools, allowing companies to hedge against interest rate fluctuations and other financial risks.

#### **Reasons for underdeveloped bond market in India:**

- **Narrow investor base:** Demand for corporate bonds as an investment is mostly confined to institutional investors with retail investors accounting for only 3% of outstanding issuances.
- **Dominance of government securities:** Central and state government securities constituted almost half of the total investment in the bond market.
- **Constraints on foreign investors:** Investment limit for FPIs in corporate bonds has been enhanced along with a reduction in the withholding tax. However, FPIs are not fully utilising enhanced limits due to limited liquidity in the market.
- **Absence of longer maturity bonds:** Corporate bond market is basically dominated by bonds with average maturity period of 2-5 years. This market has not been able to cater the long-term investors such as pension and insurance fund companies through issuance of long-term maturity bonds.
- **Lack of risk management market:** Absence of interest rate/ credit derivatives which can efficiently transfer the risks arising out of interest rate movements.
- **Taxation Structure:** Stamp duties on corporate bonds across various states have not been standardised.

### **Way Forward:**

Several reports by expert committees on development of corporate bond markets in India such as **R. H. Patil Committee (2005)**, **High Powered Committee on Making Mumbai an International Financial Centre in 2007 (Percy Mistry Committee)**, **H.R Khan Committee on Corporate Bond Market**. Important recommendations:

- **Easing the process of bond issuance:** To incentivise corporates to raise a part of their requirements through bonds, time and cost for public issuance and disclosure and listing requirements should be reduced and made simpler.
- **Enhancing Investor Base:**
  - ✓ the scope of investment by provident/pension/ gratuity funds and insurance companies in corporate bonds should be enhanced.
  - ✓ Retail investors should be encouraged to participate in the market through stock exchanges. Such investors should also be encouraged to participate in the corporate bond market through mutual funds.
  - ✓ Investment in corporate bonds should be considered as part of total bank credit while computing credit deposit ratio by banks.
- **Bonds Primary Issuance Database:** A centralised database of all bonds issued by corporates; made available free of cost to all the investors.
- **Municipal bond market:** Municipal bonds may be given some fiscal support in the form of bond insurance so that municipalities are encouraged to issue such bonds.

Link:<https://indianexpress.com/article/explained/explained-economics/jp-morgan-indian-government-bonds-8959037/>

<https://www.thehindu.com/business/deeper-bond-markets-critical-to-finance-energy-transition/article67408542.ece>

## **2) ECONOMY: SEMICONDUCTOR MANUFACTURING IN INDIA**

### **About Semiconductors:**

- Semiconductors are materials which have a conductivity between conductors and insulators. Semiconductors can be pure elements, such as silicon or germanium, or compounds such as gallium arsenide or cadmium selenide.
- A semiconductor chip is a network of semiconductors, also called integrated circuits or microchips.
- End-use industries dependent on semiconductors include mobile devices, telecom equipment, industrial machinery, computing devices, automobiles etc.

### **Significance of semiconductor industry for India**

- **Economic and Industrial growth:**
  - ✓ According to the Electronics and IT Ministry, semiconductor demand in India would increase to \$70- \$80 billion by 2026 with the growing demand for digital devices and electronic products (mobiles & laptops etc).
  - ✓ This will create numerous employment opportunities for the Indian youth.
  - ✓ Further, India would be required to import fewer semiconductor chips which would decrease the import bill.
  - ✓ Production of semiconductors in surplus of domestic requirement will enable the country to meet export demand as well.
- **National security:** Semiconductors are essential components in many critical industries, including defence, telecommunications, power transmission etc that have implications for national security.
  - ✓ Chips made locally will be designated as ‘trusted sources’ and can be used in products ranging from CCTV cameras to 5G equipment.
- **Geopolitical benefits:** Self-sufficiency will decrease reliance on chinese chip imports especially during hard times like the recent Galwan Valley border clash.
  - ✓ The program will attract large global chip makers to make India their production base, fulfilling the government’s vision for Atmanirbhar Bharat.
- **Supply chain resilience:** The COVID-19 pandemic highlighted the vulnerabilities of global supply chains, including those in the semiconductor industry.
  - ✓ The pandemic and the subsequent lockdowns impacted the supply of chips to India. Automobile manufacturers like Mahindra & Mahindra and Tata group were compelled to reduce their production due to the shortage.
- **Technological Leadership:** Semiconductors are the building blocks of today’s technology. Semiconductor chips are widely used in (a) Computers and laptops; (b) Phones, mobile devices and other electronic gadgets; (c) Automobiles; (d) Aviation; (e) Medical devices especially diagnostics; (f) Military equipment among others. These semiconductor chips are the drivers for ICT (Information and Communication Technologies).

### **Semiconductor at Global level:**

- The semiconductor chip-making process is complex and requires high precision and technological expertise. Manufacturing processes have multiple steps in the supply chain such as designing software for chips and patenting them through core Intellectual Property (IP) rights.
- The global semiconductor industry is currently valued at \$500-\$600 billion.

- **Major Producer:** Presently, **Taiwan is the world leader** in manufacturing microchips with producing over 60% of the world's semiconductors and over 90% of the most advanced ones.
- **Globally, the entire value chain** has seeped in the interdependence between a handful of countries like the **USA, Taiwan, Japan, China**, and some European nations.
- However, this value chain has witnessed two key disruptions in the last few years.:
  - ✓ **US-China conflict:** Presently, USA and China are engaged in trade and technology conflict.
    - The **USA passed the CHIPS and Science Act**, providing subsidies for manufacturing chips in the country, **formed the “Chip 4 Alliance”** and imposed additional restrictions on the Chinese semiconductor industry.
    - In a similar manner, China put curbs on the exports of germanium and gallium, two niche metals used in the manufacturing of semiconductors.
  - ✓ **COVID-19 Pandemic:** Lockdowns disrupted the functioning of these semiconductor manufacturing units and its forward & backward linked supply chains. This created a demand-supply mismatch and resulted in long-pending orders with end-use industries.

#### **India's Role:**

- India has **positioned itself as a player in the critical semiconductor technology** field providing an opportunity for companies **to diversify their bases from China**.
- **Market Size:** Reports project India's semiconductor market to value **about \$64 billion by 2026**, showing three-times growth from 2019. According to the India Electronics and Semiconductor Association (IESA), semiconductor consumption in India is growing at a rate of 15.1%.
- **Chip Design:** India has become the hub for semiconductor design with nearly 2,000 chips being designed per year.
- **R&D in the industry:** Research and development (R&D) in this industry, which includes electronic products and embedded systems, generated about US\$2.5 billion in revenue.
- However, 100% of our chips, memory, and display **are imported into the country, 37% coming from China**. Chips import bill is estimated to touch \$100 billion by 2025 from \$24 billion now.
- **India can be a major beneficiary of Taiwan's New Southbound Policy**, focusing on shifting its trade and investments from China to Southeast Asia and South Asia.

#### **Challenges faced in India:**

- **High Cost of establishment:** Fabs are highly capital-intensive undertakings, costing billions of dollars for large facilities. As per a government estimate, it would cost roughly \$5-\$7 billion to set up a chip fabrication unit in India.
- **Infrastructural requirements:** There are often challenges in meeting the infrastructural requirements of a cluster of semiconductor manufacturing fabs such as continuous supply of water, uninterrupted electricity etc.
- **Long gestation:** A state-of-the-art fab can take up to five years before going into full production but requires full financing and continuous supply of labour during the gestation period.

- **Delays in setting up facilities:** Three entities that had applied to build the chips are all facing hurdles in setting up their plants – potentially delaying their manufacturing bases.
- **Shortage of skilled workforce:** There are hardly any semiconductor engineers trained in the knowledge of device physics and process technology.
- **Need for the ecosystem:** Beyond locating and building structures, fabs require a variety of high-purity gases and wafers to fabricate the chips. Presently, India has to import many of these raw materials from external sources.

### **Semiconductor manufacturing policies in India:**

- **National Policy on Electronics 2019:** It envisions positioning India as a global hub for Electronics System Design and Manufacturing (ESDM) sector.
  - ✓ It aims to encourage the development of core components, including chipsets.
- **Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS):** The government will provide a **financial incentive of 25% on capital expenditure** for a list of products that constitute the supply chain of electronic products.
  - ✓ This includes products such as electronic components, semiconductors, and specialized sub-assemblies.
- India launched its **India Semiconductor Mission (ISM)** in 2021 and **Production Linked Incentive (PLI) scheme for the semiconductor industry.**
- **About Modified Semicon India Programme:**
  - ✓ **Ministry:** Ministry of Electronics and Information Technology.
  - ✓ **Objective:** It aims to provide attractive incentive support to companies/consortia that are engaged in Silicon Semiconductor Fabs, Display Fabs, Compound Semiconductors, Semiconductor Design (Design Linked Incentive Scheme for nurturing 100 domestic companies of semiconductor design) etc.
  - ✓ **Tenure:** Support under the scheme will be provided for six years.
  - ✓ **Nodal Agency:** India Semiconductor Mission, within Digital India Corporation, MeitY is the designated nodal agency for implementing the programme.
- In 2022, India signed **India-US Initiative on Critical and Emerging Technologies (iCET) deal** which enables India to access technologies associated with manufacturing of high-end semiconductors and chipsets.

### **Way Forward:**

- **Ecosystem Development:** Develop a strong ecosystem for the semiconductor industry to include supply chain management besides design and manufacturing facilities.
- **Skill Development:** India, with its demographic dividend, must focus on training the highly skilled labour required for the semiconductor industry.
- **Increased focus on R&D:** Increase spending on research and development and develops an innovation culture.

- **Incentivising Industry:** There is a need for incentivising industry to collaborate with academia to provide training and internship opportunities to students and invest in R&D to develop new technologies.
- **Partnership:** Strengthen partnerships with countries such as the USA, Taiwan and Japan for supply chain efficiency and availability of necessary raw materials and technologies.
- **Attracting foreign companies:** India needs to enable a conducive environment for attracting foreign companies to set up their manufacturing bases in India.



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### OCT 2023: BOOKLET-5

## YOJANA (OCT) - INFRASTRUCTURE

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## 1. GENERAL STUDIES-3:

### 1) UNITY MALLS

- In the Budget 2023-24, Union Finance Minister unveiled a remarkable initiative - the establishment of a 'Unity-Mall' in each state of the country.
  - These malls are envisioned to be strategically located, preferably in the respective state capital, financial capital or one of the prominent tourist centres.
  - **Mall Design, Amenities and features:** The Department of Expenditure in the Ministry of Finance, GoI, has issued comprehensive guidelines to States regarding the construction of Unity Malls:
    - » The architectural design of these malls should signify India's Unity and Grandeur. They are required to have a standardized signage design, as prescribed by Department for Promotion of Industry and Internal Trade (DPIIT). It should also incorporate ODOP logo and Make in India logo. Additionally, the states are encouraged to explore the use of multilingual signage, showcasing India's rich linguistic diversity.
    - » **One Shop(Space) for every state/UT:** The guideline further stipulates that each unity mall should have minimum 36 commercial spaces, with one designated for each state or UT for the sale and promotion of ODOP products. These spaces should have uniform floor space and should be subjected to consistent rental provisions. This is to ensure equitable representation of nation's diversity.
      - It will enable sale of GI products, ODOP offerings and other prominent regional products.
    - » Each unity mall should also allocate commercial space of equal size for every district within the state, including those districts that have been announced by not yet formally notified.
    - » The design should also incorporate flexibility to accommodate the expansion of commercial spaces as needed.
    - » **Range of Essential features:** State-of-the art food court, ample parking facilities, and purpose-built spaces for recreational and cultural activities, all tailored to their respective scales. Functional areas for conferences, events, galleries and exhibitions should also be incorporated into the design.
    - » These malls should also offer technology-driven experience such as VR, AR, Digital displays, and interactive Kiosks.
    - » Special attentions must be devoted to ensure convenience and accessibility in compliance with National Building Code standards.
    - » States have also been urged to provide financial assistance to facilitate the participation of sellers from distant regions and remote districts.
      - They are also supposed to empower local ODOP sellers by implementing capacity building programs.
    - » States are also encouraged to undertake promotional activities aimed at establishing Unity Malls as vibrant cultural hubs and attractive tourist destinations.
    - » To ensure long term sustainability of Unity Malls, their operation and maintenance will be structured under PPP model.
      - In this arrangement ownership of the mall remain with the state government, while O&M responsibilities will be entrusted to private players.

- A concession period of 30 years have been recommended for this PPP.
    - Furthermore, states are expected to commit to covering the operational expenses of the malls if such support become necessary.
  - » In case a state/district chooses not to participate in the mall, the private party responsible for Malls' O&M will actively seek out sellers who can showcase and sell ODOP products in the commercial spaces designated for that specific state or district.
  - » Artisans who are not able to get space within the mall, will be periodically allocated exhibition spaces allowing them to display and sell their products.
- **Approval Procedure and State of Implementation:**
- » DPR is submitted to the DPIIT which meticulously evaluates and then subsequently recommends an amount, not exceeding the amount allocated for the state, to the Department of Expenditure which grants final approval and disburse the funds.
  - » So far, final approval for construction of Unity Mall in 8 states have been given. These include Assam, Chhattisgarh, Gujarat, MP, MHA, Meghalaya, Nagaland and Tripura.
- **Support from Centre:**
- » As part of the Scheme for Special Assistance to States for Capital Expenditure (interest free 50-year loan), a substantial sum of Rs 5,000 crore has been specifically earmarked to extend financial support to states for the construction of Unity Mall.
    - The amount is allocated to states based on the number of districts.
- **Contribution of States:**
- » State will provide land for the malls free of cost and may also allocate additional funds for the project from their budget.
- The initiative to establish Unity Malls throughout the nation draws inspiration from the successful 'Ekta Mall' in Kevadia, Gujarat.
- **Advantages:**
- » It will advance infrastructure development throughout the country and stimulate capital investment within the states.
  - » **Contribute to overall economic prosperity:**
    - Expedite progress towards 'Make in India' and 'Atmanirbhar Bharat' initiative.
    - Offers local artisans opportunities to showcase and sell their products, create employment opportunities and facilitate skill development.
    - It also bolsters tourism.
  - » Foster national unity and diversity:
    - Champion local cuisine
    - Celebrate cultural heritages.
- **Conclusion:**
- » This unique initiative of GoI is poised to play pivotal roles in fostering economic development, providing citizens with recreational spaces, enhancing tourism, and celebrating the rich cultural heritage of our diverse and unique nation distinctively.

## 2) ROAD INFRASTRUCTURE GETTING SMARTER

- **Introduction:**
  - India has the 2<sup>nd</sup> largest road network in the world with 63.71 lakh kms of roads. Road transport is the dominant transport sector in India, both in terms of traffic and in terms of contribution to National Economy (3.08% of GVA (out of total 4.6% by transport sector)).
- **Types of roads in India**
  - India's road infrastructure is categorized into six categories:
    - i. **National Highways:** 1.32 lakh kms
      - These are the primary roads of the country and connect large cities and big industrial areas.
      - Their development and maintenance are the responsibility of central government.
      - **Further need of development of National Highways:**
        - » Out of the total roads, only 2.06% is **national highway**, but its carrying capacity is 40%.
        - » Higher the density of National Highway -> Higher the inter-state trade (Export + Import) as percent of GSDP (ESI)
        - » A positive relationship exists between density of NHs and the per capita income in Indian States.
        - » Presently, more than 70% of NHs are either **two lane or less**. Thus, there is a lot of scope of improvement.
  - ii. **State Highways:** 1.79 lakh kms
    - These roads link all the important centre of industry, trade and commerce of the state and National Highways
  - iii. **District Roads:** 6.12 lakh kms
    - These roads connect different parts of the district, important industrial centres and market centres and usually lead to local railways stations
  - iv. **Rural Roads:** 45 lakh kms
    - These roads are found in villages and usually are of two types - *Pucca (or metalled)* and *Kutcha (or non-metalled)*. They constitute 70% of roads in India.
  - v. **Urban Roads:** 5.41 lakh kms
  - vi. **Project Roads:** 3.43 lakhs kms
- **Rate of Growth of Road Development in India**
  - The CAGR of total road length since 1991 to 2019 has been 3.64%. This CAGR between 1951 and 1991 was 4.50% on a much lower base.
  - The total road length in 1951 was 4 lakh kms; in 1991 it was 23 lakh kms and in 2019 it was 62 lakh kms.
  - So, in last 28 years (1991-2019), about 40 lakh kms of road has been added in the country.
- **Key Reasons for improvement in road construction** (both quality and quantity) in the last 3 decades:
  1. **Delinking Road Development and Direct Employment:**
    - » Until the liberalization reforms (i.e., 1991), the road development was also connected with direct employment leading to labor intensive construction and also putting a cap on the quality of roads.

- » After 1991, the mindset changed and the use of capital intensive high-tech road making equipment was brought into use.
- 2. **Creation of National Highway Authority of India (NHAI):**
  - » NHAI became operational in 1995, which increased the focus on and quality of NHs. Before this NH development and maintenance was the responsibility of the state with funding from the centre.
- 3. **Creation of State-Level Road Development Corporations:**
  - » After the formation of NHAI, many states started thinking of better organizational forms than the PWD for road development under its charge.
    - For e.g., Maharashtra was first state to set up the Maharashtra State Road Development Corporation Limited (MSRDCL) in Aug 1996. It developed Pune-Mumbai expressway.
- 4. **Bringing In PPP Partnership:**
  - » Initially, the concession agreements were loaded in favor of government and thus attracted very few private players in limited low risk projects.
  - » **New Contracting Models and Asset Monetization** also increased PPP's success.
    - BOT (Toll and Annuity)
    - HAM
    - Toll Operate Transfer (TOT) operational model.
- 5. **Starting of NHDP**
  - » Started in 1998, this was the biggest road development projects in India (till Bharatmala was launched). It had two major components: the Golden Quadrilateral and the North-South & East West Corridors.
- 6. **Pradhan Mantri Gram Sadak Yojna** launched by MoRD during the Vajpayee regime is the most successful rural road development project in the country. Its success can be attributed to three reasons:
  - » **Selection of villages for connectivity based on objective criteria**.
  - » **Overseeing from independent agencies**, including world bank
  - » **Keeping the project under MoRD rather than MoRTH**
- 7. **Viability Gap Funding (VGF):** When PPPs were hardly forthcoming for GQ project, the government came up with the idea of mitigating risks by providing VGF with a cap of 40% of the project cost. This increased the interest of bidders and many projects after phase 1 were done through PPP projects.
- 8. **Increased focus on Expressways:** The first access-controlled expressways for fast and streamlined movement was opened between Mumbai and Pune in 2002. While the construction of expressway had a slow start, it has picked up in last 10 years. As of Aug 2023, India has about 5,000 km of operational express way, and other 9,000 kms under construction.
- 9. **Creation of Focused Organizations:**
  - » Indian Highway Management Company Limited (IHMCCL) was set up to carry out electronic tolling.
  - » National Highways & Infrastructure Development Corporation Limited (NHIDCL) was formed to develop roads in border states.

- » National Highways Logistic Management Limited was set up in 2020 for developing Multi-Modal Logistic Parks (MMLPs) and the first/last mile port connectivity projects.

#### **10. Improvement in Road Making Technology:**

- » As the NHDP rolled out, the import of road infrastructure was brought under Open General License, making it easy for procurement. Further, using the transfer of technology mechanism, domestic manufacturing was encouraged.

#### **11. Electronic Toll Collection (ETC):**

- » It reduced the toll collection time and consequent waiting.
- » But this technology needs to further evolve, like in developed countries, to the point where vehicles need not slow down for the electronic payments but can have it done while travelling at the maximum speed.

#### **- Some key challenges which continue and need to be worked upon:**

- **Safety:** India roads record more than 1.5 lakh deaths every year making Indian roads the deadliest in the world.
  - There is a need to improve engineering, promote awareness among drivers to avoid rash driving; ensuring buffer lanes for turns; and providing for sufficient roadside parking.
- **Urban Roads (i.e., the city roads)** suffer from a lot of congestion in almost all cities and hampers first/last mile connectivity.
- **Lane Kms vs Road Kms:**
  - As more multiple lane roads get constructed, it's important to measure lane kms. This will not only help us measure length but also the capacity.
- **Origin to Destination (OD) Data:**
  - For future planning and development of road network, it is important to get OD data. This can also be used for ETC.
- **Better Coordination with PPP players:**
  - Significant time and energy are wasted in disputes between the PPP players and the authority. Projects get delayed leading to significant inconvenience.

#### **- Conclusion:**

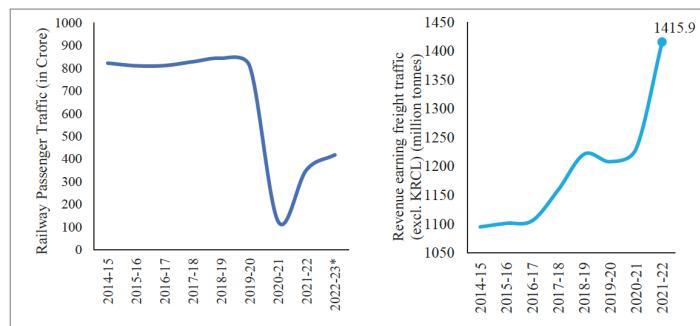
- Given the traction that India has built on road infrastructure, we should hope that the challenges are addressed and the momentum enhanced for development

### **3) RAIL INFRASTRUCTURE**

- Railways in India began in **1853**, when the first train steamed off from **Mumbai to Thane**, a distance of **34 kms**.
- From that modest beginning today, Indian Railways have grown into vast network of more than 7,000 stations, over 68,000 kms of route length and around 130,000 bridges. It is the fourth largest railway network in the world under single management.
- The Indian railways is also one of the **largest employers** in the country by employing more than **13 lakh workmen**.
- **Railway Passenger and Freight Traffic** (as per ESI 2022-23)
  - Passenger Traffic was 809 crore in FY20 which dipped to 125 crore in FY21 and has recovered to 351.9 crore in 2021-22.

- During the **FY20**, IR carried 1.2 billion tonnes of freight and 8.1 billion passengers - making it the world's largest passenger carrier and fourth largest freight carrier. The freight was sustained by IR despite the COVID-19 lockdown. Between FY21 and FY22, there was a sharp increase in freight traffic.

Figure XII.7: Railways passenger as well as freight traffic have seen strong growth post Covid-19 period



Note: \* For FY23 the data is from April-November, 2022

Source: Ministry of Railways

- Capital Expenditure** on infrastructure in railways has received tremendous boost since 2014. It has seen a continuous increase in the last four years with CAPEX (BE) of Rs 2.5 lakh crore in FY23.

## A) OTHER ASPECTS ABOUT RAILWAY INFRASTRUCTURE

- Central Public Sector Enterprises under Ministry of Railways:**
  - There are 12 CPSEs under the administrative control of Ministry of Railways viz. RITES Limited; IRCON International Limited; IRFC; CONCOR; KRCL; MRVC, IRCTC, RCIL; RVNL; DFCCIL; KMRCL; and BCL.
- Research & Development:**
  - The Research Design and Standards Organization (RDSO) at Lucknow is the R&D wing of Indian Railways. It acts as a consultant to Indian Railways in technical matters. It also provides consultancy to other organizations connected with railway infrastructure and design.
- Railway Finance:**
  - Separate Railway Budget in the past:** Since 1924-25, Railway Budget was being presented separately to Parliament since 1924-25 owing to the separation convention. The main reason behind the separation convention was to ensure stability of civil estimates as railway finance used to be a sizable part of the general finance.
  - Merging of the general budget and railway budget** has taken place since FY18. This gives a holistic picture of the financial position of the government. It facilitates multimodal transport planning.
- Railway Electrification:**
  - IR's Mission 100% Electrification** policy is seen as a pivotal for the country's entire energy sector.
    - Advantages:**
      - Reducing crude oil imports and saving forex was the initial motivation.
      - Environment benefits of electrification are becoming more important reasons now.
      - Better quality of service** is also ensured by electric rails. The average speed is higher.

- » **Progress:** As of March 2023, electrification on IR has been extended to 58,812 Route Kms including Konkan Railways.

- **Rail Tourism:**

- IR connects various tourist destinations in the country and is thus the prime mover of tourism in the country.
- **Under Bharat Gaurav Train Policy**, the railways have introduced **theme-based Tourist Circuit Trains**. This will showcase rich cultural heritage and magnificent historical places to the people of India and the world through professionals of the tourism sector and other potential service providers.
  - » Under this, State Tourism Development Corporations or any other potential service provider may run theme-based tourist circuit trains covering any destination of their choice.
  - » Ministry of Tourism supports this by provision of better quality LHB coaches under Bharat Gaurav Train Policy and gives approximately 33% concession in the charges due to the Railway, for promotion of railway tourism.
- Further, specialized tourism products, mostly train based, are also introduced from time to time in association with IRCTC and selected states

## B) NATIONAL RAIL PLAN 2030

- Indian railways have prepared a National Rail Plan (NRP) for India - 2030.
- The plans is to create **future ready** Railway system by 2030.
- The NRP is aimed to formulate strategies based on both **operational capacities and commercial policy initiatives** to increase modal share of the Railways in freight to 45% (at present it is around 27%) and to sustain it.
- **Other aspects:**
  - » Reduce transit time of freight substantially by increasing average speed of freight trains to 50Kmph.
  - » As part of the National Rail Plan, Vision 2024 has been launched for accelerated implementation of certain critical projects by 2024 such as: 100% electrification, multi-tracking of congested routes, upgradation of speed to 160 kmph on Delhi-Howrah and Delhi-Mumbai routes, upgradation of speed to 130kmph on all other Golden Quadrilateral-Golden Diagonal (GQ/GD) routes and elimination of all Level Crossings on all GQ/GD route.
  - » Identify new Dedicated Freight Corridors and new High Speed Rail Corridors.
  - » Assess rolling stock requirement for passenger traffic as well as wagon requirement for freight.
  - » Assess Locomotive requirement to meet twin objectives of 100% electrification (Green Energy) and increasing freight modal share.
  - » Assess the total investment in capital that would be required along with a periodical break up.
  - » Sustained involvement of the Private Sector in areas like operations and ownership of rolling stock, development of freight and passenger terminals, development/operations of track infrastructure etc.

## C) VANDE BHARAT EXPRESS

- **Vande Bharat Express** is India's first indigenous semi-high-speed train. It has been manufactured by **Integral Coach Factory, Chennai** and is a successful step towards 'Make in India' and 'Atmanirbhar Bharat'.
- These trains have **ultra-modern features** like quick acceleration, substantial reduction in travel time, maximum speed of 160 kmph, on-board infotainment and GPS based passenger information system, automatic sliding doors, retractable footstools and Zero discharge vacuum bio toilets, CCTV cameras, etc. and other contemporary features as per global standards.
- **As of July 2023**, 50 Vande Bharat Train services are running on the **Indian Railways**, connecting states having **Broad Gauge Electrified network**.
  - The first Vande Bharat Express train was flagged off on **15th Feb 2019**, on the New Delhi-Kanpur-Allahabad-Varanasi route.
- The introduction of trains, including Vande Bharat services, is an ongoing process on Indian Railways subject to operational feasibility, traffic justification etc.



by  
Santosh Kumar

**PHASE 1**  
**PRE-CUM-MAINS**  
2 Class/Week  
Nov 23 - Jan 24



**PHASE 2**  
**TARGET PRELIMS**  
3 Classes/Week  
Jan 24 - April 24



**PHASE 3**  
**TARGET MAINS**  
4 Classes/Week  
June 24 - Aug 24



**Mode:** Offline/Online

COMMENCING FROM

**4<sup>th</sup> Nov 2023**

**FEE**

(Offline) ₹ 20,000/- + GST

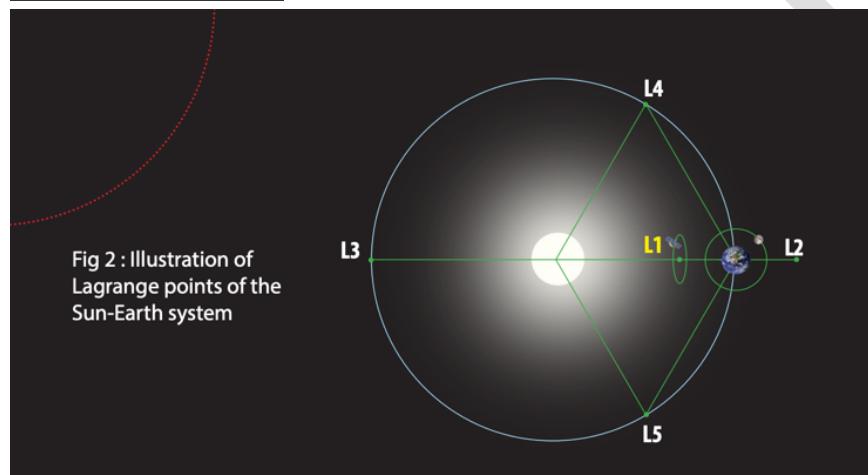
(Online) ₹ 18,000/- + GST

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Rajinder Nagar, New Delhi-110060

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7041021151

#### 4) S&T: ADITYA-L1

- It is India's first observatory class space based solar mission. It was launched in Sep 2023 by ISRO. It has a mission life of 5 years during which its payloads will study various aspects of sun. It will be serving as a space weather station and the data from the spacecraft will aid in making models and predicting storms in advance.
- **Why study sun from space and specifically from Lagrangian point 1?**
  - **Why study sun from Space?**
    - Various types of radiations from sun are not able to reach earth due to atmosphere of the earth and earth's magnetic field making their study difficult from earth.
  - **Why from Lagrangian Points?**
    - A Satellite placed in the halo orbit around the Lagrangian point 1 (L1) of the Sun-Earth system has the major advantage of continuously viewing the Sun without any occultation/ eclipses.



- **What Trajectory ADITYA-L1 follows to reach Lagrangian Point-1:** Through various orbit raising manoeuvres and cruise phase, it will be placed in a halo orbit around the Lagrangian Point-1 (L1) of the Sun Earth System, which is about 1.5 million km from the Earth.



The path Aditya-L1 will take to get to L1. | Photo Credit: ISRO

- **Major Science Objectives:**
  - Understand the coronal heating and solar wind acceleration: It will observe the flow of energy in the sun's outer atmosphere to test competing theories for the heating of sun's corona.
  - Understanding initiation of Coronal Mass Ejection (CME), flares and near earth space weather: By analysing X-Ray radiation, it will seek to understand how violent solar storms are born.
  - To understand coupling and dynamics of the solar atmosphere
  - To understand solar wind distribution and temperature anisotropy.
  
- **Various Payloads of ADITYA-L1:** It goes with **7 payloads**:
  - a) Visible Emission Line Coronagraph (VELC): It can peek as close as 1.05 solar radii, a region never imaged by any solar telescope. It can thus give us more information about coronal mass ejection.
  - b) Solar Ultraviolet Imaging Telescope (SUIT): It will observe UV radiations from different zones of the solar atmosphere. It will help us to better understand the climate variation on earth.
  - c) Solar Low Energy X-Ray Spectrometer (SoLEXS)
  - d) High Energy L1 Orbiting X-Ray Spectrometer (HEL1OS)
  - e) Aditya Solar Particle Experiment (ASPEX): In-situ measurements of solar particles and ions.
  - f) Plasma Analyzer Package for Aditya (PAPA)
  - g) Advanced Tri-axial High Resolution Digital Magnetometers
    - With the help of e, f, and g scientists can predict probable geomagnetic storms and better understand space weather dynamics.

**Conclusion:** If the mission succeeds, it will be a resounding vindication of India's investment in space science research, which can on the one hand spur fundamental enquiry of our cosmos and on the other generate knowledge of strong societal relevance.

## 2) S&T: SPACE INFRASTRUCTURE IN INDIA

- **Background:**
  - Space activities in India began with the establishment of the Indian National Committee for Space Research (INCOSPAR) in 1962. In the same year, work on establishment of Thumba Equatorial Rocket Launching Station (TERLS) near Thiruvananthapuram was also started.
  - ISRO was formed on 15<sup>th</sup> Aug 1969, and superseded INCOSPAR with an expanded role. In 1972, Space Commission and Department of Space (DOS) were constituted by the GoI, and ISRO was brought under DOS.
    - **ISRO** is the space agency of India. It is involved in science, engineering, and technology to harvest the benefits of our space for India and mankind. It has established major space systems for communication, television broadcasting, and remote sensing. It has also developed satellite launch vehicles like PSLV, GSLV, LVM-3 etc. It also contributes to science and science education in the country. It has launched Indian's NAVIC, Chandrayaan, MOM-1, Aditya-L1 and several other incredible missions.

- **Space Commission** formulates the policies and oversees the implementation of the Indian Space Program to promote development and application of space science and technology for the socio-economic benefit of the country.
- **DOS** implements these programs through ISRO and other associated organizations:

- The Major establishments of DOS and their area of activities are:

---

#### A) VIKRAM SARABHAI SPACE CENTRE (VSSC):

- Located in Thiruvananthapuram, it is responsible for design and development of launch vehicle (rocket) technology. Its major programs include, PSLV, GSLV, LVM-3, RLV, Rohini Sounding Rockets etc.

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#### B) UR RAO SATELLITE CENTRE (URSC)

- Located in Bengaluru, it is the lead centre for design and development of satellites including communication, navigation and remote sensing satellites. These satellites provide applications in the areas of telecommunication, television broadcasting, VSAT services, tele-medicines, tele-education, navigation, weather forecasting, disaster warning etc.

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#### C) SATISH DHAWAN SPACE CENTRE (SDSC)-SHAR

- It is the 'Spaceport of India'. It is the backbone of the ISRO in providing launch base infrastructure for the Indian Space Program.
- It is located at Sriharikota, Andhra Pradesh.

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#### D) LIQUID PROPULSION SYSTEMS CENTRE (LPSC)

- It is the lead centre of ISRO for the design, development, and realization of advanced propulsion systems for launch vehicles.
- It is primarily responsible for developing and deploying earth storable, cryogenic, semi-cryogenic, and electric propulsion systems for ISRO's launch vehicles and satellites.
- Its activities are spread across its two campuses, namely, LPSC, Valiamala, Thiruvananthapuram, and LPSC, Bengaluru.

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#### E) SPACE APPLICATION CENTRE (SAC)

- Located in Ahemedabad, it's a major R&D centre of ISRO.
- It develops space borne and air-borne instruments and payloads and their applications for national development and societal benefits.
- For e.g., the communication transponders developed at this centre for the INSAT and GSAT series of satellites are used by the government and private sector for VSAT, DTH, Internet, broadcasting etc.

- It also designs and develops **optical and microwave sensors** for satellites, signal and image processing software, GIS software, and many applications for Earth Observation Program of ISRO.

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#### F) HUMAN SPACE FLIGHT CENTRE (HSFC)

- Set up in 2019, it is the **lead centre** for ISRO's Human Spaceflight program.
- It undertakes **multidisciplinary R&D activities** in new domains of human science and technology while conforming to high standards of reliability and human safety.
- It is **currently focused on Gaganyaan mission** and is working on **end-to-end mission planning, development of orbital module, life support systems, selection and training of astronauts etc.**
- It is **currently operating from ISRO-HQ campus, Bengaluru.**

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#### G) NATIONAL REMOTE SENSING CENTRE

- It is responsible for **establishment of ground centres for receiving satellite data, generation of data products, aerial remote sensing data acquisition, dissemination to the users, development of techniques for remote sensing applications including disaster management support, geospatial services etc.**

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#### H) ISRO PROPULSION COMPLEX (IPRC)

- Located in **Mahendragiri**, it is responsible for **assembly, integration and testing of liquid propulsion systems** for operational and developmental launch vehicles.
- It is also responsible for **qualification, testing and acceptance of liquid engines, cryogenic engines, spacecraft engines etc.**

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#### I) ISRO TELEMETRY, TRACKING AND COMMAND NETWORK (ISTRAC)

- It is responsible for providing **telemetry, tracking and command (TTC), and mission control services to major launch vehicle, laboratory for electro-Optics Systems (LEOS) and Interplanetary Spacecraft missions of ISRO.**
- It is also responsible for **operating the complex ground segment of NaVIC.**

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#### J) MASTER CONTROL FACILITY (MCF)

- It is responsible for **on-orbit Operations (OOP) and Launch & Early Orbit Phase (LEOP) operations of geostationary/geosynchronous & IRNSS class of space crafts of ISRO.**
- It is located at **Hassan in Karnataka.**

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#### K) ISRO INERTIAL SYSTEMS UNIT (IISU)

- Located in Thiruvananthapuram, it is **responsible for design and development of inertial systems for launch vehicles and satellites.** These include **mechanical and optical gyros, Altitude reference systems, accelerometer packages etc.**

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#### **L) LABORATORY FOR ELECTRO OPTICS SYSTEMS (LEOS)**

- Located in Bengaluru it is responsible for design, development and production of altitude sensors, high resolution imaging optics, and special purpose science instruments for several space crafts.

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#### **M) INDIAN INSTITUTE OF REMOTE SENSING (IIRS)**

- IIRS, Dehradun, is a premier institute with primary aim to build capacity in Remote Sensing and Geoinformatics and their applications through education and training programs at the postgraduate levels.

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#### **N) DEVELOPMENT AND EDUCATIONAL COMMUNICATION UNIT (DECU)**

- Located in Ahmedabad, it is responsible for implementation of satellite-based societal applications in the country.
- It is involved in the system definition, planning, implementation, and social research & evaluation of such applications.

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#### **O) PHYSICAL RESEARCH LABORATORY (PRL)**

- PRL, Ahmedabad is an autonomous body under DOS, and a premier research institute engaged in basic research in the areas of Astronomy and Astrophysics, solar physics, planetary science and exploration, space and atmospheric sciences, geosciences, theoretical physics, atomic, molecular and optical physics etc.

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#### **P) NATIONAL ATMOSPHERIC RESEARCH LABORATORY**

- Located in Gadanki near Tirupati, it is an autonomous organization engaged in cutting edge research in atmospheric and space sciences with the vision of developing capability to predict the behaviour of the earth's atmosphere through observations and modelling.

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#### **Q) NORTHEASTERN-SPACE APPLICATIONS CENTRE (NE-SAC)**

- It is an autonomous organization under DOS and Northeastern Council (NEC). It has the mandate of providing space-based governance and development by taking up projects in the fields of natural resource management, infrastructure planning, healthcare, education, emergency communication etc.
- It also conducts training and capacity building in the field of geospatial technology and UAV based remote sensing applications.

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#### **R) INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY**

- Established in 2007 at Thiruvananthapuram, it is Asia's first Space University. It aims to provide high quality education in Space S&T to meet the demands of the Indian Space Program. It offers undergraduate, postgraduate, doctoral and post-doctoral programs.

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#### **S) ANTRIX CORPORATION LIMITED (ACL)**

- It is a GoI company under the administrative control of DOS.
- It is engaged in providing space sector products and services worldwide ranging from supply of hardware and software, earth observation and scientific missions, transponder lease services, launch services etc.

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#### **T) NEW SPACE INDIAN LIMITED (NSIL)**

- Incorporated in 2019, it is a CPSE, under the administrative control of DOS. It focuses on commercially utilization of R&D work of ISRO centres and other DOS constituents.
- The emergence of NSIL would spur the growth of Indian industries in the space sector and enable Indian industries to scale up manufacturing and production base.

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#### **U) INDIAN NATIONAL SPACE PROMOTION AND AUTHORIZATION CENTRE (IN-SPACE)**

- It is an independent nodal agency under Department of Space (DoS). It was set up in 2020 to boost commercialization of Indian Space Activities and encourage private sector participation.
- It will permit and oversee the following activities of non-Government Private Entities (NGPEs):
  - Building of launch vehicles and satellites and providing space-based service as per the definition of space activities.
  - Sharing ISRO infrastructure/premise etc.
  - Establishment of temporary facilities within the premise of ISRO
  - Establishment of new space infrastructure and facilities, by NGPEs, in pursuance of space activities based on safety norms and other statutory guidelines and necessary clearance.
  - Building of Spacecrafts by NGPEs for registration as Indian satellites and all associated infrastructure
  - Using of spacecraft data and rolling out of space-based services and all other associated infrastructure for the same.



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### OCT 2023: BOOKLET-6

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### 1) SOCIAL JUSTICE: MEDICAL TERMINATION OF PREGNANCY/ ABORTION

- Why in news recently?
  - SC disallows abortion of a 26-week pregnant women (Oct 2023)
- Example Questions
  - Discuss the key reasons for increasing unsafe deliveries in the country. In this light discuss how the 2021 amendment to the Medical Termination of Pregnancy Act, 1971 resolve these issues. [15 marks, 250 words]
- Introduction
  - Abortion refers to the removal or expulsion of an embryo or fetus from the uterus, resulting in, or caused by, its death. In India, abortion is allowed only in some cases. This has led to large number of unsafe abortions in the country.
- Legal Provisions Regarding Abortion in India
  - Section 312 of IPC made abortion under any circumstances, except danger to a pregnant woman's life, as illegal in India and prescribed a punishment of 3 years for the offence.
  - **Medical Termination of Pregnancy (MTP) Act, 1971** overrides the section 312 of IPC. Key Provisions include (after 2021 amendment):
  - For pregnancies upto 20 weeks, termination is allowed under the opinion of one registered medical practitioner if:
    - A. The continuance of the pregnancy would involve a risk to the life of the pregnant woman or of grave injury to her physical or mental health; or
    - B. There is a substantial risk that if the child was born, it would suffer from any serious physical or mental abnormalities.
      - The 2021 amendment replaced the term 'married woman and her husband' with the term 'woman and her partner'. Hence now unmarried women can also terminate her pregnancies within gestational limits under the act.
      - The explanation to the provision states that termination within 20 weeks is allowed if the pregnancy was caused by failure of contraceptive which was used for limiting the number of children or for preventing pregnancy. The anguish caused by such unwanted pregnancy may be presumed to constitute a grave injury to the mental health of the pregnant women.
  - For pregnancies between 20-24 weeks, the Rules attached to the law prescribe certain criteria in terms of who can avail termination. It also requires opinion of two registered practitioner in this case.
    - **Medical Termination of Pregnancy (Amendment) Rules, 2021** notified in Oct 2021.
    - The gestation limit for termination of a pregnancy in India has been increased from 20 to 24 weeks for some categories of women.

- **Section 3B of the Rules** list seven categories which include survivors of rape/incest; minors; change in marital status during the ongoing pregnancy (widowhood, divorce); women with physical disabilities (major disabilities as per the criterias of PwD Act, 2016); Mentally ill women; cases of foetal malformation; women with pregnancy in humanitarian settings or disaster or emergency situation as may be declared by the government.
- Abortion beyond 24 weeks is allowed only in cases of substantial foetal abnormalities diagnosed by a medical board.  
All states/UT governments will constitute a **medical board** consisting of gynecologist, pediatrician, radiologist/sonologist and other members notified by the state government.
- Abortion at any stage will be allowed if needed immediately to **save women's life**. Here only **opinion of one registered medical practitioner would be needed**.
- **Protection of Privacy:** Name or other details of a woman whose pregnancy has been terminated shall not be revealed except to a person authorized in any law for the time being in force. Violation of this privacy norm is punishable with imprisonment up to a year, a fine or both.

- **Global Scenario:**

- Globally there has been a trend towards liberalization of abortion laws and increased access to abortion services.
- Since the early 1990s, nearly 60 countries across the world eased abortion laws to expand the grounds under which abortion is legal.
- Only four countries, namely El Salvador, Nicargua, USA and Poland have removed legal grounds for abortion during this time. Most notably, the US Supreme Court eliminated the constitutional right to abortion in 2022.

- **Problems that still remain:**

- Despite various laudable steps, the law didn't go far enough to change the landscape of abortion rights in India:
  - Experts believed that extension of abortion permission till 24 weeks should be for all women rather than a few categories.
  - **Women still hasn't been given complete control over her body** - Over the years, the understanding and appreciation of the need for women to have complete control over their bodies has increased. This is evident from various Supreme Court verdicts (e.g. the Puttaswamy Judgment) and International Conventions (e.g. the Convention on Elimination of All Forms of Discrimination against women). But, the amendment still leaves the decision of termination in the hands of doctors.
    - Various SC verdicts had supported this argument:
      - In 'Suchita Srivastava vs Union of India' case, the SC held that a women's right to make reproductive choices is also a dimension of personal liberty guaranteed under Article 21 of the Constitution.
      - In 'Puttaswamy verdict' the court held that a women's constitutional right to make reproductive choices and the right to "abstain from

procreating" was read into the right to privacy, dignity and bodily autonomy.

- Allowing termination of pregnancy beyond 24 weeks in case of only "foetal abnormalities" would mean that a woman would still need to file a writ petition before the court if she wishes to undergo termination for a reason other than the existence of "foetal abnormalities".
  - Similarly, in case of "sex workers", having a provision for "partner" in the framework for abortion, would be a challenge.
  - Finally, very restrictive laws, promote backstreet abortions/ illegal abortions or leads to abandonment of child.
- Some operational issues:
- Accountability of the medical practitioners and hospitals for providing the sanction needed for abortions. There is no onus on the doctors to respond within a clearly specified timeframe, preferably in matters of hours.
  - The law also doesn't deal with situations where the two doctors are of contrasting opinion.
- POCO and MTP contradictions
- MTP requires doctors to protect confidentiality of person getting abortion, whereas POCO and the CrPC require mandatory reporting of sexual offences against children.

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#### A) SUPREME COURT VERDICT: X V NCT (SEP 2022)

- Background:
  - Provision 3B of the Medical Termination of Pregnancy Rules, 2003 allowed only some categories of women to seek termination of pregnancy between 20-24 weeks under certain extra ordinary categories.
  - The Challenge to the provision was made in July 2022 when a 25 year old unmarried woman who moved the court seeking an abortion after Delhi High Court declined her plea to terminate pregnancy in the 24th week. The woman's case was that she wished to terminate her pregnancy as "her partner had refused to marry her at the last stage". She also argued that continuation of pregnancy would involve a risk of grave and immense injury to her mental health.
  - However, the law allowed such change in circumstances only for "married" relationships.
  - The Supreme Court, holding that the law had to be given a purposive interpretation, had allowed the petitioner to terminate her pregnancy in an interim order. However, the larger challenge to the law, which would benefit other women as well, was kept pending.
- Key Highlights and significance of the verdict:

- The Court held that "the distinction between married and unmarried women under the abortion law through its rules is "artificial and constitutionally unsustainable"" and perpetuates the stereotype that only married women are sexually active.
  - Rights available to married women under Medical Termination of Pregnancy Act, 1971, to abort foetus will be available to all women (married or in consensual relationships, and including "persons other than cis-gender women").
- The court also expanded on Rule 3B(a) - "Survivors of sexual assault or rape or incest" - to include married women in its ambit. Although it doesn't have the effect of striking down the marital rape exception under the IPC, the ruling said that the women who have suffered "marital assault" can be included in the provision. It is not inconceivable that married women become pregnant as a result of their husbands having "raped" them.
- Clarification on POCO vs Right to Privacy norms:
  - The court acknowledged that adolescent girls who have indulged in consensual sex and are seeking abortion face problems while accessing safe and legal MTP due to provision of mandatory reporting to the police under the POCO. The judgment clarified that while the need to report mandatorily remains, the identity of the pregnant person need not be disclosed in the cases of consensual sexual activity and where the minor and/or her guardian request the medical service provider to maintain confidentiality.
- Constitutional values, such as the right to reproductive autonomy, the right to live a dignified life, the right to equality, and the right to privacy has led court to reinterpret the contours of the MTP Act and the MTP rules.
  - The ruling "recognizes" the right of unmarried women; expands and enlarges women's reproductive right.
  - The Court said "Article 21 of the Constitution "recognises and protects the right of a woman to undergo termination of pregnancy if her mental or physical health is at stake. Importantly, it is the woman alone who has the right over her body and is the ultimate decision-maker on the question of whether she wants to undergo an abortion... Depriving women of autonomy not only over their bodies but also over their lives would be an affront to their dignity"
  - While recognizing right to equality, the court also said that her agency and choice is equally important.
- The apex Court has thus created a progressive jurisprudence which interprets the law from the point of view of rights of persons accessing the services.
  - The verdict interprets the provisions of the law/rules as per the changing social mores.
  - The verdict said "transformative constitutionalism promotes and engenders societal change by ensuring that every individual is capable of enjoying the life and liberties guaranteed under the Constitution" and "the law must remain cognizant of the fact that changes in society have ushered in significant changes in family structures"
- The judgement also makes Indian legal system in compliance with international norms which obligates India to provide safe and legal access to sexual and reproductive health and rights that include abortions.

- Report by UN population Fund in 2022 - nearly 67% of abortions in India are deemed unsafe killing eight women on an average daily.

## B) SUPREME COURT VERDICT (OCT 2023): REJECTED A 26-WEEK PREGNANT WOMEN'S PLEA FOR ABORTION:

- A married woman 26 weeks pregnant had approached the SC seeking to terminate her pregnancy citing inability to take care of the child due to post-partum depression and other health issues. She has two other children and the new pregnancy had gone undetected due to lactational amenorrhea. Her last pregnancy was an year ago and she is being treated for postpartum psychosis.
- The Supreme Court rejected the woman's plea for abortion.
- **Reasons why court denied the request:**
  - The AIIMS medical board in its report found no cause for immediate concern: the foetus was healthy and viable.
  - The court also added government would bear the cost and woman may give the child for adoption post delivery.
  - It said that there are rights of unborn child too and it should be balanced.
- **Analysis:**
  - **Rights of women vs Foetal Rights**
    - While in X v NCT the court declared that 'it is woman alone who has the right over her body' and is the ultimate decision maker. However, in practice, when individual women come before courts, a discourse on foetal rights has begun to emerge.
  - **Pro-Life and Pro-choice debate:**
    - This conversation is largely alien to India. But now, court has initiated this debate and thus it has to be engaged with.
    - A pro-choice discourse however, is not materially and politically conducive argument for Indian Society.
- **Way Forward:** Apex Court's decision (Sep, 2022) is only the first step forward in the Indian women's fight for reproductive and bodily autonomy. Much more needs to be done:
  - The true measure of the success of the amendment and the 2022 SC judgment would be its effective implementation and how it is able to bridge the access gaps.
    - Focus on increasing access - increase the number of gynaecologists and obstetricians in community health clinics in rural areas.
    - Take strict action against illegal abortion clinics.
    - Put in place a rights-based approach, telemedicine etc.
  - **Bring clarity on the "Rights of a foetus"**

- The rights of foetus under the Indian Constitution is unclear - there is no upfront articulation about it. Whether the foetus possesses rights, or simply interests is also ambiguous.
  - A 2016 Bombay High Court decision relied on international human rights law to hold that the foetus doesn't have rights till birth.
- **In essence**, the state of law is jumbled, and requires urgent deliberation, especially if foetal interests (or, rights) are being used to restrict abortion rights.
- **Make the wording of the law more inclusive by replacing "Women" with "Person".**
  - Many people who don't identify as women but can experience pregnancy. They also require access to safe abortions.
- **Some other amendments** which could further make MTP progressive include:
  - Allowing abortion upto 12 weeks at the will of the pregnant women.
  - Extending the option of abortion beyond 24 weeks to survivors of sexual abuse/rape.
- **Increased Awareness** about the law and the SC Verdict:
  - This is needed as abortion still remains a stigma, especially in the lower rungs of society with motherhood constantly being looked through a moral prism.
- **Mainstream medical curriculum** as well as **Society** -> needs to be sensitized towards women's right and their freedom of choice to either keep or terminate her pregnancy, which would ultimately affect her entire life by interrupting her education, her career, or affecting her mental health.

## 2. GENERAL STUDIES-3

### 1) S&T: FUSION REACTIONS:

- **Why in news?**
  - US scientists repeat fusion ignition breakthrough for 2<sup>nd</sup> time in July 2023.
    - Scientists at the California-based lab repeated the fusion ignition breakthrough in an experiment in the National Ignition Facility (NIF) on July 30 that produced a higher energy yield than in December.
- **Example Questions:**
  - "Use of fusion process for generating electricity at a commercial scale is decades away, but the latest experiment by US scientists is still a big deal. Elaborate. How is their method different from the one being used by ITER?"
- **Introduction:**
  - **Fusion** is the energy source of the Sun and Stars. A fusion reaction occurs when two atoms of lighter nuclei combine to form an atom with heavier nucleus. The mass of the resulting atom is slightly less than the combined mass of the constituent atoms, and this lost mass is released in the form of energy as per Einstein's mass-energy equivalence relation ( $E=mc^2$ )
  - **Fusion takes place** at very high temperature (for e.g. Sun's core has a temperature of 15 million degree C)
    - What is the **need of extremely high temperature?**
      - » to **overcome the electrical repulsive force**
  - Till date we don't have any stable fusion reactor.
    - **Development of thermonuclear energy power plants has been difficult:**
    - **Three conditions must be fulfilled** to achieve fusion in a laboratory:
      - » **Very High Temperature** (on the order of 15 million degrees C)
      - » **Sufficient Plasma particle density** (to increase the likelihood that collisions do occur)
      - » **Sufficient confinement time** (to hold the plasma, which has the propensity to expand, within a defined volume)
  - **Note:** Twentieth century fusion science identified the most efficient fusion reaction in the laboratory setting to be reaction between two hydrogen isotopes, deuterium (D) and tritium (T), as the D-T reaction produces the higher energy gain at the "lowest temperatures".
- **Why nuclear fusions are important as an energy source?**
  - **Easily available raw material**
  - **Most efficient known form of energy production** in the universe – it produces four times more energy than a standard Uranium-based fission reaction.

- Nuclear Fusion is a clean and green route to produce energy, as it doesn't involve any remnant waste products.
  - Long term energy security
- **USA's Attempt:**
- In Dec 2022, an experiment at US National Ignition Facility (NIF), within the Livermore National Laboratory, Livermore, California, achieved a **fusion ignition** by successfully conducting a fusion test that produced 153% (1.53 gain) as much energy as went into triggering it.
  - In July 2023, in a repeat of the above experiment, scientists were able to generate more energy with nearly a **factor of 2 in gain** compared with energy of the incoming lasers.
- **Types of Fusion Reactions:**
- **What happens in Sun's Core?**
    - Class discussion
  - For fusion reaction to happen in reactors, the high temperature must be created artificially. There are two different ways of achieving this: **Inertial Confinement Method** and **Magnetic Confinement Method**:
    - 1) **Inertial Confinement Method:** In this method, high energy laser beams are focused onto a pellet of the fuel (D-T), which creates extreme temperatures required for fusion inside it. The outer mass of the pellet explodes and is responsible for confining the reaction.
      - E.g., **The NIF reactions**
    - 2) **Magnetic Confinement Fusion (MCF):** It uses a magnetic field to contain plasma, which prevents the particles from hitting the reactor walls which could otherwise cause them to slow down.
      - **Magnetic confinement** uses a torus-shaped reactor called tokamak, in which a hydrogen plasma is heated to a high temperature and the nuclei are guided by strong magnetic fields to fuse. **ITER** is a famous example of an experiment trying to achieve fusion using magnetic confinement.
    - 3) **Some other variants** also exist such as those which use a combination of these methods (Magnetized Target Fusion) and those that combine fission with fusion (Hybrid Fusion)
- **The NIF Breakthrough:**
  - » In Dec 2022, NIF was finally able to achieve 'breakeven', or a **net positive energy gain**.
  - » In July 2023, it was able to replicate its efforts, but now with a bigger gain (almost 2)
  - » In both these achievements **inertial confinement was employed**.

- In NIF's set up, high-power lasers fire pulses at a 2 mm wide capsule inside a 1-cm-long cylinder called **hohlraum**, in less than 10 billionths of a second. The capsule holds deuterium and tritium atoms.
- As the pulse strikes the hohlraum's inside, the latter heats up and releases x-rays, which heat the nuclei to millions of degrees centigrade and compress them to billions of Earth atmosphere. This technique is called inertial confinement method because the nuclei's inertia creates a short window between implosion and explosion in which the strong nuclear force dominates, fusing the nuclei.
- Specifically, when two hydrogen-2 nuclei fuse, they yield a helium-4 nucleus, a neutron and **17.6 MeV** of energy.
  
- **Significance:**
  - » Fusion ignition is one of the most impressive feats of the 21<sup>st</sup> century and is an engineering marvel beyond belief.
  
- **Some Caveats:**
  - » **First:** NIF experiment is highly sophisticated and required very high precision. Even small changes in the experiment may negatively impact the output. So, for long term use, **they will have to reproduce these results again and again.**
  - » **Second:** For fusion reaction to be truly gainful, the **energy released by the reactions needs to be greater than the energy going into the lasers**, about 300 megajoules, and not just the energy delivered to the hohlraum. This hasn't been achieved yet. The energy transferred to plasma is just 1%, the rest is all lost in other processes. **"Future research will need to focus on reaching the next major milestone – a target gain of G > 100, which is required to run a power plant efficiently."**
  - » **Third:** The **road to a power plant from the NIF's current achievement isn't well understood.**

- **India and Fusion:**
  - India has become one of the major players in fusion technology and has been one of the pioneers in its development.
  - The **Plasma Physics Program** was initiated by the GoI in 1982 to conduct research at MCF, which later evolved into the **Institute for Plasma Research (IPR)** in 1986 and led to the creation of India's own **tokamak, ADITYA**, in 1989.
  - Subsequently, it also developed a large semi-indigenous tokamak called the **Steady State Superconducting Tokamak (SST-1)** which was fully commissioned in 2013. IPR has also revealed its plans for a **successor**, the SST-2, due in 2017.
  - In 2005, India became the 7<sup>th</sup> member to join the **International Thermonuclear Experiment Reactor (ITER) project**, a global initiative attempting to build the world's largest tokamak reactor.
    - **ITER-India** has been set up under the supervision of IPR and is responsible for fulfilling India's commitment to the project. It has already provided the **world's largest cryostat**, a vacuum application stainless steel vessel, to house the reactor, along with a host of other equipment.

- **Key Limitations for India:**
  - Lack of **Private Investment**: it is primarily because of **Atomic Energy Act, 1962**, which puts the brunt of developing and running nuclear power stations on the government.
    - **However**, a recent government panel convened by NITI aayog has recommended overturning the ban of foreign investment and allowing greater participation of private players.
- **Conclusion:** The NIF experiment has opened up a new avenue for achieving nuclear fusion through the means of inertial confinement and it would be fruitful for India to take notice and invest in this technology since it's clear that this is where the future lies.

## 2) NON-PERFORMING ASSETS (NPAS)

- **Non-Performing Assets - Basics**
  - » Assets in a banking system comprises of loans given and investments (in bonds etc.) made by banks as these earn interest/profit for banks.
  - » If the interest/ principal instalment of a loan is not paid until due date, it is called **bad loan**.
  - » An asset including a leased asset, becomes non-performing when it ceases to generate income for the bank.
  - » According to RBI **A Non-Performing Asset** is a loan or advance where instalment/interest is due for more than 90 days in case of a term loan or overdraft account/ credit account. Similarly in case of **agriculture loans** an account becomes an NPA if the instalment/interest remains overdue for two crop season for a short duration crop, or one crop season for a long duration crop.
- **Stressed Assets** refers to all NPAs plus restructured assets plus written off assets.
- **NPAs of Indian Banking System had reached 11.18% in 2018.**
- **Why had NPAs increased so much in the last decade?**
  - I. **Credit Boom in mid 2000s and then the global financial crisis:** In Mid 2000s large corporates were granted loans based on extrapolation of their recent growth and performance. But with stagnating economic growth due to Global financial crisis, their loan returning capabilities decreased.
  - II. **Indian creditors used the strategy of "Giving time to time" and hoped that economic revival will reduce NPAs -> this only led to evergreening of NPAs.**
  - III. **Poor Recognition:** Banks were initially reluctant to recognize NPAs. The true extent of NPA problem only started becoming clear once the RBI initiated the Asset Quality Review in 2015.
  - IV. **Poor Governance and Regulation of Banks - Crony Capitalism - Poor Recovery**
  - V. **Lack of specialization of banks in recovering bad loans / NPAs**
  - VI. **Other Factors which negatively impacted businesses**
    - **Key Judicial Decisions**
      - Judicial decisions like abrupt cancellation of coal mines and spectrum allocation led to reallocation through expensive auctioning procedure and thus proved to be a fatal burden on respective business models of power, steel and telecom.

- **Land Acquisition and environmental clearance issues** also blocked a number of projects and contributed towards increasing NPAs.

VII. **Insolvency and Bankruptcy Procedure** has not proved very effective yet.

VIII. **Absence of strict action against bank frauds of high magnitude**

- This is because of absence of a strong law against wilful defaulters and fraudsters

– **IMPACT Of High NPAs**

» **On Banking Sector**

- Decreasing income/Increasing losses for the banks
- Reduces effective internal source of increasing capital which is even under a lot of pressure on account of impeding BASEL-3 guidelines.
- Downgrading of ratings as asset quality deteriorates, this would make international operation and funding difficult.

» **Hinders Economic Growth**

- Accumulation of NPAs in the banking system, specifically in the PSBs, had adverse effects on credit disbursement. Reduction in credit available for market and individual customers led to slowing down of economy.
- The Rise in NPAs occurred with the deterioration of the balance sheet of non-financial firms, and this **twin balance sheet problem** contributed significantly to the deceleration of growth in late 2000s.

» **On Government**

- Increasing **fiscal burden** on government as it has to recapitalize these banks to ensure their proper functioning.

» **On Individuals/ Society**

- **Relatively expensive loans** and decreased interest on deposits.
  - This means that performing borrowers and depositors were effectively being taxed in order to subsidize the non-performing borrowers.
  - Only after demonetization, the interest rates went down because of the flux of cash with the banks
- Less budget/credit available for social welfare programs.
- Eventually its common man's money in the form of deposits which have been lend by banks and is put at risk in case the bank fails.

– **Balance Sheet Syndrome with Indian Characteristics:** High NPAs (TBS problem) have derailed growth in other countries. But huge NPAs have not had as huge an impact as in case of other countries. This is being considered 'Balance Sheet Syndrome with Indian Characteristics.'

- This is because the NPA's are concentrated in public sector banks which not only hold their own capital but are ultimately backed by the government who would eventually come to save these banks in case situation gets out of hand. Therefore, creditors have retained confidence in the banking system and there has been no bank runs, no stress in the inter-bank market etc.
- Mid 2000s boom had created enough infrastructure (in India's severe supply constraint economy), that there was ample room for the economy to grow after the GFC.

- **4 Key steps in solving the NPA problem** (As suggested by Economic Survey of India 2015-16)
  - o **4Rs, Recognition, Recapitalization, Resolution, Reform**
    - » **Recognition:** Banks must value their assets as far as possible close to true value (recognition) as the RBI has been emphasizing
      - Asset Quality Review by RBI has done this and brought the real numbers forward.
    - » **Recapitalization:** Once the true value of the assets is recognized, the capital position must be safeguarded via infusion of equity (recapitalization).
      - Bank recapitalization has been a regular feature of the Union Budget since 2016-17. Between FY17 and FY21, the centre has infused about 3.31 lakh crore into banks.
    - » **Resolution:** The underlying stressed assets in the corporate sector must be sold or rehabilitated (resolution) as the government has been desiring.
      - IBC has played an important role in increasing recovery.
    - » **Reform:** Future incentives for private sector and corporates must be set-right to avoid repetition of the problem.
      - Reform is one area where least progress has been made.
      - Governance structure of the banks have almost remained the same

- **Steps Taken:**

1. **Know your customer (KYC)** norms have been strengthened
2. **Early identification and reporting of stress** - Special Mention Account (As per revised framework for resolution of stressed assets - Feb 2018)
  - Lenders are required to identify incipient stress in loan accounts, immediately on default, by classifying assets as Special Mention Account (SMA) as per the following categories

SMA Subcategory	Basis for classification - principal or interest payment or any other amount wholly or partly overdue
<b>SMA-0</b>	1-30 days
<b>SMA-1</b>	31-60 days
<b>SMA-2</b>	61-90 days

  - This has to be reported to Central Repository of Information on Large Credit (CRILC) on all borrowers' entities having aggregate exposure of Rs 5 crore and above with them.
3. **Asset Quality Review by RBI**
  - To deal with the cases of divergences in identification of NPAs or addition provisioning across banks at the central office level
4. **Indradhanush Scheme**
  - Improving 7 different areas of banks (including capitalization)
5. **Insolvency and Bankruptcy Code (IBC-2016)**
  - To fast track insolvency resolution process and increase the % recovery. This was a more direct path to handle bad loan.
  - It allowed lenders to take defaulting borrowers to NCLT and trigger off bankruptcy proceedings against them.

6. **Fugitive Economic Offenders Act, 2018**, is also acting as a deterrent and may prevent future offenders from running to other countries.

## 7. Project Sashakt (July 2018)

- It is a five pronged strategy to resolve bad loans outline - SME resolution approach, bank led resolution approach, AMC/AIF led resolution approach, NCLT/IBC approach and asset trading platform
  1. **SME Resolution Approach (SRA):** Bad loans of upto 50 crore will be resolved at the bank level, with a deadline of 90 days. For this approach, the committee has also suggested setting up of a steering committee by banks for formulating and validating the schemes, with a provision for additional funds.
  2. **Bank led resolution approach:** For loans between 50-500 crore, banks will enter an inter-creditor agreement, authorizing the lead bank to implement a resolution plan in 180 days, or refer the asset to NCLT. Here, an independent steering committee appointed by the Indian Banks Association (IBA) will validate the process. The resolution plan has to be approved by lenders holding at least 66% of the debt.
  3. **AMC/AIF led resolution approach:** For loans above 500 crore, the panel envisages one or more Independent Asset Management Company (AMC), supported by institutional funding through the Alternate Investment Fund (AIF).
    - The committee suggested that the bidding process should follow a market-led approach, inviting bids from AMCs, ARCs, and AIF.
    - Existing players, such as ARCL and the national AMC, will be allowed to set the floor price for the bad assets while other players will be asked to either match the price or better it.
    - The AMC has to redeem security issued to banks by ARCs within 60 day
  4. **Asset trading platform** for performing and non-performing loans
  5. **NCLT/IBC approach**
    - If none of the above approaches work, NCLT will take over under the IBC provisions.

## 8. Prompt Corrective Action (PCA) Framework

- **What is PCA?**
  - It is a framework under which banks with weak financial matrices are put under watch by RBI.
  - The framework uses **three parameters** to measure the weakness of a bank:
    - **Capital Ratio**
    - **Asset Quality**
    - **Profitability**
- **RBI's revised PCA framework for banks applicable from 1st Jan 2022.**
  - The framework would apply on all banks operating in India, including foreign banks operating through branches or subsidiaries based on breach of risk thresholds of identified indicators.
  - **Three parameters** to measure the weakness of the bank: Capital, Asset Quality and Leverage Ratio.

- **Indicators to be tracked** for capital, asset quality and leverage would be CRAR/Common Equity Tier-1 Ratio, Net NPA Ratio, and Tier 1 Leverage Ratio.
- **Breach** of any risk threshold may result in invocation the PCA.
- **Entry:** A bank will generally be placed under PCA framework based on the Audited Annual Financial Results and the ongoing Supervisory Assessment made by RBI.

**PCA matrix – Parameters, indicators and risk thresholds**

Parameter (1)	Indicator (2)	Risk Threshold 1 (3)	Risk Threshold 2 (4)	Risk Threshold 3 (5)
<b>Capital</b> <b>(Breach of either CRAR or CET 1 ratio)</b>	CRAR - Minimum regulatory prescription for Capital to Risk Assets Ratio + applicable Capital Conservation Buffer (CCB)  and/or  Regulatory Pre-Specified Trigger of Common Equity Tier 1 Ratio (CET 1 PST) + applicable Capital Conservation Buffer (CCB)  <b>Breach of either CRAR or CET 1 ratio to trigger PCA</b>	Upto 250 bps below the Indicator prescribed at column (2)  Upto 162.50 bps below the Indicator prescribed at column (2)	More than 250 bps but not exceeding 400 bps below the Indicator prescribed at column (2)  More than 162.50 bps below but not exceeding 312.50 bps below the Indicator prescribed at column (2)	In excess of 400 bps below the Indicator prescribed at column (2)  In excess of 312.50 bps below the Indicator prescribed at column (2)
<b>Asset Quality</b>	Net Non-Performing Advances (NNPA) ratio	>=6.0% but <9.0%	>=9.0% but < 12.0%	>=12.0%
<b>Leverage</b>	Regulatory minimum Tier 1 Leverage Ratio	Upto 50 bps below the regulatory minimum	More than 50 bps but not exceeding 100 bps below the regulatory minimum	More than 100 bps below the regulatory minimum

- **RBI's corrective action plan based on risk threshold**
  - RBI can put **mandatory restrictions** on dividend distribution, branch expansion, and management compensation based on the risk threshold.
    - In an extreme situation, breach of third threshold, would identify bank as likely candidate for resolution through amalgamation, reconstruction or winding up.
  - Further there can be **discretionary restrictions** on bank's lending limit, special audit etc.
  - RBI can supersede the bank's board, under the PCA.
- **Idea behind PCA:**
  - Handle problems before they attain crisis situation.
  - Essentially PCA helps RBI monitor key performance indicators of banks, and taking corrective measures, to restore financial health of a bank.

## 9. UDAY Scheme (for state power discoms)

- As they were one of the largest NPA holders.

## 10. Governance Reform in banks

- E.g., Separation of the post of CMD and Chairman

### - Impact: Current Situation:

- » Since 2015-16, RBI and the government have made dedicated efforts in terms of calibrated measures like strengthening the regulatory and supervisory framework, implementation of 4R's

approach of **Recognition, Resolution, Recapitalization, and Reforms** to clean and strengthen the balance sheet of the banking system. These continuous efforts have culminated in the enhancement of risk absorption capacity and a healthier banking system balance sheet in terms of asset quantity and quality over the years.

- » **Indian Banks' NPA has fallen to a 10-year low and is expected to improve further: RBI**
  - Gross NPAs of Indian Banks is 3.9% as of March 2023.
  - Net NPAs had dropped to a ten year low of 1.3% in Sep 2022.
- » **Why decrease:**
  - Lower slippages and reduction in outstanding GNPAs through recoveries, upgrades, and write offs led to this decrease.

- **What more can be done:**

- » **Governance Reform in Banks and exit of poorly performing banks.**
  - Financial sector is undergoing structural changes (fintech and other NBFCs) are challenging existing business models.
  - Governance reforms and cost reduction through innovation should be the key to survive in this environment and therefore it is important that inefficient banks should be wind up.
  - Banks have to come up with robust credit worthiness evaluation mechanism.
  - Process of consolidation of banking sector should continue.
- » **Strengthening Insolvency and Bankruptcy Code** as and when loopholes emerge
  - Currently NCLT faces huge work load and hence its resources needs improvement.
- » **Bring back developmental financial institutions.**
- » **Robust and Transparent Secondary market** should be promoted to deal with bad loans.
  - For e.g., in USA, almost a trillion dollar of bad debt is handled every year through an active secondary market which includes ARCs.
  - A robust and transparent secondary market, unhindered by excessive regulation, is an essential element in the vital process of transferring risk from the banks to the capital markets.
- » **Strengthening legal system** to deal with willful defaulters.
  - Currently, willful defaulters are mostly able to go scot free. This will inculcate discipline among the borrowers.

- **Conclusion**

- » Though NPA issue has been resolved, but if the core issues of the banking sector like poor governance, political interference, etc are not resolved, the problem may re-emerge in future.

### 3. PRELIMS FACTS

#### 1) PLACES IN NEWS: GULF OF GUINEA

It is the north easternmost part of the tropical Atlantic Ocean from Cape Lopez in Gabon, north and west to Cape Palmas in Liberia.

The intersection of Equator and Prime Meridian (Zero degree longitude and Zero degree latitude) is in the gulf.

It borders eight African countries - Ghana, Togo, Benin, Nigeria, Cameroon, Equatorial Guinea, Gabon, Sao Tome & Principe.

**Note:** Some definitions of Gulf of Guinea also include Cote d'Ivoire and Liberia as the border countries of Gulf of Guinea.

**River:** the main river dispersing its water in the Gulf are the Niger River and the Volta river.

**Note:** Volta is the main river system in the country of Ghana.

In Oct 2023, India conducted joint drills with warships from the EU in Gulf of Guinea, including flying exercises and tactical manoeuvres off the coast of Ghana.

This is the **first time** Indian ships have taken part in such a drill in the Gulf of Guinea with EU.

**Indian Navy's INS Sumedha**, an offshore patrol vessel, was joined by naval ships of three EU member states - Italian ship ITS Foscari, French Ship FS Ventose and Spanish Ship Tornado



**Earlier**, in Sep 2022, INS Tarkash, which is deployed in Gulf of Guinea for anti-piracy operations took part in joint maritime exercise with Nigeria Navy Patrol Ships. This exercise marked the first joint operational deployment by India and Nigeria, in support of anti-piracy operations, in the Gulf of Guinea.



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### NOV 2023: BOOKLET-1

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## 1) SOCIAL JUSTICE: THE QUESTION OF SAME SEX MARRIAGE

### - Background:

» In Navtej Singh Johar case, Supreme Court decriminalized homosexuality. But gay marriages still didn't have legal recognition in India. In a landmark case, a group of 18 same-sex Indian couples had petitioned the country's Supreme Court to legalize same-sex marriage.

- **Key Demands:** The petitioners had sought a ruling by which the Special Marriage Act (SMA), 1954, which provides for a civil marriage for couples who can't marry under the personal law, should be interpreted as gender neutral, thus allowing the same sex marriage. The current interpretation of SMA, they argued violates Articles 14, 15, 19, 21 and 25 by not allowing marriage between same-sex, gender non-conforming, LGBTQIA+ couples, and sought the words "husband" and "wife" as well as any other gender-specific term to be substituted by the word "party" or "spouse".
- The petitions argued that marriage brings with it several rights, privileges, and obligations that are "bestowed and protected by law".
- The Delhi Commission for Protection of Child Rights (DCPCR) also advocated for recognition of marriage, filing an intervention application to assist the court on the impact of such marriages on children.

### » Respondents Opposing the petition:

- The Central Government, the National Commission for the Protection of Child Rights, and a body of Islamic Scholars called the Jamiat-Ulama-i-Hind, opposed the petitions.

### - Argument Supporting Same Sex Marriage

#### » Protecting the Fundamental Rights of Every Citizen:

- The right to marry for non-heterosexual couple is implicit in Article 14 (Equality), 15 (Non-Discrimination), 16 (Equality of Opportunities in public employment), 19 (Freedom of Speech), and 21 (Right to Life). This is specially true after the SC ruling in 'Navtej Singh Johar vs. Union of India' and 'KS Puttaswamy verdict'.
- In Navtej Singh Johar verdict, Justice Chandrachud held that members of LGBT community are entitled, as all citizens, to a full range of constitutional rights, including liberties protected by the Constitution.

#### » Ensuring other benefits of marriage to homosexuals:

- Being able to marry a partner would allow homosexuals to a host of rights currently reserved for heterosexual married couples - including right to jointly adopt children, own property together or nominate one another as a surrogate decision maker in a medical emergency, right to inheritance, maintenance and tax benefits.

- » Since Navtej Singh Johar Judgment, several high court verdicts have ruled in favor of same sex couples having the right to live together.
  - In **Madhu Bala vs State of Uttarakhand (2020)**, the high court of Uttarakhand held that right of a same sex couple to live together is a constitutional and human right.
  - In **Vanitaben Damjibhai Solanki vs State of Gujarat (2020)**, the Gujarat High Court ordered police protection for two women police constables in a relationship.
  - In **S Sushma v Commissioner of Police (2021)**, the court protects the couple in relationship and makes sure that both sets of parents are taken along in this journey.
- Legal recognition of same sex marriage will contribute to society's acceptance towards homosexuality.
- A study titled 'The Anticipated Impact of LGBTQIA+ Marriage Equality Legislation on Indian Society and Mental Health' among Indians has found that legalization of such unions will have a "positive impact on mental health of LGBTQIA+ individuals".
- There are around 30 countries where same sex marriage is legalized. These countries have seen no harm to their culture and no deterioration of the legitimacy of traditional marriage in any place where same sex marriage is lawful.
- Arguments of people opposing same sex marriage:
  - They argue that same sex marriage is afront to Indian customs and is an urban elitist concept.
  - The government also argued that if Supreme court legalizes same sex marriage, it will mean a virtual judicial rewriting of an entire branch of law and court must refrain from passing such omnibus orders. Proper authority for this should be the legislature.
  - Some don't consider it as normal because they can't replicate babies.
- Supreme Court Verdict: Supriyo a.k.a Supriya Chakroborty & Abhay Dang v. Union of India (Oct 2023)
  - The Supreme Court declined to legalize same sex marriage, leaving it on the Parliament to legislate on the subject.
    - In fact, all five judges agreed that there is no fundamental right to Marry under this Indian Constitution.
- Key highlights of the majority verdict (3:2):
  - There is no fundamental right to marry in the Constitution, and the court can't intervene.
    - » "An institution can't be elevated to the realm of fundamental right based on the content accorded to it by law".
  - Legal recognition of the right to a Civil Union - akin to marriage or civil union - can only be through enacted law.
  - Courts can't enjoin or direct the creation of a legal or regulatory framework resulting in the conferment of legal status on same-sex couples, **nor the same sex couples be granted the right to adopt**.

- The Court cannot read words into the provisions of the SMA and provisions of other allied laws such as the Indian Succession Act and the Hindu Succession Act because that would amount to Judicial legislation.
      - » The provisions and objectives of the SMA clearly points to the circumstances that Parliament intended only one kind of couples, i.e., heterosexual couples belonging to different faiths, to be given the facility of civil marriage.
      - » The court in the exercise of power of judicial review must steer clear of matters, particularly those impinging on policy, which fall in the legislative domain.
  - Despite the above, separate directions have been issued to the Union of India for setting up a high-level committee (under the chairmanship of cabinet secretary) to help ameliorate the manifold difficulties (including discrimination) experienced by the same sex couples living together.
- The **minority opinion**, of CJI D.Y. Chandrachud and Justice Sanjay Kishan Kaul, said the LGBTQIA+ community had a fundamental right to form relationships and that the state was obligated to recognize and grant legal status to such unions, so that the same sex couple could avail the material benefits provided under the law and also could adopt kids. But they also declined to read down the provisions of the SMA to that effect.
- **Analysis: Positives of the Judgment:**
- » **The verdict respects Constitutional Morality:** Separation of Power is one of the basic features of the constitution and judicial legislation would have violated it.
    - Under India's Constitution the power to make laws - including laws related to marriage - vest exclusively either with Parliament at the Centre or with a state legislature in a state - by reason for provisions contained in Article 245(1) and Article 246(2) of the Constitution read along with Item 5 in the Concurrent List.
  - » **To bestow legal recognition to homosexual marriages would need amendment to several laws,** which is the domain of people's elected representatives, not a few selected jurists.
- **Analysis: Limitations:**
- » **Right to marry is a human right as per Universal Declaration of Human Rights (UDHR)** of which India is an original signatory.
    - **Article 16 of the UDHR, 1948** provides that, "Men and women of full age, without any limitations due to race, nationality, or religion, have the right to marry and to form a family.
    - Since Right to Marry is a human right, it should also be recognized as a fundamental right.
    - SC in the past have relied on UDHR to interpret provisions of Fundamental Rights in India.
      - For e.g., in the Maneka Gandhi case, the SC relied on Article 10 of the UDHR to read in principles of natural justice in the administrative process to state.
  - » The Constitution has given the task of defending the fundamental rights of all citizens to the Supreme Court and Supreme court has in the past struck laws which are violative of fundamental rights. If a law is providing legal protection to some citizens and not covering other

citizens, it is definitely **violating Article 14 of the Constitution** and it should be in the mandate of the Supreme Court to amend it.

- The judgement will prolong the long and arduous struggle to create the conditions where same sex couples could live a life without fear, in the sweet elixir of freedom and equality.

» **Social Morality/ Majoritarian Morality** has been given more importance than Constitutional Morality.

- In Navtej (2018), Justice Chandrachud had held that "the Court has to be guided by the conception of constitutional morality and not by the societal morality. In the garb of social morality, the members of the LGBT community must not be outlawed or given a step-motherly treatment of malefactor by the society".
- » **Negative social implications for LGBT community:** The unintended consequence of the judgement in the larger society is that the notion that the same sex couples are "not fit for marriage" will be perpetuated.

- **Way Forward:**

- **Consistent Efforts by LGBT community and other human rights group to get legal recognition:**
  - » Government was against same sex marriage in the SC and thus there are less chances that it would come up with amendments to recognize same sex marriage at its own.
  - » The LGBT community, and human rights group will have to work on several fronts to increase the social acceptance of the same sex marriage which would eventually make government bring changes.
- **Pressure on Legislature** may also come from the side of the opposition parties who may be sympathizing with the cause of homosexual couples.
- **Implementing SC verdict** regarding various protection being available for queer couples.
  - » This will require strong political will and strict judicial oversight as even during Navtej Singh Johar judgment, the SC had directed the state to ensure that the judgment is given wide publicity through media and government should initiate programs to reduce stigma associated with homosexuality. Five years later, almost nothing has been done in this regard.

- **Conclusion:**

- The LGBTQIA+ community was gazing upon the Supreme Court with a profound sense of optimism. Though they were relieved about the recognitions granted in the minority judgment, they have been left disheartened by the final verdict.

## 2) SOCIAL JUSTICE: DEMAND FOR MARATHA RESERVATION

- **Why in news?**
  - » Agitation by Maratha groups in Maharashtra over demand for reservation again took violent route with many cases of arson, loot and public property destruction (Oct-Nov 2023)
    - Maratha leader Manoj Jarange Patil ends fast, warns of 'choking Mumbai' if no quota is ensured by 2nd Jan 2024
- **Example Questions:**
  - » Examine the reasons for recent increase in demand for reservation among the dominant caste groups in India. What could be its impact on the social and political landscape of the country [15 marks, 250 words]
  - » Evaluate the role of reservation policies in achieving social justice and equality in a diverse country like India. [10 marks, 150 words]
- **Introduction**
  - » The last decade has seen various traditionally powerful and influential communities such as Jats in Haryana, Patidar in Gujarat, Kapu in Andhra Pradesh and Marathas in Maharashtra agitating and demanding for OBC Status. The recent protest in Maharashtra is a continuation of this trend.
- **Reasons for such demands/agitations**
  - » **Farming and Employment Crisis:**
    - Agriculture sector over the years have suffered due to land fragmentation, increased input cost, climate change, land degradation etc. It has impacted the income of landed groups and a lot of farmers have turned into small and marginal farmers or even agricultural laborers. These people don't have access to good quality education and skilling opportunities which impacts the jobs available for them.
  - » **Exploitation of vulnerable groups in private sector jobs** because of lack of job security, weakening of labor laws and excesses by the employer. This makes everyone look for limited number of government jobs and here reservation plays a crucial role.
  - » **Perception of Economic Marginalization:**
    - These groups perceive that in the era of globalization and industrialization, they have been left behind and see reservation as a mechanism to access higher education and stable government jobs.
  - » **Sub castes or Parallel castes which got reservation** (like Yadavas in Haryana, Jats in Rajasthan, Kunbis in Maharashtra) have shown an improvement in socio-economic conditions.
    - For e.g., Maratha families witnessed the dramatic rise of poorer-than-them families from society's lower strata. They attributed the rise of Dalits and OBCs to reservation.
  - » **Political Aspirations of the caste leaders:** Mobilizing the community for reservation gives an opportunity for the caste leaders to bring a name for themselves and thus achieve political goals.

- **Should these groups be given reservation?**

- » The **national and state backward class commissions** have found that **these communities are not socially and educationally backward and are adequately represented in the services.** Therefore, their past requests for inclusion in OBC has been rejected.
  - **For e.g.**
    - Marathas from **33% of Maharashtra's population**, are among the strongest of all communities in the state.
    - **12/20 chief ministers of Maharashtra** have been from Maratha community. Current CM and Deputy CM are from this community.
    - In education sector, **most major private deemed to be universities in the state**, like Bharti Vidyapeeth, DY Patil University **are found and run by Marathas.**
  - In fact, **even when governments granted reservation to these groups, it was declared unconstitutional in Supreme Court verdicts** (E.g. in May 2021, the SC struck down the quota for Marathas under the state's Socially and Educationally Backward Class (SEBC) Act, 2018)
- » Since they are **not meeting the objective criteria**, they are **resorting to an exercise of coercive power on governance.** If government agrees to these demands, it **will set a wrong precedent.**
- » **The Constitution** already provides for **10% reservation for the EWS category** for people belonging to **non-reserved class.**
- » **Giving reservation to these "upper caste" group would go against the spirit of affirmative action** that has guided the eligibility quotas in central and state lists.
- » **Therefore, no, these groups should not be given reservation, but rather steps should be taken to relieve the above mentioned grievances.**

- **Way forwards**

- » **Reforming Agriculture Sector:**
  - Since a large section of these dominant groups are dependent on agriculture, its very important to bring reforms in agriculture **to increase agri-income.** Various recent initiatives like **PMKSY, PMFBY, e-NAM, Increased MSP** are steps in this direction.
  - Government should also focus **mechanisms to promote rural industries** including in the **Food Processing Sector** to ensure economic opportunities for everyone.
- » **Improving Quality of Higher Education in Private Institutions:**
  - The demand for reservation is strengthened by the fact that **among HEIs, government colleges where the provision for reservations are implemented provide affordable good quality educations.** Private colleges are not only expensive but lack good quality.
- » **Focus on Skilling of the workforce** so that they can easily get **jobs in the private sector.**
- » **Special focus on labor intensive manufacturing sectors** to ensure employment opportunities for the youth in the country.
- » **Effective regulation of private sectors** to ensure **good working conditions, dignity and stability for workers** to ensure that the most vulnerable are spared the excess of market.
- » **Review Reservation Policies:**
  - To make it more inclusive and **exclude well to do section from it.**
    - Strict implementation of Creamy layer provision among OBCs and introduction of creamy layer provisions for SCs/STs will go a long way in improving the inclusivity of the reservation provisions.

- » **Stop politicizing the issue:** The political class should desist from pandering into these demands and take an unequivocal stand that Socially Advanced Castes cannot be included in the list of Socially Backward Classes.
- **Conclusion:**
  - » The demand for reservation will keep emerging among different sections of societies if economic distress increases and therefore government should focus on skill development, encourage entrepreneurship and enhance the overall economic opportunities in the country.

### 3) SOCIAL JUSTICE: MGNREGA

- **Why in news?**
  - » Union Government SOP permits drone usage for investigating corruption complaints or other violations at MGNREGA worksites (Aug 2023)
  - » Standing Committee on Rural Development & Panchayati Raj highlights various issues with MIGREGA and gives recommendations (July 2023)
- **Example Questions**
  - » Discuss the keyways in which MGNREGA has contributed in the socio-economic sphere of rural India. What are the key challenges being faced currently in the implementation of the program. [15 marks, 250 words]
- **Introduction**
  - » Mahatma Gandhi National Rural Employment Guarantee Act 2005 is a statutory job guarantee scheme for rural India.
  - » It's an initiative by MoRD, which was launched in 2006. It is aimed at:
    - Enhancing the livelihood security of people in rural areas by legally guaranteeing 100 days of wage-employment in a financial year to adult members of any household willing to do unskilled manual work related to public work at the statutory minimum wage.
    - Creating **durable assets** (such as roads, canals, ponds, wells)
  - » The scheme also helps in protecting environment, empowering rural women, reducing rural urban migration, and fostering social equity, among others.
- **Other Key Features**
  - » **Demand Driven Program:** Workers are provided work when they demand it and not when the government wants it.
  - » Employment is to be provided within 5 km of an applicant's residence.
  - » If work is not provided within 15 days of applying, applicants are eligible for an unemployment allowance.
  - » **1/3rd** of the stipulated workforce should be women.
  - » **Social audit** of the work done by Gram Sabha.
- **Steps taken to improve the functioning.**
  - i. **Management Information System** - digitization of all process in MGNREGA - available in public domain - promotes transparency.

- ii. **Mandatory expenditure on agriculture and allied sector:**
  - » As per the provision of the Act, the District Programme Coordinator is required to ensure that at least 60 per cent of the works to be taken up in a district in terms of cost shall be for the creation of productive assets directly linked to agriculture and allied activities through development of land, water, and trees.
- iii. **Training and Skill Development of Workers:**
  - » Training of MGNREGA workers under initiatives like Bare Foot Technicians (BFT) to move than up the skilling ladder.
  - » Similarly, project "UNNATI" focuses on upgrading the skill base of MGNREGA workers.
- iv. **Other technology to Reduce Corruption and improve transparency:**
  - » DBT through E-Payments are used for payment of wages which is ensured fast payment and reduced siphoning of resources.
  - » **Geo-Tagging of assets** to reduce corruption.
    - Rolled out in 2017 and more than 5.2 crore assets (Jan 2023) have been geo-tagged and made available in public domain.
  - » **National Mobile Monitoring Software (NMMS)** App was launched in 2021 which permits taking real time attendance of workers in MGNREGA worksites with a geo-tagged photograph.
    - It is a big step toward step towards bringing transparency and proper monitoring of the schemes and will help in increasing oversight of the program.
  - » **According to a SOP** recently (Aug 2023) issued by MoRD, drones will be used for monitoring of MGNREGA work. It will be used in four types of monitoring: Surveying the ongoing works, inspecting the completed works, impact assessment, and special inspections in case of complains.
- v. **Regular verification of Job Cards (JC) to weed out the bogus and duplicate JCs**
- vi. **Efforts to cover all landless households:**
  - » As per the SECC 2011, there are 5.5 crore households in India which fall in the landless category. Government is taking measures to get all these households a Job Card and thus employment under MGNREGA.

- **Performance of the Scheme:**
  - i. **Positives/Achievements**
    - » **Various Government Reports** have indicated that MGNREGA has led to:
      - **Reduction in Poverty:** The program reduced poverty by 32 percent and prevented 14 million people from falling into poverty.
      - **Raised Income level:** Although it fails to add to the number of days that Individual work, it attracted individuals who were previously employed in less productive work, thereby raising their income.
      - **Relief during distress situations**
        - **During COVID-19 crisis** it had emerged as a mechanism to ensure jobs for migrants returning back home and

- It serves as an important source of income during distress situations such as drought, famine etc. Additional employment opportunities is made available in these circumstances.
  - **Upliftment of weaker sections** like women, SCs and STs through creation of livelihood opportunities.
    - Increase in women's control over resources: MGNREGS scheme may be the first opportunity for many women to earn cash income resulting in substantial increase in women's control over resources- including cash in hand and likelihood of having a bank account.
    - The % of SC workers in MGNREGA has been around 20% and ST workers around 17%.
  - **Impact on Education of Children**: Higher level of educational attainment for children: MGNREGS households were likely to obtain higher level of educational attainment and were less likely to be working.
  - **Rise in financial inclusion**: during this period, there has been a general increase in financial inclusion, reliance on moneylender has gone down and accessing of formal credit grew.
  - **Development of Rural Assets**
    - Irrigation canals and roads have augmented rural infrastructure.
  - **Mitigation of climate change** - through water conservation, drought prevention, reforestation and flood control activities.
- **International praises**
- In World Development Report 2014, the world Bank termed it a "stellar example of rural development."
- ii. Shortcomings/Limitations in implementation**
- **Factors which adversely affect the implementation of MGNREGA**
    - » **Funds constrains.**
      - Parliamentary Standing Committee has also raised concerns about slashing of the budget for MGNREGS. In the FY 2023-24, the allocations for MGNREGS have been drastically slashed to Rs 60,000 crores for this financial year from a Rs 73,000 crore budgetary estimates for 2022-23.
        - This allocation is much lower than World Bank recommendations of Rs 1.7% for the optimal functioning of the program.
    - » **Disparity of wages across state and Wages less the minimum wages in many states:**
      - Parliamentary committee in a report in 2023 has highlighted that daily wage rates ranged from Rs 204 to Rs 331 in different states and UTs.
      - According to the new wage rate notified for FY2023-24, the lowest wage is in Chattisgarh and MP at Rs 221, while the highest is in Haryana at Rs 357.
    - » **Delays in wage payment sometimes discourages work under MGNREGA. It also increases the chance of corruption.**
    - » **Institutional Shortcomings:**

- PRIs suffer from challenges like inadequate administrative and technical expertise:
      - This adversely affects proper planning, approval, monitoring and social audit of the scheme.
      - Inadequate technical staff to help unskilled workforce.
  - » **Non-Appointment of Ombudsmen:**
    - Under the act, there should be an ombudsperson for each district who will receive grievances, conduct enquiries, and pass awards.
    - Standing committee in 2022 noted that out of 715 possible appointments, so far only 263 ombudsmen have been appointed which shows poor coordination between central and nodal agencies.
  - » **Quality of Assets** which are getting created have turned out to be of incomplete or of poor quality, requiring repairs every year.
  - » **Cases of corruption / lack of transparency**
    - Social audit hasn't been very effective because of lack of cooperation from government officials. Further, non-compliance with transparency and accountability provisions and poor maintenance of records are impacting the implementation of the mega scheme.
    - **Fabrication of jobs cards** and associated corruption.
  - » **Inadequate coverage of person with disabilities and women in many states** is impacting inclusive aspect of the scheme.
  - » **Some Issues specific to women:**
    - Lack of childcare facilities and basic amenities at the site like clean drinking water, sanitation facilities impact health and safety of women.
    - Lack of awareness about the process and entitlements available under the scheme.
- **Steps that need to be taken**
- i. **More Funds:** MGNREGA has the potential to change the face of rural India and hence more funds should be allocated for the scheme.
  - ii. **Minimum wage:** MGNREGA wages should be linked with Minimum wages act (Now The Code on Wages) and no state should be allowed to pay less than the statutory amount.
    - » Parliamentary Standing Committee has recommended that government should explore the possibility of making the wages paid under the scheme uniform across the country.
    - » Wages should also be linked with CPI-R rather than CPI-AL which is an outdated index.
  - iii. **Capacity Building of PRIs** by empaneling institutions that can be training institutions for MGNREGA.
    - » **More technical human resource** needs to be provided at rural level to improve the quality of the assets which are getting created.
    - » **Better Planning for durable infrastructure** creation.

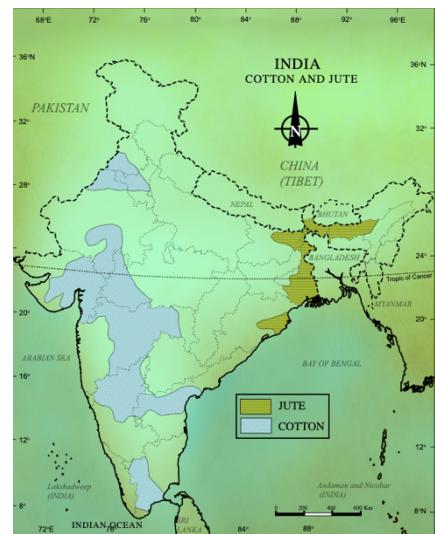
- iv. **Appoint Ombudsperson** in all districts on high priority to ensure simple and effective grievance redressal.
- v. **Monitoring** of the projects needs to improve.
  - » Strengthening Social Audit: CAG should develop mechanism in consultation with other stakeholders to handhold Gram Sabhas to ensure regular social audits of all projects under MGNREGA.
  - » Civil Society can also monitor the Information Management system to ensure that the program is properly implemented.
- vi. **Promoting the use of Adhaar based biometric verification** to prevent fake job cards etc.
- vii. **Improved facilities at workplace** specially for women laborers. (E.g., Clean Sanitation facilities, child care facilities etc.)

- **Conclusion**

- » Since, MGNREGA has proved its socio-economic advantages for rural areas, the program should be continued in full throttle. But, at the same time it is important that the work being done under it is producing something concrete & sustainable and that there is a transparent grievance redressal mechanism for the unskilled work force which has worked under MGNREGA or is seeking work under MGNREGA.

## 1) AGRICULTURE: COTTON

- **Example Questions**
  - » What are the key climatic requirements of Cotton cultivation. How is cultivation of cotton distributed geographically in the country? [10 marks, 150 words]
- Cotton is one of the principal commercial crops of India and it provides livelihood to about 6.0 million cotton farmers.
  - » **India is the largest producer and consumer of Cotton** in the world. Adoption of Bt Cotton in 2000s enabled significant increase in cotton production from 10 million bales in 2001-02 to 34.3 million bales in 2022-23.
  - » It is an indigenous crop which is sown as Kharif Crop in semi-arid region of the country. It takes 6-8 months to mature.
- **Suitable Climate Condition for Cotton**
  - » Cotton is a crop of tropical and subtropical areas and requires uniformly high temperatures between **21 degrees and 30 degrees C**. The growth is negatively impacted if the temperature falls below 20 degree C. Frost is harmful for the crop.
  - » The crop has **modest water requirement** (average annual rainfall of **50-100 cm**) and can be grown in areas with lower rainfall with the help of irrigation.
  - » **Good sunshine** is a must at the time of flowering and moist weather or heavy rainfall at the time of ball opening and picking are detrimental to the crop.
- **Other requirements**
  - » Cheap and skilled labor force at the time of picking of cotton. Normally the picking season is spread over a period of 3 month.
  - **Traditionally**, it is cultivated on the **lava plateau of Deccan** and therefore the soil here is called the **Black Cotton soil**.
  - In **Tamil Nadu**, it can be grown both in Kharif and Rabi season as there is **no threat of frost** which is dangerous for the cotton production.
- **Total Production and Distribution of Cotton Cultivation in India:**
  - » India has the world's highest area under cotton cultivation which accounts for around 6% of the net sown area. India produces **6 million tonnes** of Cotton every year, which is **about 23% of the world cotton**.
  - » India also produces **51%** of the total organic cotton production of the world, which demonstrates India's effort towards sustainability.
  - » There are **three major cotton producing regions** in India:
    - Southeast Punjab, Western Haryana, and Northern Rajasthan



- ii. Gujarat, Maharashtra and neighboring Southern Rajasthan in Western India
- iii. North Karnataka, Andhra Pradesh and Tamil Nadu

- **Initiatives:**

» **Budget 2023-24:**

- To enhance productivity of extra-long staple cotton, we will adopt **a cluster based and value chain approach through Public Private Partnerships (PPP)**.

This will mean collaboration between farmers, state and industry for input supplies, extension services, and market linkages.

- **Various types of cotton grown in India:** Three broad types of cotton are generally recognized on the basis of length, strength, and structure of the fiber.

a. **Long Staple Cotton**

- Cotton with longest fiber (24 to 27 mm)
- Fine and shining quality, used for superior quality of clothes.
- About 50% of the cotton produced in the country is long stable type.

b. **Medium Staple Cotton**

- Length of the fiber (20 to 24 mm)

c. **Short staple cotton**

- Inferior cotton with less than 20 mm length. Used for making inferior cloth and fetches less price.

- **Conclusion**

- Cotton cultivation, together with cotton textile industry employs millions of people in India and therefore can play a very important role in improving the employment situation in the country.

## A) PINK BOLL WORM (PBW) RESISTANCE AGAINST BT COTTON AND CHALLENGE TO SUSTENANCE OF BT COTTON

- **Background:** Indian farmers have faced consistent loss of Bt Cotton crops due to pink bollworm attacks since the mid-2000s, when scientists found that the insect had became resistant to the genetically modified variety of cotton.

» **About PBW:**

- PBW is a worm that destroys parts of the developing cotton fruit, such as the square (flower bud) and the boll (rounded sac of seeds with cotton fibres).
- Adult worms are thin grey moths that lay eggs on buds, flowers, and bolls. The larvae hatch from the eggs and burrow into the bolls to feed on the seeds. It cuts through the lint and stains it in the process, resulting in a loss of quality

» Bt Cotton was encoded with Cry1Ac toxin which protected it from all three species of bollworms (American, spotted, and pink bollworm)

- Later, Cry2Ab gene was also added in Bt Cotton to improve protection against the American Bollworm.

» But, in 2008, scientists in India found unusual survival of Pink bollworm in Amreli district of Gujarat, indicating of Pest's resistant to Bt cotton.

- By 2014, it was clear that Pink Bollworm had become resistant to both Cry1Ac toxin as well as Cry2Ab toxin.
  - **PBW** is more dangerous than American Bollworm as it feeds from inside the bolls and thus remains elusive in the initial stages and is seen in harvest stages when the damage is already done. As it feeds from inside, no amount of pesticide help control it.
- **How was resistance developed by PBW: Key Factors:**
  - » **Early Sowing and Late Sowing:** The ideal time for sowing cotton is April 15 to May 15. But many farmers in the northern belt of Haryana, Rajasthan and Punjab have started sowing from March end or the first week of April and extend it up to June end, which is an increase from 45 days to 80 days.
    - The early sowing season coincide with the time the PBW comes out of hibernation or the diapause stage in the winter months. The pest survives in this stage between two cotton seeds or cotton crop residue.
    - The cotton plants are at bud or flowering stage, during which the PBW searches for food and begins feeding on bolls during the larval stage, which continues for 14-17 days. It eventually starts laying eggs.
    - The issue worsens for farmers who sow late. The process enables worms to access food for longer periods and increasing generations.
  - » The **longer duration of cotton varieties** in the south and central India, which lasted upto 150-160 days, helped the pest develop resistance to the genetically modified varieties.
  - » **Not Planting other varieties against Advice:** Farmers were repeatedly advised to plant indigenous, hybrid varieties of cotton alongside Bt to prevent developing resistant. "The crossbreeding of pests from different varieties of plants would have prevented developing tolerance for longer years". But farmers haven't followed the advice.
- **Cotton Crops across the North-Indian States**, Punjab, Haryana, and Rajasthan are reporting a severe pink bollworm attack and even Bt-Cotton is falling prey to the pest it was created to resist. (Oct 2023)
- **Impact:**
  - » **Damage to crops:** Damage in 2023, is the highest since 2001 - both according to government and farmers.
    - **Note:** Before 2001, the American bollworm created havoc and ruined lives of farmers.
  - » **Difficult to find laborers:** As laborers refuse to pick leftover crop as yield is too low
  - » **Difficult to find buyers** as traders refuse to buy citing poor quality.
  - » **Farmer Suicide:** In Sep 2023, Sri Ganganagar district saw first farmer suicide in over a decade. It was due to the fact that farmer had a lot of debt accumulated due to loss of cotton crop consecutively for 3 years.
  - » **Farmers giving up cotton cultivation** in the northern belt (for e.g. the production of cotton in Punjab has almost halved in the past decade).
- **Way Forward:**
  - Effective monitoring and timely adoption of a crop-window based integrated pest management (IPM) is the immediate solution.
  - Scientists are also experimenting with a technology that has proven successful in the USA. This is called PBKnot or PB Rope L.

- It involves using a 20 cm polyethylene hollow rope that is impregnated with pheromone gossyplure - chemical emitted by female moths - to attract male moth. This confuses the male moth and prevent them from reaching the actual female moth. This thus disrupts the mating process and reproductive cycle.

- **Conclusion:**

- While promoting Crop-Wise Integrated Pest Management, the GoI also needs to promote PBKnot a biotechnology tool and implement it in all cotton-producing states.

## 2) S&T: CAR-T CELL THERAPY: NEXCAR19 – INDIA’S FIRST INDIGENOUSLY DEVELOPED CAR-T CELL THERAPY

- **Why in news?**

- The CDSCO has granted market authorization for NexCAR19, India’s first indigenously developed CAR-T cell therapy, to ImmunoACT (Nov 2023)

- **Practice Questions:**

- Explain the mechanisms of CAR-T Cell therapy? Discuss the key advantages of NexCAR19 over other foreign CAR-T cell therapies [15 marks, 250 words]

- **Background: How Cancer has been treated before CAR T-Cell Therapy:**

- **Surgery** (removing the cancer)
- **Radiotherapy** (delivering ionizing radiation to the tumour)
- **Systematic Therapy** (administering medicines that act on tumour)
  - » The earliest form of systematic therapy was chemotherapy. It preferentially acts on cancer cells because of the latter’s rapid, unregulated growth and poor healing mechanisms. These drugs have modest response rate and significant side effects as they effect numerous cell types in the body.
  - » The next stage in its evolution was targeted agents a.k.a. immunotherapy: The drugs bind to specific target on the cancer or in the immune cells that help the tumour grow or spread. This method often has less side effects as the impact on non-tumour cells is limited. However, it is effective only against tumours that express these targets.

- **CAR-T Cell Therapy** has emerged as a new development in this front.

- It is a revolutionary therapy that modifies immune cells, specifically T-Cells, by turning them into potent cancer fighters known as CAR-T Cells.

▫ **How it works?**

- » In CAR T-cell therapy, the patient’s blood is drawn to harvest T-cells – immune cells that play a major role in destroying tumour cells.
- » Researchers modify these cells in the laboratory so that they express specific proteins on their surface, known as chimeric antigen receptors (CAR): they have an affinity for proteins

on the surface of tumour cells. This modification in the cellular structure allows CAR T-cells to effectively bind to the tumour and destroy it.

- » These modified cells are then infused back into the patient's blood stream after conditioning them to multiply more effectively.
- » The cells are even more specific than targeted agents and directly activate the patient's immune system against cancer, making the treatment more clinically effective. This is why they are called '**living drugs**'.
- **Advantages of CAR-T Cell therapy over other Cancer fighting methods:**
  - » It is very accurate and only targets cancer cells.
  - » It makes the treatment easier with onetime therapy (unlike several sessions of chemotherapy)
  - » It can also fight non-responsive cancer patients.
  - » It is designed to cure and provide lifelong benefits.
- **CAR T-Cell Therapy in India:**
  - The first major clinical trial showing they were effective was published almost a decade ago. The first indigenously developed therapy in India was successfully performed only in 2021.
  - **In Oct 2023, the Central Drugs Standard Control Organization (CDSCO) granted market authorization for NexCAR19, India's first indigenously developed CAR-T cell therapy, to ImmunoAct, a company incubated by IIT Bombay. This paves the way for commercial launch of this therapy in India.**
    - It is designed to target cancer cells that carry the CD19 protein. This protein acts like a flag on cancer cells, which allows CAR-T cells to recognize and attach themselves to the cancer cells and start process of elimination.
    - **Who can get the NexCAR19 therapy?**
      - » The therapy is for people with B-Cell lymphomas who didn't respond to standard treatments like chemotherapy, leading to relapse or reoccurrence of the cancer.
      - » **B-Cell leukaemia is most common among children. Are they also eligible?**
        - For now, therapy's approval is only for patients aged 15 years and above.
        - The pediatric trial phase is currently underway at the Tata Memorial Hospital, in collaboration with IIT-Bombay.
    - **Significance:**
      - » India is one of the first developing country to have its own Car-T therapy. Even some developed nations don't have their own CAR-T therapies and they import from USA or Europe.
      - » This reduces the cost of treatment to about 1/10<sup>th</sup> of the cost abroad and has the potential of boosting medical tourism in India. It costs around Rs 3.3 crores abroad while in India it will cost somewhere between 30-40 lakh rupee.
      - » Lab and animal studies have shown that **NexCAR19** lead to significantly lower drug-related toxicities. For e.g., it causes minimal damage to neurons and the central nervous system, a condition known as neurotoxicity. The therapy also leads to minimal Cytokine Storm.

Syndrome (CRS), which is characterized by inflammation and hyperinflammation in the body due to the death of a significant number of tumour cells, as CAR-T cells are designed to target and eliminate cancer cells.

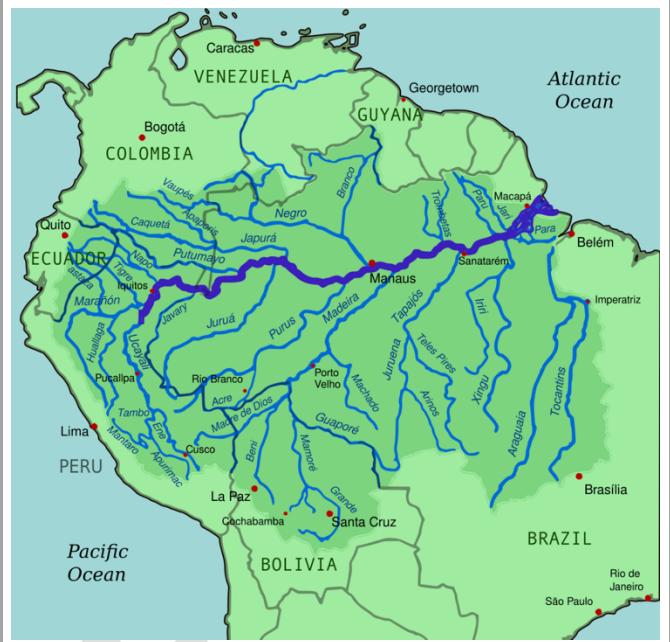
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### 3. PRELIMS FACTS:

#### 1) PLACES IN NEWS: AMAZON RIVER

##### Amazon River:

- Amazon river is the river with largest drainage system in the world in terms of volume of its flow and the area of its basin.
  - It is estimated that about 1/5th of all water that runs off Earth's surface is carried by Amazon. The immense amount of freshwater flowing into Atlantic dilutes the ocean's saltiness for more than 160 kms from shore.
- **Length:** The total length of the river - as measured from the headwaters of Ucayali-Apurimac river system in the southern Peru is atleast 6400 km which makes it slightly shorter than Nile river.
- **Source:** The source of the river is in Andes mountains and the mouth is in Atlantic Ocean.
- **Controversy:** Both length and source of the river have been debated and some claim that the river is longer than Nile.
- **Drainage Basin:** The entire area that Amazon river drains is the largest river basin in the world. It drains part of Brazil, Peru, Ecuador, Columbia, Bolivia and a small part of Venezuela, Guyana and Suriname.



- **Amazon river is not building Delta:** Most of the estimated 1.3 million tons of sediments that the amazon pours daily into the sea is transported north by coastal currents to be deposited along the coasts of Brazil and French Guiana.
- **Affects sea level in Caribbean Sea:** The Amazon river releases so much fresh water into the Atlantic sea, it alters the sea level in the Caribbean. The amazon water get picked up by Caribbean current, which carries the water to Caribbean island.

#### B) AMAZON BASIN FACING WORST DROUGHT IN 122 YEARS (OCT 2023: DTE)

- The Amazon river is currently experiencing a severe drought, which has caused the region's waterways to reach their lowest levels since the early 20th century.
- **Reasons:** Climate Change and El Nino are likely factors.
- **Impact:**
  - **Increasing wildfires** -> devastating effects on region's air quality.
  - **Biodiversity Loss:**
    - » E.g. Abnormally hot water temperatures, combined with diseases, pollution and low water levels, resulted in death of at least 100 Amazon River Dolphins (Inia geoffrensis), a species listed as EN by the IUCN.

- » Similarly, the regions caiman species (the black caiman, spectacled caiman, Cuvier's caiman and the smooth-fronted caiman) are also likely to be adversely impacted.
- » **Food shortage** because of reduced production of fruits, vegetables etc is becoming a reality.
- **Increased human animal conflict:**
  - » E.g. increased human-caiman conflicts are already occurring i.e. there is increasing alligator attacks on humans.

## 2) S&T: BIOLOGY: CHONDROCYTES PRODUCING HAEMOGLOBIN

- **Why in news?**
  - » Haemoglobin isn't used only in blood, scientists find in major discovery (Nov 2023: Source: TH)
- **About Haemoglobin and its functions**
  - » **Haemoglobin (Hb)** is a protein found in the red blood cells that carries oxygen from the lungs to the body's tissues and returns carbondioxide from the tissues back to the lungs.
  - » It is made up of four protein molecules (globulin chains) that are connected together. Each globulin chain contains an iron containing compound termed heme. Embedded within the iron compound is an iron atom which is vital for transporting oxygen and carbondioxide in our blood. This iron contained in the haemoglobin is also responsible for the red color of the blood.
- » **Normal haemoglobin levels:**
  - The normal range of haemoglobin depend on the age and, beginning in adolescence, the gender of the person.
  - **Adult male:** 14 to 18 gm/dL
  - **Adult female:** 12 to 16 gm/dL
- **Recent Updates (Nov 2023)**
  - » In a study published in ***Nature***, scientists have reported that cells that make cartilage, (the connecting tissue between bones) also make haemoglobin.
    - **Note:** The primary cells that makes cartilage is the Chondrocyte.
  - » **Scientists at Beijing Institute of Biotechnology** the chondrocytes within the growth plates of newborn mice were not only producing large amount of haemoglobin, but also that it was coalescing and forming large blobs without a membrane. The scientists called these blobs haemoglobin bodies or Hedy.
  - » **Are these haemoglobin bodies (Hedy) functional?**
    - Scientists found that removing the gene that made haemoglobin specifically in the cartilage tissue resulted in cell deaths among the chondrocytes. It was clear that Hedy was essential for chondrocytes to live.

- » **Does haemoglobin also carries oxygen in chondrocytes?**
  - Scientists found that cartilage tissue synthesized a large amount of haemoglobin to cope with hypoxic conditions.
  - They found that cartilage that didn't contain haemoglobin showed signs of hypoxic stress.

### 3) EB&CC: UNEP'S CHAMPION OF THE EARTH AWARD

- **About the Award**
  - » Instituted in 2005, it is the highest environmental honour of the UN, which is given annually and recognizes outstanding figures from the government, civil society and private sector whose actions have had a transformative, positive impact on environment.
  - » The award is given in **different categories** including Policy Leadership, Science and Innovation, Entrepreneurial Vision, Inspiration and Action, lifetime achievement etc.
- **In Oct 2023**, awards were given to:
  - » **Josefina Belmonte**, Mayor of Quezon City in the Philippines (Policy Leadership), the UK based Ellen MacArthur Foundation (Inspiration and Action), China's Blue Circle (Entrepreneurial Vision), Jose Manuel Moller of Chile (Entrepreneurial Vision) and Council for Scientific and Industrial Research (CSIR) (Science and Innovation) were declared winners "for the innovative solutions and transformative actions to tackle plastic pollution".
  - » **Belmonte** is driving environmental and social change through a raft of policies to combat climate crisis, end plastic pollution and green Quezon city.
  - » **The MacArthur Foundation** has played a leading role in mainstreaming a lifecycle approach, including for plastics.
  - » **Blue Circle** is China's largest marine plastic waste program. It uses blockchain and IoT to track and monitor the full lifecycle of plastic pollution - from collection to regeneration, remanufacturing and resale.
  - » **Jose Manuel Moller** is the founder of Algramo, a social enterprise dedicated to providing refill services that reduce plastic pollution and lower cost of everyday essentials.
  - » **South Africa's CSIR** uses cutting edge technology and multidisciplinary research to develop innovations to tackle plastic pollutions and other issues.
- **Award to PM Modi in 2019**
  - » He was selected in **leadership category**.
  - » For his championing of International Solar alliance, a global partnership that aims to scale up solar energy in 'solar-resource' rich countries and for his leadership in the fight against plastic pollution.

### 4) EB&CC: MOTHS

- **Why in news?**
  - » Study identifies 37 rare moth species in Kerala, three first time in India: ZSI (Nov 2023)

### About Moths:

- Moths are group of insects that include all members of the order Lepidoptera that are not butterflies.
- **Kingdom: Animalia; Phylum: Arthropoda; Class: Insecta; Order: Lepidoptera**
- **Note:** Lepidoptera is an order of insects that includes butterflies and moths.
- While butterflies are pollinators, moths are largely considered crop pests. Though some moths pollinate the flowers that bloom at night.

### Significance of Moths:

- They perform some **essential ecosystem services**, including pollination, nutrient cycling and providing prey to birds and bats.
- Moths are nocturnal and potential indicators of ecosystem health and changes. Therefore, in agro-ecosystem, moth abundance is positively related to abundance of crops.

### Problems caused by Moths:

- Several moths are considered pests.



### Important Moths:

- **Silkworm moth**, (*Bombyx mori*) in its caterpillar stage is used for silk production (sericulture) for thousands of years. The species has undergone complete domestication with the species no longer being found in the wild.

- **About the Zoological Survey of India's study on Moths in Kerala:**
  - The study was conducted through a two - year long survey from 2018.
  - **Key Findings:**
    - » The study identified 37 new moth species including **3 new species discovered first time in India**. These were Aeolarcha eaphthalma, Pharambara micacealis, and Tirathaba leucotehars.
    - » There has been a decline in the diversity due to excessive use of pesticides, radiation and air pollution.

## 5) EB&CC: BIODIVERSITY: CANDOLLEOMYCES ALBOSQUAMOSUS: NEW MUSHROOM SPECIES FROM WESTERN GHATS (OCT 2023: TH)

The mushroom sports a honey-yellow cap, white stem, and grows to 58 cm.

Its habitat includes dead logs or bamboo culms in the natural forest.

**Significance:** The discovery of the new species of genus Candolleomyces in India is special given that there are only 35 species in this genus worldwide.





# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### NOV 2023: BOOKLET-2

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## 1) SUBCATEGORIZATION OF OBCS

- **Why in news?**
  - » OBC and subcategories: Why this has been a hot-button issue for long (Oct 2023: Source: IE)
- **Introduction:**
  - » **OBCs**, the beneficiaries of 27% reservation in central government jobs, are not a monolith. Within the OBC are hundreds of castes, all at different level of marginalization.
  - » A perception has developed that some dominant groups in OBCs are reaping the benefits and advantages of reservation whereas the very marginalized groups are not able to reap the benefits. Therefore, a demand for subcategorization and sub-reservation within the OBC community emerges.
    - It should be noted that some states like Andhra Pradesh, Jharkhand and WB etc. already have such kind of subcategorization.
- **Past Commissions and their recommendations about Subcategorization:**
  - i. **First OBC Commission** headed by Kaka Kalelkar was constituted in 1953 during the time of Jawaharlal Nehru's government. It submitted its report in 1955.
    - » This commission prepared a list of **2,399 backward castes** in the country and categorized **837 of them as "most backward"**.
    - » This report was never discussed in the Parliament and never implemented.
  - ii. **Second OBC Commission: BP Mandal Commission**: It was appointed by 1979 Morarji Desai's Janta government, but its implementation was announced only in 1990 by VP Singh Government.
    - » Here no subcategorization was recognized; But one of the members, L R Naik had said in his dissent that OBCs should be split into intermediate backward classes and depressed backward classes.
  - iii. **In Feb 2014, the NCBC examined the issue of subcategorization** which in its report suggested that OBCs should be subcategorized into Extremely Backward Classes, More Backward Classes and Backward Classes. This recommendation was not implemented.
- **In Oct 2017 a new Commission for Subcategorization of OBCs was constituted** under the chairpersonship of **Justice G Rohini**, a retired judge of Delhi High Court.
  - » Its original tenure of 12 weeks was extended 14 times till it submitted its report on 31st July 2023. This report hasn't been made public yet.
  - » **Terms of Reference**: Originally, it had three terms of reference.
    - Examining the extent of inequitable distribution of benefit of reservation among different castes of OBCs in the Central List.
    - Develop a scientific criteria/mechanisms/parameters for subcategorization.
    - Identify respective castes/communities/sub-castes in the central OBC list and classify them into respective sub-categories.

- A fourth, was added later: To study the various entries in the Central List of OBCs and recommend correction of any repetitions, ambiguities, inconsistencies and errors of spelling or transcription.
  
- Note: Article 340 of the Indian Constitution provides that the President may by order appoint a commission to investigate the conditions of backward classes.
  
- Findings So far:
  - » In 2018, the Commission analysed the data of 1.3 lakh central jobs given under OBC quota over the preceding five years and OBC admissions to central higher education institutions, including universities, IITs, NITs, IIMs and AIIMS, over the preceding three years. The findings are:
    - 97% of all jobs and educational seats have gone to just 25% of all sub-castes classified as OBCs;
    - 983 OBC communities — 37% of the total — have zero representation in jobs and educational institutions;
    - 994 OBC sub-castes have a total representation of only 2.68% in recruitment and admissions
  
  - » What is the current level of OBC recruitment in Central Jobs:
    - As per the 2018-19 annual report of the Department of Personnel and Training, OBC representation is 13.01% in group-A central government services, 14.78% in group-B, 22.65% in group-C (excluding safai karmacharis) and 14.46% in group-C (safai karmacharis).
  
    - RTI information tells us that there was not a single professor or associate professor appointed under OBC quota in Central Universities.
      - The data showed that 95.2% of the professors, 92.9% of associate professors and 66.27% of assistant professors were from the general category (which may also include SCs, STs and OBCs who had not availed the quota). At assistant professor level, representation of OBCs was just 14.38%
  
- Need of Sub-categorization
  - » Equitable distribution of benefits: A perception that only a few affluent communities among the over 2,600 included in the Central List of OBCs have secured a major part of 27% reservation.
  - » Focus Policy implementation: Various government policies can be tailored specifically to meet the requirements of the most vulnerable groups.
  - » NCBC had recommended subcategorization in 2015
  
- Other Impacts of Subcategorization

- » It will be a significant addition to the Mandal Commission-based OBC system.
  - » **Political Implication:** It is being seen as an attempt by government to reach out to the most backward classes.
- **Hurdles that subcategorization may face:**
- » It may be opposed by dominant OBC groups and regional parties dominated by dominant OBC groups.
  - » **Subcategorization with OBC Enumeration** would be a challenge as caste based population data is not publicly available and central government has shown reluctance towards the idea of caste census.
  - » Subcategorization would make proper allotment of seats to each reserved group in the new roster system a very difficult task.
- **Way forward:** Subcategorization of OBCs would be successful if the following conditions are met:
- » **Enumerate the OBC population** for objective sub-categorization.
    - Make the recommendations of Justice G Rohini committee public and let it be debated by various stakeholders.
    - Ensure transparency in criteria for subcategorization avoiding ambiguity in classification process.
  - » **Sensitize OBC communities** (including the dominant OBC communities) to make them aware of the need of sub-categorization.
  - » **Periodic review of subcategorization** to keep the list updated as per the changing socio-economic conditions of various groups.
  - » **Ensure effective implementation of OBC reservation** at all levels and take steps against the institutions not doing so.
  - » **Improve the roster system** to make sure SC/ST/OBC get the number of seats they are entitled to.
  - » **Establish legal and regulatory framework** which ensures effective implementation of subcategorization and makes available fast track grievance redressal

## 1) AGRICULTURE: PULSE PRODUCTION IN INDIA

- Example Questions:
  - » Discuss the significance of pulse production in India's agriculture system. Analyze the trend in the production of pulses in India and highlight the factors influencing these trends [15 marks, 250 words]
  - » Discuss the key strategies that can increase domestic production of pulses. [10 marks, 150 words]
  - » Examine the role of government policies and initiatives in the pattern of pulse production in India [10 marks, 250 words]
- Intro
  - » Pulses are the important source of proteins, vitamins and minerals and are popularly known as "Poor man's meat".
- Advantages Positives about Pulses
  - » **Nutritional Security:** In a country like India, where many people are poor and vegetarian, pulses are an important and affordable source of protein.
  - » **Suitable for Marginal Environment:** Drought resistant and deep rooting species of pulses can supply ground water to companion crops when planted in inter cropping pattern.
    - Locally adapted pulse varieties can enhance production system in dry environments.
  - » **Increase fertility of Land:** The leguminous plants of pulse also help in nitrogen fixation and thus ensuring higher fertility of soil.
  - » **Low food wastage footprint:** Pulses can be stored for longer period without losing their nutritional value and minimizing loss.
- Various pulses and production in India.
  - » India is the **largest producer** (25% of global production), **consumer** (27% of world consumption) and **importer (14%)** of pulses in the world.
    - They account for 20% of India's total area under cultivation and provide 7-10% of the total food grains in the country.
  - » **The overall pulse production in India** has gone up from 8.4 million tonnes in 1950-51 to 27 million tonnes in 2022-23.
    - In fact, in the last decade, India's production has increased by 50% (from 18 million tonnes to 27 million tonnes)
    - But, pulse production has not increased in step with the population growth, per capita availability of pulses have declined from 22.1 kg per person in 1951 to 16.4 kg per person in 2022.
    - Though there is surplus production of Chana, the imperfect substitution among pulses and limited international availability put pressure on the prices of some pulses.
  - » **Main Crops:**

- **Bengal Gram** (Desi Chick Pea/ Desi Channa), **Pigeon Peas** (Arhar/ Toor/ Red Gram), **Green Beans** (Moong Beans), **Chick Peas** (Kabuli Chana), **Black Matpe** (Urad / Mah / Black Gram), **Red Kidney Beans** (Rajma), **Black eyed Peas** (Lobiya), **Lentils** (Masoor), **White Peas** (Matar) are major pulses grown and consumed in India.
  - » **Rabi Crops (60% Production Share)**: Gram, Peas, lentil (masur), and black gram
  - » **Kharif Crops (40% Production Share)**: Arhar(tur), Moong and Urad etc.
  - » **Gram** (with 50% share) is the most dominant pulse produced and consumed in India. it is followed by **Tur/Arhar (15-20%)** and **Urad & Moong (8-10%)**.
    - **Note:** Experts say that Tur's consumption in meals as dal is much more than that of Chana. Chana is used more on account of its use in packaged food.
  - » **Gram** is the crop of subtropical areas. It is a rainfed crop.
  - » **Major Pulse Producing States**:
    - Madhya Pradesh, Maharashtra, Rajasthan, UP, and Karnataka.
- Primary reasons for domestic shortage of pulses and reduction in per capita availability of Pulses in India are:
- A. The increase in area under cultivation, production and productivity of pulses has been extremely slow.
    - » The production of pulses grew only by 45% from 1951 to 2008, while wheat production increased by 320% and rice by 230 percent. Therefore, for pulses India has been import dependent since 1981.
  - B. Low Yield, increased irrigation facilities and Blue Bulls trouble
    - » The yield of wheat is high (around 3,000 - 4,000 kg per ha) as against 750 Kg/ha of pulses.
      - In countries like France (4219 kg/ha), Canada (2000 kg/ha), USA (1882 kg/ha), China (1596 kg/ha) the per unit yield is much higher than that of India.
      - Lower yield is due to poor crop management, prevailing environmental conditions and better irrigation facilities.
    - » Hence with improve irrigation facilities farmers in north India (specially Uttar Pradesh) have slowly moved away from pulses.
    - » Cattles and blue bulls also preferred pulse crops leading to higher damages for pulse farmers.
  - C. Open ended procurement of wheat and rice under MSP -> Lack of assured price for pulse
  - D. Very less R&D on pulses globally (due to very less consumption in advanced western countries)
- Steps which have been taken to increase pulse production.
- A. Measures to incentivize Pulse Production under National Food Security Mission (NFSM), Minimum Support Price Programs and by Increase production.
    - For e.g., PM AASHA's prize support scheme specifically focused on increasing the procurement of pulses on MSP.
  - B. MoA&FW have also formulated a Special Kharif Strategy which was implemented during Kharif 2021:
    - Here, HYVs of seeds available with Central Seed Agencies or in the States were distributed free of cost to increase area under pule production through intercropping and sole crop.

C. **Crop Diversification Program** (a sub scheme of RKVY) is being implemented in original green revolution states viz. Punjab, Haryana, and in Western Uttar Pradesh to diversify paddy areas towards less water requiring crops like oil seeds, pulses, coarse cereals, agro forestry etc.

- **Way Forward:**

» **Augmenting domestic production**

- **Policy reforms** like higher MSP for pulses and inclusion of pulses under the PDS system.
- **Improved Agri-Inputs for Pulses:**
  - **Increased R&D** to focus on developing new HVYs which are adapted to drought, climate change etc.
  - **Promoting** cultivation of pulses in well irrigated areas and ensuring better irrigation facilities in existing pulse growing areas.
  - **Ensure timely availability of chemical fertilizers** which has remained a problem for this sector.
    - Similarly, inadequate availability of Gypsum or pyrites as a cheap source of sulphur remains a serious impediment in many states.
  - **Prioritizing the crop insurance scheme in pulse growing regions and its proper implementation**
- **Promoting Scientific Cultivation:** Currently, improper sowing time, low seed rate, defective sowing methods, insufficient irrigation etc. are the major agronomic constraints.

» **Focus on solution for blue bulls' trouble.**

- Biodiversity protection and conservation in forest areas could ensure enough availability of food for blue bulls in the forest areas and reduce their infiltration in cultivated areas.

» **Improving technology of Dal Mills -> Reduce wastage.**

- Most of the dal mills have outdated technologies, resulting in excessive loss of pulses in the form of broken or powdered grains.

» **Distribution channels** also have to be made more efficient.

» **Dealing with fluctuation of prices** - Increased buffer stocks and diversifying imports.

## 2) DISASTER MANAGEMENT: DAM SAFETY

- **Why in news?**

- » In Oct 2023, Sikkim's highest Dam (Teesta-III Dam at Chungthang) was washed away after an GLOF which raised doubts about hydropower projects being developed in the country (Oct 2023)
  - Various reports have since revealed that there were no EWS, no risk assessment or preventive measures in place as required under the 2021 Dam Safety Act.

- **Example Questions**

- » Discuss the key provisions of the Dam Safety Act 2021. How far does it go in ensuring structural and operational safety of dams [12.5 marks, 200 words]
- » What are the key concerns related to Dam Safety in India? How far will the Dam Safety Act, 2021 be able to resolve these concerns? [10 marks, 150 words]

- **Introduction**

- » Dams are playing a very important role in the development of India. They not only supply water for irrigation, but also contribute in flood control and Energy generation (around 17% of India's total electricity).
- » In terms of **number of Dams**, India stands third in the world with more than 6,000 large dams in operation and another 400+ large dams under construction. Further, India has thousands of medium and small dams.
- However, a **poorly maintained and ill-operated dam** can become a source of threat not only for human life and infrastructure, but also for the environment. Therefore, there has been a long felt need of a **uniform law and administrative structure** in the country for the purpose of dam safety.

- **Key concerns associated with Dam Safety in India**

- » **Very Old Dams** - around 4% (227) of large dams are more than 100 years old and 80% are more than 25 years old.
- » Many of these dams are located in earthquake prone zones.
- » India has faced 36 major dam failure in the past, the worst one of Machchhu Dam (Gujarat) in 1979 in which about 2000 people had died.
- » There are **varying degree of inadequacies** in meeting the current standards of dam health and safety.
  - **Poor Implementation** of the existing safety provisions
  - A report by CAG has found that
    - The structural strength of 348 large dams are suspect and they have not been inspected for over a decade.
  - Similarly, the **world bank report on Dam Rehabilitation and Improvement Project (DRIP)** indicates that the implementation of the program has been moderately unsatisfactorily.

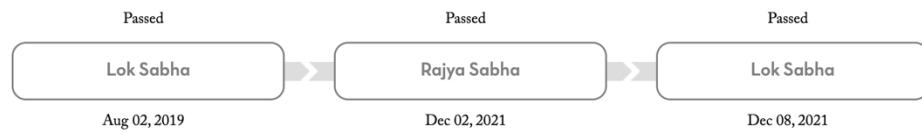
- **Institutional Framework/Programs/Schemes dealing with dam safety in India**

- » **The Central Water Commission**, Ministry of Jal Shakti through the National Committee on Dam Safety (NCDS), NDSO, SDSCO etc has been making constant endeavours in the direction of Dam Safety.
- » **Dam Rehabilitation and Improvement Project (DRIP)** is being implemented by Ministry of Jal Shakti with assistance from World Bank.
  - The main objectives of DRIP are:
    - TO improve the safety performance of selected existing dams (223 dams across 7 states) in a sustainable manner
    - To strengthen the dam safety institutional set up in participating states as well as at central level.
  - The seven DRIP states are - Uttarakhand, Madhya Pradesh, Jharkhand, Odisha, Karnataka, Kerala and TN.
- » **The Dam Health & Rehabilitation Monitoring Application (DHARMA)**
  - It is a webtool/app which is focused on digitizing dam related data effectively. It will help in easy identification of vulnerable dams and ensure need based rehabilitation.

- » Ministry of Power and DRDO have signed an MoU for vulnerable Hydro Projects/ Power Stations in Hilly Areas

- Under this they would work jointly together towards developing suitable mitigation measures against avalanches, landslides, glaciers, glacial lakes, and other geo-hazards
- For vulnerable projects in hilly areas, expertise of DRDO will be used for developing comprehensive EWS.

- **Dam Safety Act, 2021**



- » The act is aimed at helping states and UTs to adopt uniform safety procedure and thus ensure safety of the dams. It also gives statutory backing to various dam safety institutions and provides for strict punishment in case of the violation of the law.
- » It provides for surveillance, inspection, and maintenance of all specified dams across the country.
  - These dams are with height more than 15 meters, or height between 10 meters to 15 meters but with certain design and structural principle.
  - The act establishes a robust Institutional Framework for Dam Safety:
    - It sets up **two national bodies**
      - i. **The National Committee on DAM SAFETY** which would evolve policies and recommend regulations regarding dam safety.
      - ii. **The National Dam Safety Authority** which would implement policies of the National Committee, provide technical assistance to State Dam Safety Organizations (SDSO) and resolve matters (dispute resolution) between SDSOs of states or between SDSOs and Dam Owners.
- » The law also sets up **two state bodies**
  - i. **State Committee on Dame Safety** which will review work of SDSO, order Dam Safety Investigation, recommend dam safety measures and review the progress of such measures.
  - ii. **State Dam Safety Organization (SDSO)** will be responsible for surveillance, inspection, monitoring, operation, maintenance and investigation of dams.
- » **Jurisdiction over dams**
  - All specified dams will fall under jurisdiction of the SDSO of the state in which dam is situated.
  - For dams owned by CPSU or which extends in two or more states or when a dam owned by one state is situated in other state, NDSA will have the jurisdiction and will play the role of SDSO.
- » **What are states required to do?**

- Provisions require states to classify dams based on hazard risk, conduct regular inspections, create emergency action plan, institute emergency flood warning systems, undertake safety reviews and period risk assessment studies.
  - » **Duties and Functions of DAM owners** ( sufficient funds, trained manpower, dam safety units to conduct regular inspections, mandatory presence of engineers during floods and emergency, install emergency flood warning system; carry out risk assessment at regular intervals)
  - » **Comprehensive DAM Safety Evaluation (CSE)**
    - The act provides for comprehensive safety evaluation by independent panel of experts at regular intervals.
  - » **Offences and Penalties** for violation of provisions
- **Analysis of the act : Key challenges/Limitations**
- » **Jurisdiction of Parliament on the issue** (Entry 17 of the State List read with Entry 56 of the Union List, gives powers to state to make laws on water supply, irrigation and canals, drainage and embankments, storage etc for intra state rivers) .
  - » The **functions** of the NCDS, NDSA, SCDS are listed in the schedule of the act which can be modified by government through notification. Experts have raised concerns over this kind of overwhelming powers with central government.
  - » **States Raising Concerns** regarding NDSA having jurisdiction over dams owned by one state but situated in others. Some states feel that this takes away rights of states over their dams.
    - Note: TN own dams in the state of Kerala (in Mullaperiyar, Parambikulam, Tunakadavu, and Peruvanipallam)
  - » **States lack technical capability** to really implement the act in terms of number of trained personnel's, engineers etc.
    - The Sikkim GLOF reveals poor compliance at all levels of dam safety, from the dam's design to the spillway capacity.
  - » **Environment Impact ignored**
    - The act does not contain any norms which relates to environmental impact in the upstream and downstream of the rivers.
  - » **Lack of focus on operational safety** (like rate of filling or rate of water release) could lead to continuance of cases of Dam induced floods (e.g. Kerala floods, 2018)
- **Other problems related to Dam**
- » **Lack of coordination between states** leads to faulty management of dams.
    - For e.g., the recent floods in Odisha was caused by faulty management of Hirakud Dam. One of the reasons for it was lack of information from Chhattisgarh to Odisha regarding the flow of water.
- **Way forward**
- » **Set up the institutional framework envisaged under the law**
    - **Dam Safety Policy** should be finalized quickly to act as a guiding principle towards protection of Dams.
  - » **Promote More transparency:**

- Dam Safety is a public purpose and thus everything about dam safety, functions of institutions, their reports, decision minutes and agendas, everything should be promptly available to public.
  - » **Human Resource development:**
    - We will need huge human resource for ensuring that trained people man dams, engineers are available for inspection and monitoring, emergency action plan etc.
  - » **Land use plans** should have dam safety issues integrated in it.
  - » **Operational Safety and Environment Impact** needs to be better integrated in the act and any future policies.
  - » **Increased coordination between states:**
    - E.g. of the United States web-based integrated risk management tool called Dam Sector Analysis tool. The tool was developed using variables from dam failure models and decision support systems, which enables the software to project downstream risk in the case of a dam failure.
- **Conclusion:**
- » India's first prime minister, Pandit Jawaharlal Nehru, had referred to dams as the 'temples of modern India'. These temples would remain a boon, only if all the stakeholders work towards eliminating risks associated with Dam Safety.



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### NOV 2023: BOOKLET-3

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## 1. GS-2

### 1) POLITY AND CONSTITUTION: PARLIAMENTARY PRIVILEGES

- **Why in news recently?**
  - » Parliamentary Privileges in case of defamation justified or not? [Nov 2023, Source: LiveLaw]
- **Introduction**
  - » Parliamentary privilege refers to **rights and immunities enjoyed by Parliament as an institution, MPs in their individual capacity and various committees**. These privileges ensure effective working of the Parliament and ensure authority, dignity and honour of the Parliament and its members.
  - » The Indian Constitution specifies the powers and privileges of Parliament in **Article 105** and those of State legislatures in **Article 194**. This includes
    - i. **Freedom of Speech** in Parliament subject to other provisions of the Constitution and standing order of the house (Article 105(1), 194(1)).
    - ii. **Immunity for all speeches and votes** in the parliament or any committee from **judicial scrutiny** (Article 105(2), 194(2))
      - **Immunity for persons publishing any report, paper, votes or proceeding by Parliament or under the authority of parliament.**
    - iii. **Powers and privileges and immunities of each house of the Parliament, and of the members and the committee of each house, shall be such as may from time to time be defined by Parliament by law.** (105(3), 194(3))
      - Until then it would have the same privilege as the British Parliament had in 1950.
        - This was amended by the **44th Constitutional Amendment Act**. It provided that other privileges of each house of Parliament, its committees and its members are to be those which they had on the date of commencement (i.e. 20th June 1979), until defined by Parliament.
        - Till now, parliament or state legislature have not passed any law to codify their privileges.
    - iv. The above immunities are also applicable to persons who by virtue of this constitution has the **right to speak in, or otherwise to take part in the proceedings of**, a House of Parliament or any committee thereof as they apply in relation to members of Parliament. (104(4), 194(4))
  - » **Note**
    - Article 194 is an **exact reproduction of Article 105** and it deals with the state legislatures and their members and committees.
  - **Two Types of Parliamentary Privileges**
    1. **Collective Privilege:**
      - The privileges, immunities **enjoyed by each house of the parliament collectively**
        - Right to publish its reports, debates and proceedings
        - Excluding strangers from its proceedings
        - Holding secret sittings

- To Punish members as well as outsiders for breach of its privileges or its contempt by reprimand, admonition or imprisonment (also suspension or expulsion, in case of members)
- The Courts are prohibited to enquire into proceedings of a House or its committees

## 2. Individual Privilege:

- In Civil cases, no arrest during the session of the house of 40 days before the beginning of the session and 40 days after end of the session
- **Freedom of Speech in Parliament.** No proceeding can be initiated against them in any court for anything said or any vote given in Parliament or its committees.
  - This freedom is subject to the provisions of the Constitution and to the rules and standing orders regulating the procedure of the Parliament.
- They are exempted from jury service.

### - Need of Parliamentary Privileges

- » Enable each house of the legislature to discharge function properly and free of any pressure.
- » The members of highest deliberative body in the country and in each state should have freedom of speech to ensure all views (no matter how small, fringe or different) are being discussed.
- » Immunity from Judicial proceedings ensure non-interference by Judiciary in the parliamentary proceedings and separation of powers.
  - It further enhances the quality of deliberation in the house without worrying about Judicial interference.
- » These privileges ensure that undue influence, pressure or coercion is not brought on the legislature in the course of its functioning.

### - What constitutes a breach of privilege?

- » A breach of privilege is a violation of any of the privilege of MPs/Parliament.
  - Among other things, any action 'casting reflections' on MPs, parliament or its committees; could be considered breach of privilege.
- » **No clearly laid out rules** on what constitutes breach of privilege and what punishment it entails.
  - This has led to a very high weightage being given to view of the members of the house.

### - Sources of the Parliamentary Privilege

- » **Not codified yet**
- » They are based on following sources:
  1. Constitutional provisions
  2. Various laws made by Parliament
  3. Rules of Both the Houses
  4. Parliamentary Conventions
  5. Judicial Interpretations

### - Cases of breach of privileges?

- » Several such cases.
  - In 1967, two people were held to be in contempt of Rajya Sabha, for having thrown leaflets from the visitors' gallery.

- In 1983, one person was held in breach for shouting slogans and throwing chappals from the visitor's gallery.
  - Sentenced to simple imprisonment
- » Similarly there are many cases on breach of privilege of state assemblies.
  - In June 2017, Karnataka Assembly speaker ordered the imprisonment of two journalists for a year based on recommendations in two separate reports of its privilege committee.

- **Criticism of Parliamentary Privileges:**

- » **Against Freedom of Speech**
    - Because of no codification it sometimes can be misused
    - For countering genuine criticism by individuals or media
  - » **Unlimited Powers:** No codification of provisions through a law has also led to parliamentarians getting unfettered powers to deal with cases.
  - » **Conflict of Interest:** It allows politicians to act as judge in their own cause, raising concerns of conflict of interest and violating basic fair trial guarantee.
  - » **Used for non-essential reasons:** Further, breach of privilege is invoked for the ostensible reason of protecting the image of the house on the whole or its individual members.
    - It should only be used when the functioning of the house is being obstructed.
  - » **Right to life and personal liberty violated**
    - Legislatures power to punish someone with imprisonment is questionable.
- Violation of the principle of separation of power** between legislature, executive and judiciary

- **Parliamentary Privilege vs Fundamental Rights**

- » In **MSM Sharma case 1959**, the Constitutional bench of the Supreme Court held that in case of conflict between fundamental right under Article 19(1)(a) and a privilege under Article 194(3) the latter would prevail.
- » In **Raja Ram Pal v Hon'ble Speaker, Lok Sabha and Ors. (2007)**, a constitutional bench of the Supreme court held that FR under article 20 and 21 could prevail over privileges under Article 105 and 194.

- **Supreme Court's jurisdiction**

- » Remain somewhat unclear
- » No rationale for Supreme court holding some FR superior and some subservient to parliamentary privileges.

- **Aug 2022 - Chairman of Rajya Sabha - Venkaiah Naidu said that MPs don't enjoy any immunity from being arrested in a criminal case during session or otherwise.**

- **Way Forward to prevent misuse**

- » **Codification** of privileges is the need of the hour -> Clearly define what privileges are:
  - Framers of constitution also envisaged codification of privileges through law.
- » Breach of privilege should be applied when there is a real obstruction of functioning of a house, and not in a way that sets legislator above ordinary comment and criticism.
- » Restrict the use of privilege to the proceeding of the legislature.
  - Members who are falsely accused of impropriety can use the defamation route through courts.

- » Another issue that has to be resolved is that whether the House should have the power to sentence a person to a jail term.
  - While the British parliament continues to have such powers, it has not used it since 1880.
  - Considering the Constitutional Bench's judgement in Raja Ram Pal case in 2007 where it said that privileges could be subordinate to Article 20 and 21, the legislative house shouldn't have the right to punish with imprisonment as it affects the Right to Life and Personal Liberty under Article 21.
- » Courts should also revisit their earlier judgment and find the right balance between Fundamental Rights of citizens and privilege of the legislature.
  - Considering that the privileges is subject to other provision of constitution, interpreting FR to be subordinate to parliamentary privileges can be reconsidered.

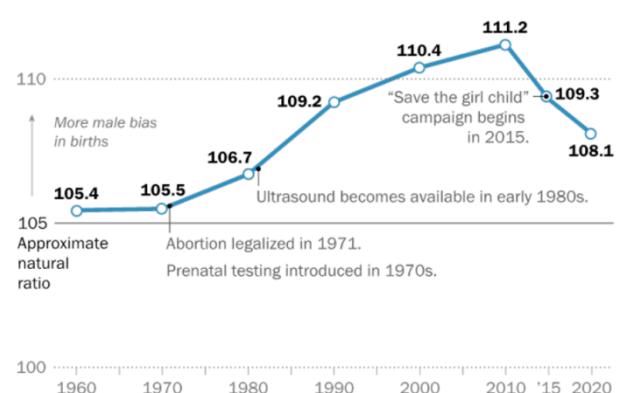
## 2) SOCIAL JUSTICE: SEX RATIO

- Why in news?
  - » International Day of the Girl Child was observed on 11th October with the theme 'Invest in Girls' Rights: Our Leadership, Our Well Being' (Oct 2023)
- Example Questions:
  - » Examine the effectiveness of government initiatives like Beti Bachao Beti Padhao in improving sex ratio in India. What are the key challenges in the implementation of these initiatives [15 marks, 250 words]
- Introduction:
  - » Gender Equality is a cornerstone of comprehensive socio-economic development. It reflects a society's commitment to fairness and inclusivity. The sex ratio of a country serves as a crucial yardstick to measure gender equality. It directly mirrors the status and well-being of women, serving as a barometer of societal attitudes towards women.
- Bad Situation of Sex Ratio in the past:
  - » As per the 2011 census, India's sex ratio was 940 females for every 1,000 males.
  - » Child Sex Ratio (CSR) was even more alarming at 914 (or 111 males for every 100 females) in 2011.
    - At least 9 million female births went "missing" between 2000 and 2019 because of female selecting abortions (as per a Pew analysis of various NFHS data and census data)
- Factors which led to poor sex Ratio:
  - » Social Factors: Patriarchal Social Norms - Son Preference (& Son-Meta Preference)
    1. **Patrilocality** (women having to move to husband's house after marriage)
    2. **Patrilineality** (property passing on to sons rather than daughters)
    3. **Dowry** (which leads to extra cost of having girls)
    4. **Old age support from sons**
    5. **Various rituals** performed by sons like last rites (lighting the funeral pyre and scattering their ashes).
  - » Technological Advancements:

- Beginning of use of pre-natal diagnostic tests and introduction of ultrasound technology in 1980s made it easy to determine sex of an unborn child.
  - Legalization of abortion (MTP Act, 1971) made situation worse.
- » **Administrative failure** - Poor implementation of laws/schemes/programs
- » **Lack of political will** - Flagship initiatives like BBBP were either missing or enough resources for the same were not allocated.
- **Negative Social Impact:**
  - » Societies with high rates of sex-selective abortions typically suffer within a couple of decades from a shortage of marriageable women, and a surplus of men seeking brides. This "marriage squeeze" can trigger a variety of social problems, such as increase in sex related violence, trafficking of women etc.
- **Steps taken to improve Child Sex Ratio:**
  - » **About Beti Bachao Beti Padhao (BBBP)**
    - Launched in 2015, it is a comprehensive program to address the declining **Child Sex Ratio (CSR)** and related issues to empowerment of women over a life-cycle continuum.
  - » **Sukanya Samruddhi Account Scheme**
    - Under these accounts of girls could be opened from the time of their birth till their attaining the age of 10. The account can be opened with an amount of Rs 1000 and in a financial year, a sum of up to Rs. 1.5 Lakh can be deposited in it. Investments made under the scheme will also be eligible for exemption under 80C of Income Tax Act, 1961.
  - » **Observation of National Girl Child Day on 24th Jan** since 2008 by MoW&CD. It focuses on increasing awareness; ensuring human rights for girls; increasing awareness about gender inequality; and addressing girl child issues.
  - » **Pre-Conception and Pre-Natal Diagnostic Techniques (PCPNDT) Act, 1994** prohibits sex selective practices.
- **Improvement in Situation:**
  - » As per the NFHS-5 (2019-21) the CSR at Birth is at 929 (or 108 males for every 100 females). It is a glimmer of hope and suggests that Indian families are less likely to use abortions to ensure birth of sons rather than daughters.
- **But this isn't good enough:**
  - » The Child Ratio at Birth (CRB), at 929 as per NFHS-5, is below the WHO's natural ratio at birth (952). This indicates that despite advancements, India is yet to reach the desired gender parity.

**India's sex ratio at birth has been moving toward balance in recent years**

*Sex ratio at birth, or the number of male births per 100 female births*  
115



- **Way Forward:**

» **Improving Implementation of Schemes BBBP:**

- As per the Parliamentary Committee led by Heena Vijaykumar Gavit:
  - Around 80% money spent on BBBP have been spent on media campaigns and advocacy alone.
    - Huge spending on national level media campaigns for the scheme was a clear violation of the INR 50 lakh provision earmarked for each district under the scheme for six different components consisting of innovation and awareness building, intersectoral consultation and capacity building, monitoring evaluation, and interventions of health and education.
    - Over all utilization of funds was below par. Only 25% of the allocated budget was utilized.
  - A 2017 CAG report also highlighted various issues with BBBP including infrequent meetings, underutilization of funds and non-compliance with the guidelines.
  - Beti Padhao component is also facing challenges due to dual burden of care responsibilities; unavailability of clean functioning toilets; lack of commuting options etc.

» **Comprehensive Strategies for gender equality should encompass a multifaceted approach:**

- **Focus on districts and prioritize cities** with low sex ratios.
- **Promoting Awareness** - through discussion, conference, and debates
- **Engage Local Communities** in the development and growth of girl children - it will foster a sense of collective responsibility and action.
- **Empower local governing bodies and community groups** to act as catalyst for social change at the grassroot level ensuring sustainable progress, as they can tailor strategies to their community's unique needs, making the efforts more effective and relevant.

» **Focus on comprehensive women empowerment:**

- **Legal Reforms** - Ensuring gender sensitive legislations, promoting economic empowerment, and ensuring property and inheritance rights for women.
- **Educational Reforms** - Implementing gender sensitive education policies. This includes curricula that challenges stereotypes, fosters safe and inclusive school environments, and providing scholarships and incentives to encourage girls' participation in education.
- **Creating Public Awareness and cultural change**: Regulating media and advertising, engaging communities to challenge harmful practices and involving men and boys as allies in the fight for gender equality can drive societal change.

- **Conclusion1:**

- » The above initiatives are integral to broader national efforts to promote gender equality and empower women and girls, setting a course for a more inclusive and equitable society where all genders have equal opportunities and rights.

- **Conclusion1:**

- » Pursuing gender equality in India is an ongoing journey marked by progress and persistent challenges that need to be continuously addressed.

### 3) SOCIAL JUSTICE: PVTGS

- **Why in news?**
  - » PM Modi launches Rs 24,000-crores scheme for vulnerable tribal groups (Nov 2023)
- **Example Questions**
  1. Who are Particularly Vulnerable Tribal Groups (PVTGs)? Throw some light on the socio-economic condition of these groups.
  2. Discuss the main limitations of the government schemes focusing on PVTGs. Suggest a few remedies to deal with these limitations.
- **Introduction**
  - » **Particularly vulnerable tribal group (PVTG)** (earlier: Primitive tribal group) is a **government of India classification** created with the purpose of enabling improvement in the conditions of certain communities with particularly low development indices
  - » The **Dhebar Commission (1960-1961)** stated that within Scheduled Tribes there existed an inequality in the rate of development. In 1973, during the fourth Five Year Plan a sub-category was created within Scheduled Tribes to identify groups that considered being at a lower level of development.
  - » Till now, 75 tribal groups have been categorized by Ministry of Home Affairs as PVTGs. They reside in 18 states and UT of A&N Islands.
- These groups are **characterized by**
  - » A pre-agriculture level of technology
  - » Stagnant and declining population
  - » Extremely low literacy
  - » Subsistence level of economy
- **Government Initiatives:**
  - i. **PM-PVTG Development Mission**
    - First announced in the 2023-24 budget, the scheme was launched by PM Modi in Nov 2023 from Jharkhand's Khunti district on the occasion of tribal icon Birsa Munda's birth anniversary and the third Janjatiya Gaurav Divas.
    - It has a budgetary allocation of Rs 24,000 crores and is dedicated to the holistic development of all 75 PVTGs living in 22,000+ villages of 18 states and UTs..
    - The **objective** of the scheme is to improve the socio-economic conditions of PVTGs by providing basic facilities like road and telecom connectivity, electricity, housing, clean water, sanitation, improved education, healthcare, nutrition, and sustainable livelihood to PVTG families and habitations.
    - This is an umbrella initiative under which 9 ministries will implement 11 interventions, including PMGSY, PMAY(G), Jal Jeevan Yojna etc.
      - **Note:** MoTA is the nodal ministry for overall policy planning and coordination.
  - ii. **Scheme for Development of PVTGs**
    - It is a central sector scheme launched in 2008 by MoTA exclusively for PVTGs.
    - **Flexibility to state:** Under the scheme, Conservation cum development (CCD)/Annual Plans are to be prepared by each state/UT for their PVTGs based on their need

assessment, which are then appraised and approved by the Project Appraisal committee of the Tribal Ministry.

- Activities for development are taken in the fields of education, health, livelihood and skill development, agriculture development, housing & habitat, conservation and culture etc.

- **Current Situation of PVTGs in India: Report by Anthropological Survey of India (AnSI) about PVTGs (April, 2017)**

- » **Report:** The Particularly Vulnerable Tribal Groups of India - Privileges and Predicaments
- » **Key Findings**

- a. **Baseline surveys** exists for only 40 groups out of 75 PVTGs -> **displays government's apathy** towards PVTGs
  - Baseline surveys are done to precisely identify PVTG families, their habitat and socio-economic status, so that development initiatives are implemented for these communities, based on the facts and figures.
- b. **Regional and state specific variations in welfare schemes for PVTGs**
  - For instance, Odisha has established exclusive micro-projects for PVTGs, there are none such in for the five PVTGs in Gujarat.
  - **Unequal treatment in same state:** In some cases, a PVTG receives benefits only in a few blocks in a district, while the same group is deprived in adjacent blocks. The reason is that micro-projects extend benefits only within their jurisdiction.
- c. **State wise distribution**
  - Among the 75 listed PVTGs the highest number are found in Odisha (13).
  - Other states
    - Bihar including Jharkhand (9), MP including Chhattisgarh (7), Tamil Nadu (6), Kerala (5), Gujarat (5), WB (3), MHA (3), Kar (2), UK (2), Rajasthan (1), Tripura (1), Manipur (1).
    - All four Tribal groups in Andaman and 1 in Nicobar Islands are recognized as PVTGs.
- d. **Huge Variation in the number of PVTGs**
  - A few individuals as in case of Great Andamanese (57), Onge(107) and Sentinelese (around 50) to more than 4 lakh population of Sahariyas in MP and Rajasthan.
- e. **Literacy rate going up**
  - Literacy rate has gone up significantly over the past.
  - From a single digit, the literacy rate has gone upto 30-40% in some PVTGs.
  - **Female literacy** rate is still considerably lower compared to male counterparts.
- f. **Considerable increase in age of marriage among PVTGs**
  - The incidence of girl child being married while still being a minor, among these tribes have been decreasing.

- **Recommendations of the report**

a. **Urgently conduct baseline surveys**

- State governments should urgently conduct baseline surveys of the PVTGs to arrive at accurate demographic and socio-economic figures of the PVTGs.

b. **Revise and refine PVTG list to avoid overlapping and repetition.**

- For instance, the list contains the synonyms of the same group such as the Mankidia and the Birhor in Odisha, both of which refers to the same group.
- Some of the PVTGs are counted in more than 1 states, and the report suggests that the total number of PVTGs should be 63.

- **Conclusion / Way forward for PVTGs**

» **Better identification of Problems:**

- **Implement the recommendations of AnSI and PM-PVTG Mission** effectively.
- » **Common Development Agency** to focus on PVTGs in case of inter-state distribution of the group.
- » **Customized development Plans** for PVTGs, considering their distinct cultural practices, traditional knowledge etc.
- » **Critical time bound monitoring and evaluation** of various projects and schemes is important for the economic upliftment of PVTGs.
- » **Bottom-up approach** rather than existing top down approach for their development -> empowering local bodies to ensure better focus on PVTGs.

- **Conclusion:**

- » Effective implementation schemes like PM-PVTG mission to the unique need of PVTG can contribute significantly to the overall development and welfare of PVTGs.

## A) PRELIMS: PVTGS IN VARIOUS STATES

State / UT Name	PVTGs Name
Andhra Pradesh and Telangana	1. Bodo Gadaba 2. Bondo Poraja 3. Chenchu 4. Dongria Khond 5. Gutob Gadaba 6. Khond Poroja 7. Kolam 8. Kondareddis 9. Konda Savaras 10. Kutia Khond 11. Parengi Poroja 12. Thoti
Bihar and Jharkhand	13. Asurs 14. Birhor 15. Birjia 16. Hill Kharia 17. Konvas 18. Mal Paharia 19. Parhaiyas 20. Sauda Paharia 21. Savar
Jharkhand	Same as above
Gujarat	22. Kathodi 23. Kohvalia 24. Padhar 25. Siddi 26. Kolgha
Karnataka	27. Jenu Kuruba 28. Koraga
Kerala	29. Cholanaikayan (a section of Kattunaickans) 30. Kadar 31. Kattunayakan 32. Kurumbas 33. Koraga
Madhya Pradesh and Chhattisgarh	34. Abujh Macias 35. Baigas 36. Bharias 37. Hill Korbas 38. Kamars 39. Saharias 40. Birhor
Chhattisgarh	Same as above
Maharashtra	41. Katkaria (Kathodia) 42. Kolam 43. Maria Gond
Manipur	44. Marram Nagas
Odisha	45. Birhor 46. Bondo 47. Didayi 48. Dongria-Khond 49. Juangs 50. Kharias 51. Kutia Kondh 52. Lanjia Sauras 53. Lodhas 54. Mankidias 55. Paudi Bhuyans 56. Soura 57. Chuktia Bhunjia
Rajasthan	58. Seharias
Tamil Nadu	59. Kattu Nayakans 60. Kotas 61. Kurumbas 62. Irulas 63. Paniyans 64. Todas
Tripura	65. Reangs
Uttar Pradesh and Uttarakhand	66. Buxas 67. Rajis
West Bengal	68. Birhor 69. Lodhas 70. Totos
Andaman & Nicobar Islands	71. Great Andamanese 72. Jarawas 73. Onges 74. Sentinelese 75. Shorn Pens

## 4) IR: INDIA-QATAR

### B) PRELIMS FACTS ABOUT QATAR

#### Location:

- » **Qatar** officially, the state of Qatar is a sovereign country located in Southwest Asia, occupying a small Qatar peninsula on the north eastern coast of the Arabian Peninsula.
- » **Land border** is only shared with Saudi Arabia in the south, while the rest of its territory surrounded by the Persian Gulf.
- » **A strait in Persian Gulf** separates Qatar from the nearby island of Bahrain.



#### History:

- » Following Ottoman empire, Qatar became British protectorate in the early 20th century until gaining Independence in 1971.

#### Capital: Doha

#### High Income Economy

- » Developed country, backed by world's third largest natural gas reserves (after Russia and Iran) and oil reserves.
- » One of the highest per capita incomes in the world.
- » Most advanced Arab state for human development.

**Middle Power:** In the 21st century, the country has emerged as a middle power in the Arab world through its resource-wealth, as well as its globally expanding media group, Al Jazeera network.

#### Total Population

- » 2.6 million
  - Around 3 lakh Qatari
  - 23 lakh expatriates
    - Around 8 Lakh.

### C) INDIA-QATAR RELATIONS

- **Practice Question:**
  - » Discuss the key pillars of India-Qatar bilateral relations [10 marks, 150 words]
- India Qatar relations have generally remained very steady:

- » **Large Indian Diaspora:** About 8 lakh Indian nationals work and live in this small country.
  - » **Close Economic Ties:**
    - **India's Energy Dependency:** Qatar is the largest supplier of LNG to India (10.74 million tonnes in FY23), accounting for 54% of India's LNG imports. India also imports ethylene, propylene, ammonia, urea, LPG etc from Qatar.
      - » LNG imports are expected to increase in future as India has set a target of increasing the share of natural gas in the primary energy mix to 15% by 2030 from a little more than 6% at present.
      - » While Indian LNG importers - predominantly the public sector oil and gas companies - continue to make efforts to diversify sourcing, it could be years before the high reliance on Qatar can be reduced to a meaningful extent.
    - **Bilateral Trade:**
      - » **India's total import** from Qatar in FY23 were valued at \$16.81 billions of which 50% was that of LNG imports.
      - » **India's exports** to Qatar were valued at just \$1.97 billion in FY23.
        - The major exports include cereals, vegetables, fruits, spices, processed food, copper articles and iron & steel.
    - **Investments** by Qatar Investment Authority is substantial in India's new economy.
      - » Major Qatari investments since 2019 include investments in Airtel's AirtelAfrica, Byju's, Adani Transmission Ltd, Adani Green Energy, Reliance Retail Ventures Limited, Swiggy, Allen Career Institute etc.
  - » **Strong Political Ties:**
    - There have been high-level visits in recent years, with PM Modi visiting Qatar in 2016, and the Emir of Qatar, Sheikh Tamim bin Hamad Al Thani, paying a state visit to India in March 2015.
    - Further, EAM S Jaishankar has visited Doha multiple times.
    - Even when Qatar was isolated and feeling the heat of Saudi-led blockade in 2017-2021, India continued its economic engagement with Doha.
  - » **Defence Cooperation** is an important pillar of the bilateral agenda.
    - India-Qatar Defence Cooperation Agreement signed in 2008, was further extended for a period of five years in 2018.
    - India offers training slots in its defence institutions to a number of partner countries, including Qatar.
    - India also regularly participates in the biennial Doha International Maritime Defence Exhibition and Conference (DIMDEX) in Qatar.
    - Indian Naval and coastguard ships regularly visit Qatar as part of bilateral cooperation and interaction.
  - » **Cooperation during COVID-19:**
    - During the pandemic, India and Qatar collaborated on many fronts including repatriation efforts for stranded citizens and sharing experiences on managing the crisis.
- **Source of tension (Key differences) which impact India-Qatar relations:**

- » India and Qatar don't have converging views on the situation in West Asia.
  - For e.g.
    - India's improved relation with Saudi-Arabia and Qatar's poor relation with Saudi Arabia led group.
    - India is sometimes seen to be abandoning its commitment to the Palestinian cause.
  - » Qatar is a bastion of Islamic conservatism.
- **Former Indian Navy Personnel Getting Death Penalty (Oct 2023)**
  - » **Basic Details of the case?**
    - The Indian Nationals were employed by the Al Dahra company in Doha. The company was involved in producing high-tech Italian origin submarines that are known for stealth capabilities.
    - These Indians were involved in imparting training to Qatar armed forces officers.
      - They were arrested in 2022 and trials were held in March and June 2023. They were provided consular access on multiple occasion by India. Eventually, they were given death penalty by a local court on 26th Oct 2023.
      - According to a report by Financial Times, the eight Indians had been charged with spying for Israel. But this has been disputed, and it has been asserted that there is no ongoing submarine contract and no Israeli connection.
  - » **India's Response:**
    - Gol has expressed shock and is exploring all consular and legal assistance in the matter.
  - » **How could India-Qatar relation get affected?**
    - The verdict is the first major crisis to hit the India-Qatar relations. Given the situation with India's energy security concerns and ambitions, the case of the retired Navy Personnel presents a sensitive challenge for India's diplomacy.
    - Further, **timing of the judgment** is another issue. Right now, West Asia is going through turmoil and polarized situation due to Israel-Palestine war.
- **Way Forward: Deft Diplomacy:**
  - » **Legal Option:**
    - Appeal in higher Court
  - » **Mercy Petition** to Emir of Qatar who is known to pardon people during Ramadan and Eid.
  - » **Political and Diplomatic Option:**
    - "Epsilonage issues are determined not only by judicial verdicts but also by the nature of relations between states": Former diplomat Vivek Katju
    - Delhi should work with various levers with Qatari establishments - Political, Economic, Defence and Indian Community.
      - Use the help of influential Indian Community members to work the levers in the Qatar establishment.
- **Conclusion:**
  - » This is a challenging diplomatic issue that requires careful consideration and strategic action.
  - » India's response should consider the implications of the Vienna Convention on Consular Relations, international precedents, and the broader context of India-Qatar relations.

- » Weather through diplomatic dialogues, political interventions, legal appeals, or a blend of these strategies, India has the potential to seek a resolution.

## 2. GS-3

### 1) S&T: DEEPFAKE

- **Why in news?**
  - » PM Modi warns against deepfakes, calls on media to educate people on misinformation (Nov 2023)
  - » Following the controversy created by Deepfake videos of actress Rashmika Mandanna and Katrina Kaif's deepfakes being circulated online, the GoI has asked social media companies to remove deepfake within 36 hours of a complaint being registered (Nov 2023)
- **Example Questions:**
  - » Examine various risks associated with the malicious use of deepfake technology. Suggest measures to regulate and manage those risks [15 marks, 250 words]
- **Example Video-1:** [https://youtu.be/3wVpVH0Wa6E?si=A2VSJMF97nATm8\\_y](https://youtu.be/3wVpVH0Wa6E?si=A2VSJMF97nATm8_y)
- **Basics:** Deepfakes refer to manipulated media (audio, video, images etc) created using a form of Artificial intelligence called Deep Learning (or Deep Neural Network). This manipulated content use lip syncing, swapping of face etc. – mostly without consent.
- **How does the Deepfake technology work?**
  - » The technology involves modifying or creating images or videos using a machine learning technique called **Generative Adversarial Network (GAN)**. The AI driven software detects and learns the subjects' movements and facial expressions from the source material and then duplicates this in another video or image.
  - » **Larger the source material used**, better will be the quality of deepfake. Therefore, highest number of deepfakes are made of public figures like politicians and film stars.
  - » **Through a collaborative work of two softwares**, the fake video is rendered until the second software package can no longer detect the forgery. This is known as "unsupervised learning" when machine language models teach themselves. The method makes it difficult for other software to identify deepfakes.
- **Advantages:**
  - » Synthetic Media/ Deepfakes can create **possibilities and opportunities for all** people, regardless of how people listen, speak, or communicate. It can give people voice, purpose, and ability to make an impact at scale and with speed.
  - » It has been used by the ALS association in collaboration with a company to use voice cloning technology to help people with ALS digitally recreate their voices in future.
- **Concerns:**

- » Like most new technologies, it can also be **weaponized to inflict harm** to individuals, institutions, businesses or a country.
  - » **Crime against women** can increase with malicious use of Deepfakes in pornography and can inflict emotional, reputational and in some cases violent outcome for some individuals. (for e.g. viral deepfake video of actress Rashmika Mandana incident)
  - » **Endanger Social Harmony** – Communal/caste-based statements.
  - » **Decrease trust towards institutions like government/media** – by propagating false propaganda against them.
  - » **Undermine democracy and impair diplomacy** – false information about institutions, public policy, and politicians powered by a Deepfakes can be exploited to spin the story and manipulate belief.
- **How to spot/identify a deepfake?**
- » Look for **unnatural blinking or lack of it**.
  - » **Lighting** that just don't sit right.
  - » Sometimes, **voice could be too robotic**.
  - » If the video sounds **too sensational to be true**, trust your gut.
  - » Voices that miss the mark on lip synchronization
- **Recent Advisory released by Ministry of electronics and Information Technology:**
- » **IT Rules, 2021** require that **all content reported to be fake or produced using deepfake be taken down by intermediary platforms within 36 hours**.
  - » An advisory was sent to social media platforms in Nov 2023, reminding them that they may **lose “safe harbour immunity”** under the IT Act, if they fail to remove within 36 hours deepfake content that has been reported.
- **Way Forward:** To defend the truth and secure freedom of expression, we need a **multi-stakeholder and multi-modal approach**. **Collaborative actions and collective techniques** across **legal reforms, social media regulation, media literacy, and technology intervention** can provide effective and ethical countermeasures to mitigate the threat of malicious Deepfakes.
- » **Legislative Reforms:**
    - IT Act needs **stronger provisions to Curb Deepfake menace**. Currently **IT Act and IPC** only partially address the harms which arise from deep fakes.
    - There is also need of a **law on AI to govern the complexities relating to AI** and related applications.
  - » **Consumer awareness and Media Literacy** by Consumers and Journalists will be the key to fighting Deepfakes. Media literacy efforts should be enhanced to **cultivate a discerning public**. A consumer should have the ability to **decipher, translate, understand and use the information we encounter**.
  - » **Technological intervention** with easy to use and **accessible technology solutions to detect Deepfakes, authenticate media, and amplify authoritative sources** will be crucial in fighting Deepfakes.
  - » **International Collaboration:** To explore **content labelling solutions or watermarking of AI-generated content**.

### 3. PRELIMS FACTS

#### 1) MAPPING: TUVALU

**Tuvalu** is a country in **West Central-Pacific Ocean**. It is composed of **9 coral islands** scattered in chain lying approximately northwest to southeast.

**History:** Together with what is now **Kiribati** (formerly the Gilbert Islands), Tuvalu formed the **British Gilbert and Ellice Islands Colony** before separately gaining its **independence in 1978**.

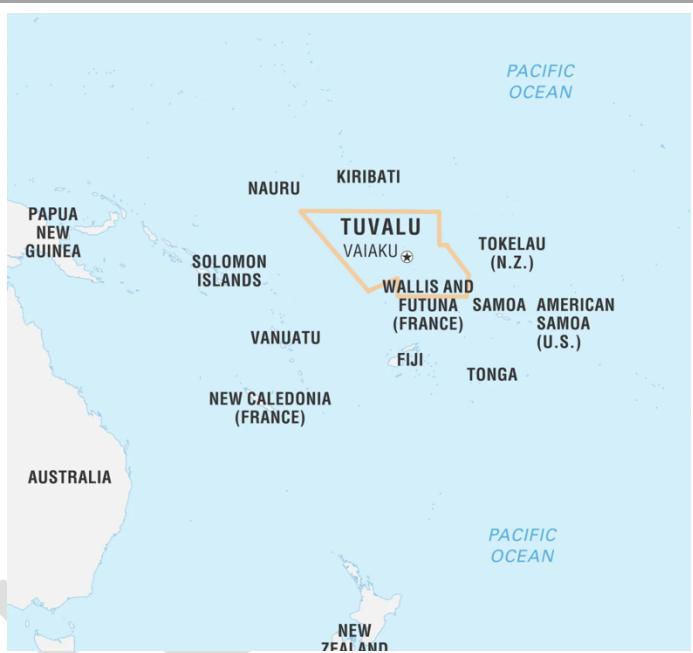
**De facto capital:** **Vaiaku**. This is where **most of the government offices are located**.

##### **Geography:**

- The islands are **low-lying**, most being **13 to 16 feet** above sea level.
- No Rivers:** Rain catchment and wells are sources of fresh water.

**Recent Developments: Australia Offers Climate Refuge to Tuvalu Citizens (Nov 2023)**

- A new **treaty** - known as the **Australia-Tuvalu Falepili Union Treaty** - is the most significant agreement between Australia and Tuvalu.
  - It promises **Australian assistance** to the nation on **climate action** and **security**.
  - Under this **Australia will provide migration pathways** for people from Tuvalu facing the existential threat of climate change. It is the **world's first bilateral agreement on climate mobility**.
  - Under the treaty, **Australia will implement special visa agreement** to allow **Tuvaluans to work, study and live in Australia**. This is **not a refugee visa**, but rather will allow **upto 280 Tuvaluans** (from a population of around 11,200) to migrate to Australia each year - presumably on a **permanent basis**. This will provide people with **both legal and psychological security**.



## 2) MAPPING: CONGO RIVER AND CONGO RIVER BASIN

Congo River was formerly also known as the **Zaire River**.

It is the **second longest (4,700 km) river of Africa** (9th longest of the world) (the longest is Nile).

It is also the **world's third largest river in terms of discharge volume** after Amazon and Ganges.

It is also the **world's deepest recorded river**, with measured depth of around **220 m**.

**Important Tributary:** The **Chambeshi** is a **tributary of the Lualaba River** (which is the name of the Congo river upstream of Boyoma Falls).

**Crosses equator twice:** It is the **only major river of the world to cross equator twice**.

The river and its tributaries **flow through the Congo Rainforest**, the second largest rainforest area in the world, **after the Amazon Rain Forest**.

**Congo River Basin:** It is the world's **second largest river basin** (after Amazon river), comprising an area of **3.4 million square kms**



**Basin countries include:** DRC, Republic of Congo, parts of Gabon, Part of Cameroon, Central African Republic, Rwanda, Burundi, parts of Tanzania, Western Zambia, northern Angola.

## 3) MAPPING: PLACES IN NEWS: DEMOCRATIC REPUBLIC OF CONGO (DRC)

It is a country located in Central Africa and equator passes through northern part of the country giving it a tropical climate.

It has a **small 40 km coastline**, otherwise it is landlocked.

DRC is the **second largest country** in the Africa (after Algeria).

**Capital:** Kinshasa (located on Congo river), is the largest city of the DRC and also its **administrative, economic and cultural centre**.

**DRC** gained **independence from Belgium in 1960** and from **1971 to 1997** the country was **officially called the**



**Neighbouring Countries:** Republic of Congo (Brazzaville); Central African Republic; South Sudan; Uganda; Rwanda; Burundi; Tanzania (Separated by Lake Tanganyika), Zambia and Angola.

**Republic of Zaire**, a change made by then ruler Gen. Mobutu Sese Seko to give the country what he thought was a more authentic African name. "Zaire" is a variation of a term meaning "great river" in local African languages; Following the overthrow of Mobutu in 1997, the country's name prior to 1971, the DRC, was reinstated.

**Lake Tanganyika**: It is the longest freshwater lake in the world and the second deepest (after Lake Baikal of Russia). It forms boundary between DRC-Burundi and part of boundary between DRC-Tanzania.

Most of the country is composed of the Central Congo Basin.

**Congo Basin Rain Forest**: The country consist of significant portion of the Congo Basin rain forest often known as the "second lung of the Earth".

## 4) MAPPING: ETHNIC CONFLICT IN CONGO

### Background of Conflict in DRC?

**Rwandan Genocide in 1994**: Ethnic Hutu extremists killed nearly 1 million minority ethnic Tutsis and non-extremist Hutus.

Since then, the eastern part of DRC, bordering Rwanda, has been facing insurgency perpetrated by several rebel militant groups. According to the UN, more than 120 insurgent groups are active in eastern provinces of Ituri, North Kivu, South Kivu, and Tanganyika.

**Tutsi led M23 Rebel Group**: The Tutsi led M-23 rebel group resurfaced in Nov 2021 and has worsened the security situation in the eastern provinces of DRC. After failure of various peace attempts, the groups have kept on advancing since Jan 2023. DRC accused Rwanda of supporting Tutsi group.

### Prominent Rebel Groups:

- The prominent groups besides M23 include the Allied Democratic Force (ADF), the Cooperative for Development of the Congo (CODECO).
- ADF is an Uganda based insurgent groups and is operating since 1999. It has also pledged its allegiance to ISIS.



Provinces of DRC

### Why insurgency?

- **Ethnic Intolerance**: Following the Rwandan genocide, around 2 million Hutu refugees crossed Rwanda into North Kivu and South Kivu provinces of DRC. The organized ethnic militias in DRC fearing persecution.
  - Tensions intensified as Rwandan Tutsis organized militias against the Hutus who fled to DRC.
  - Subsequently several, ethnic and inter-ethnic groups who felt threatened

- **CODECO** claims that they aim to protect the ethnic Lendu against the Hemas and the Congo army.

#### Impacts of Insurgency:

- Thousands are dead.
- **Huge Internal Displacement:** In Oct 2023, the UN International Organization on Migration (IOM) reported that the number of people who have been internally displaced in the DRC has risen to 6.9 million.
- In the eastern province of Kivu, nearly a million people have been displaced due to the ongoing conflict with the rebel group, **Mouvement du 23 Mars** (M23)

started organizing their militias against each other.

- **Political Instability:** President Felix Tshisekedi came to power in 2019 through democratic elections. The country is to hold elections on 20th Dec. However, election commission has raised concerns about how continuing insecurity in parts of the country would pose a challenge to a "free democratic and transparent" vote.
- **Control over territory and natural resources**
- Extrajudicial killings by security forces
- **Rising tensions with neighbouring countries** (Armed groups have been supported by the governments of **Rwanda, Uganda and Burundi**, at various points, acting as proxies for each country's interest in the region)

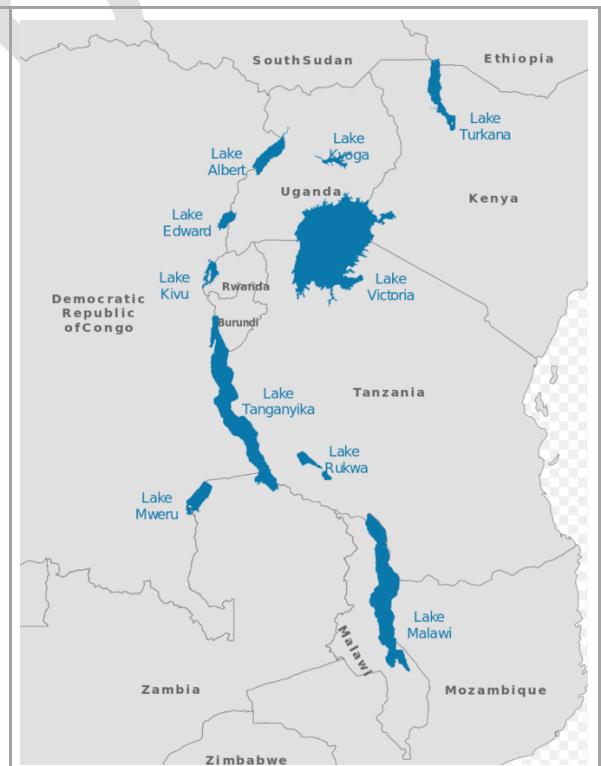
## 5) MAPPING: LAKE TANGANYIKA

Lake Tanganyika is one of the African Great Lakes. It is the world's longest lake.

It is second-oldest freshwater lake in the world, the second largest by volume, and the second deepest in the world, in all cases after Lake Baikal in Siberia.

The lake is shared between four countries - DRC(40%), Burundi, Tanzania (46%) and Zambia.

The lake drains into the Congo River system and ultimately into the Atlantic Ocean.



## 6) MAPPING: PLACES IN NEWS: KAMCHATKA PENINSULA

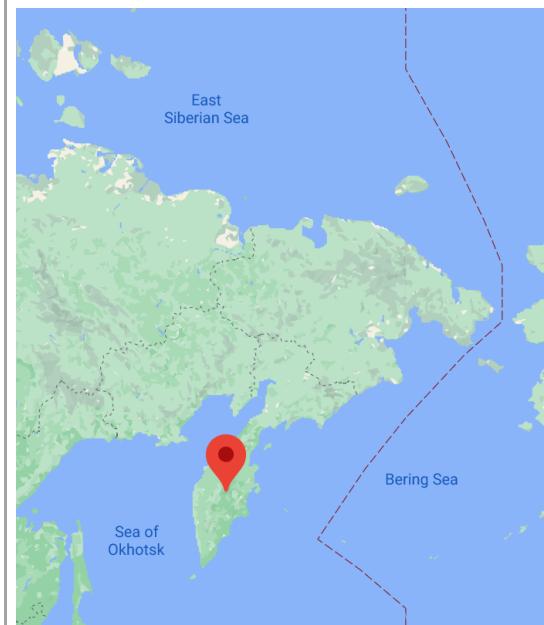
Kamchatka peninsula is a peninsula in the Russian Far East, with an area of about 2.7 lakh km<sup>2</sup>. It is sparsely populated.

The Pacific Ocean and the Sea of Okhotsk make up the peninsula's eastern and western coastlines, respectively.

The peninsula is noted for its array of active and dormant volcano, geysers and geothermal springs.

Immediately offshore along the Pacific coast of the peninsula runs the 10,500 meter deep Kuril-Kamchatka Trench.

**Biodiversity Disaster in 2020:** Many dead sea creatures (Octopus, Seals, and other sea creatures) have washed up on beaches in Kamchatka, in Russia's far east, in what is being treated as a major marine pollution incident. Initial analysis detected oil products and phenol in the water.



## 7) MAPPING: KLYUCHEVSKAYA SOPKA VOLCANO

It is the tallest volcano of Eurasia and is located on Kamchatka Peninsula. It is a stratovolcano with a height of 4,650 m.

It has been active in recent years and have released lava in June 2023. It also erupted in Nov 2023 and sent ash as high as 13 kms above sea level.



## 8) ECONOMY: ADDITIONAL TIER-1 BONDS

### - Why in news?

- » In Nov 2023, Swiss banking giant UBS sold additional tier-1 (AT-1) bonds for the first time and after taking over beleaguered banking peer Credit Suisse in March 2023.
  - Earlier, it was decided to write-off around \$17 billion in AT-1 bonds issued by Credit Suisse. This had invoked fury from investors.

### - What are AT-1 Bonds:

- » AT-1 bonds are perpetual debt instruments issued by banks to raise money and build up their core equity capital. There is no maturity date, implying that the issuer doesn't pay the principal amount back to investors but makes periodical interest payments throughout the life of the bond.

- » '**Call Option**': In practice, AT-1 bonds typically come with a 'call option' which means that the bank issuing these instruments can redeem them or repay investors after a specified period.
- » These bonds were introduced according to Basel banking norms made after the Global Financial Crisis. These are a form of "**contingent convertible (cocos) bonds**" which were created to prevent the need for government-funded bail-outs of precarious banks.

- **Why the risks for investors?**

- » Some features of AT-1 Bonds make them riskier than several other bonds.
  - AT-1 Bonds have equity like characteristics (quasi-Equity instruments), which permit banks to absorb losses.
    - If the bank faces financial stress, with capital requirement dropping below a specific levels, the covenants of AT-1 bonds typically permit the lender to hold off on interest payments or pay a lower amount. The bonds may also be converted into equity, helping to preserve the capital.
    - Some provisions allow the banks to write-off AT-1 bonds in case of severe financial crisis.
    - Further, AT-1 bond investor (unlike other bond investors) are not at the top of pecking order when it comes to receiving pay-outs from a bank facing financial stress. In fact, details sometimes put equity investors above than the bond investors.

- **How are AT-1 bonds triggered?**

- » These have different trigger mechanisms:
  - For e.g. if the Bank's capitalization level falls below a preset threshold, the bond may be converted to shares, which eliminates bank's liabilities on the AT-1.
- To compensate for these risks, banks pay investors a higher rate of interest for AT-1 bonds than other debt instruments or deposits.

## D) AT-1 BOND IN INDIA:

- **How much are the AT-1 bond holdings of Indian Banks?**
  - » Indian Banks don't depend on AT-1 bonds much.
    - In a study, brokerage firm Macquarie said that while India's **PSU banks** have an exposure of 1-2 percent to AT-1 bonds, private sector banks only have an exposure of 0-1 percent.
- The Indian market for AT-1 bond was upended in March 2020 following the crisis in Yes Bank.
  - Following severe financial stress, RBI and Yes Bank had decided to write-off additional tier-1 (AT-1) bonds worth Rs **8,415 crores**. Mutual funds were amongst the biggest sufferers.

- This was challenged in the court, and Bombay High Court in Jan 2023 ordered quashing of the write-off. But in Sep 2023, Finance Ministry has moved to the Supreme Court against the order.
- In 2021, SEBI amended valuation rule for perpetual bonds.
  - » Residual maturity of Basel-III AT-1 bonds will be 10 years until 31st March 2022.
  - » It will be 20 and 30 years for subsequent six months.
  - » From 1st April 2023, the residual maturity of AT-1 bonds will become 100 years from the date of issuance of the bond.
- SEBI then provided a phased timeline for mutual funds to value AT-1 bonds as 100-year instruments.
  - » The 100 year valuation kicked in from 1st April, 2023.
  - » Before this, AT-1 bonds were valued according to the call options on the papers - generally 5 to 10 years.
  - » **Impact:** Huge decline in mutual fund investments in AT-1 bonds as a 100-year valuation lead to very sharp movements in market yields of such papers.
- Recovery in AT-1 bond system in India:
  - » With improvement in banking sector in the form of reduced NPAs, the risk perception surrounding AT-1 bonds improved. In FY23, banks issued more than Rs 33,000 crore worth of AT-1 bonds.
- Note:
  - » AT-1 bonds are subordinate to Tier-2 bonds.
  - » Tier-2 Bonds are subordinate to unsecured creditors, banks depositors, and senior bonds. They are not perpetual instruments. They have a maturity period of minimum 5 years.

## 9) ECONOMY: INCREMENTAL CRR

In Aug 2023, RBI introduced Incremental CRR to absorb the surplus liquidity created in the system due to multiple factors, including the return of Rs 2,000 notes.

- » It was decided that wef from the fortnight beginning Aug 12, 2023, scheduled banks shall maintain an I-CRR of 10% on the increase in their net demand and time liabilities (NDTL) between May 19, 2023, and July 28, 2023.
- » This was purely a temporary measure for managing the liquidity overhang.
- » **Existing CRR** remained unchanged at 4.5%.
- » **Impact:**
  - Reduce the supply of money and thus curtail inflation.

In Sep 2023, RBI announced that it will discontinue the I-CRR in a phased manner.

- » **Why release in phased manner?**

- So that system liquidity is not subjected to sudden shocks and money markets function in a orderly fashion.
- » **RBI released 25% of I-CRR** on 9th, Sep; **25% on 23rd Sep** and **remaining 50% of the I-CRR on 7th October 2023.**

#### **About Cash Reserve Ratio:**

- Under **RBI Act, 1934** - Scheduled Banks are required to keep **a % of their net time and demand deposits (i.e. total deposits of customers)** in the **form of cash deposits with RBI**.
- **Objectives of CRR:**
  - » Since a part of total deposits in bank is available in the form of cash, it can be used to **readily make money available to customers when they demand it.**
  - » Further, **RBI also controls the amount of money in market** and thus **inflation** through CRR.
- **Note:**
  - » Banks **don't get any interest** for this money deposited with RBI.
  - » CRR has to be **maintained in cash only.**

## **10) DEFENCE: NIRBHAYA MISSILE**

- **Why in news?**
  - Nirbhaya Missile to be with All Three Forces (Nov 2023: Source: ET)
- **Introduction**
  - These are **long-range sub-sonic cruise missiles** being developed by DRDO indigenously.
  - They are **nuclear capable** with a **range of 1,000 km and payload of 300 kg.**
  - It is a **terrain hugging missile**. It can fly almost at the level of tree-tops **to evade detection** by radars.
    - It has been built to **identify and strike targets in heavily populated areas with pin-point accuracy** and is capable of **carrying a nuclear capable warhead.**
  - It is **powered by solid rocket boosters** developed by Advanced Systems Laboratory (ASL).
- **Update: Nov 2023**
  - In a significant boost to the firepower of the defence forces, **all three defence forces will now have long-range cruise missiles of the Nirbhay class** in their arsenal to strike targets at ranges of over 1,000 Km range.



# CURRENT AFFAIRS PROGRAM

## PRE CUM MAINS 2024

### NOV 2023: BOOKLET-4

## SPECIAL BOOKLET ON DISASTER MANAGEMENT

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## 1. SYLLABUS AND PYQS

### 1) SYLLABUS

- Disaster and disaster management

### 2) PYQS

- i. How important are **vulnerability and risk assessment** for pre-disaster management? As an administrator, what are key areas that you would focus on in a Disaster Management System? [2013] [10 marks]
- ii. **Drought** has been recognized as a disaster in view of its spatial expanse, temporal duration, slow onset and lasting effects on vulnerable sections. With a focus on the September **2010 guidelines from the National Disaster Management Authority (NDMA)**, discuss the mechanisms for preparedness to deal with likely El Nino and La Nina fallouts in India. [2014, 12.5 marks]
- iii. The frequency of **earthquakes** appears to have increased in the Indian subcontinent. However, **India's preparedness** for mitigating their impact has significant gaps. Discuss various aspects [2015, 12.5 marks]
- iv. The frequency of **urban floods** due to high intensity rainfall is increasing over the years. Discussing the reasons for urban floods, highlight the mechanisms for preparedness to reduce the risk during such events [2016, 12.5 marks]
- v. With reference to **National Disaster Management Authority (NDMA) guidelines**, discuss the measures to be adopted to mitigate the impact of recent incidents of **cloudbursts** in many places of Uttarakhand. [2016, 12.5 marks]
- vi. On December 2004, **Tsunami** brought havoc on 14 countries including India. Discuss the factors responsible for occurrence of Tsunami and its effects on life and economy. In the **light of guidelines of NDMA (2010)** describe the mechanisms for preparedness to reduce the risk during such event. 2017, 15 marks]
- vii. Describe various **measures taken in India for Disaster Risk Reduction (DRR)** before and after signing '**Sendai Framework for DRR (2015-2030)**'. How is this framework different from '**Hyogo Framework for Action, 2005**'? (2018, 250 Words, 15 Marks)
- viii. **Vulnerability** is an essential element for defining disaster impacts and its threat to people. How and in what ways can vulnerability to disasters be characterized? Discuss different types of vulnerability with reference to disasters [2019, 10 marks, 150 words]
- ix. **Disaster preparedness** is the first step in any disaster management process. Explain how hazard zonation mapping will help in disaster mitigation in the case of **landslides** [ 2019, 15 marks, 250 words]
- x. Discuss the recent measures initiated in disaster management by the Government of India departing from the earlier reactive approach [2020, 15 marks, 250 words]

- xi. Discuss about the vulnerability of India to earthquake related hazards. Give examples including the salient features of major disasters caused by earthquakes in different parts of India during the last three decades. (2021, 10 marks, 150 words)
- xii. Describe the various causes and the effects of landslides. Mention the important components of the National Landslide Risk Management Strategy. (2021, 10 marks, 250 words)
- xiii. Explain the mechanism and occurrence of **cloudburst** in the context of the Indian subcontinent. Discuss two recent examples. [2022, 10 marks, 150 words]
- xiv. **Dam Failures** are always catastrophic, especially on the downstream side, resulting in colossal loss of life and property. Analyze the various causes of Dam failures. Give two example of large dam failures. [2023, 10 marks, 150 words]

## 2. BASICS

- "Disaster" is defined under section 2(d) of the Disaster Management Act, 2005 as a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, and is of such nature or magnitude as to be beyond the coping capacity of the affected area.
- Disasters, whether natural or man-made, have been part of man's evolution since times immemorial. Many civilizations including the ancient Indus Valley civilization is thought to have declined because of some natural or man-made disasters.

### 1) DISASTER MANAGEMENT

- **Key Components of Disaster Management**
  - » A disaster needs to be examined in terms of its management cycle that would enable us to anticipate the crisis, prevent and mitigate it to the extent possible and deal with the crisis situation as it emerges.
- The life cycle of disaster Management can be divided into **three phases:**
  - i. **Pre-Crisis: Preparedness/ Risk Reduction**
    - This is the period when the potential hazard risk and vulnerabilities can be assessed and steps taken for preventing and mitigating the crisis and preparing for actual occurrence.
    - **It includes:**
      - Creation of legal and institutional framework



- Hazard Mapping and Vulnerability Analysis.
- Adopting risk reduction techniques
- Setting up Early Warning Systems (EWS)
- Infrastructure improvement for risk reduction
  - **Infra improvement can be both long term and short term.**
    - a. **Long term Measures** - Embankments (floods); Augmenting Irrigation facilities, watershed management (drought proofing); afforestation (landslides); earthquake resistant structures and sound environmental practices.
    - b. **Short term measures** may also reduce or modify the scale and intensity of the threat. This may include implementation of building codes; zoning regulations; maintenance of drainage system; improved awareness in public about disaster etc.
- **Capacity building of government institutions and agencies to ensure fast response during disaster.**

### ii. During Crisis: Emergency Response

- Disaster Response aims to provide immediate attention to maintain life, improve health, and to support the morale of the victim population.
  - It includes activities like **warning, search, rescue, evacuation**, followed by **provisions of basic needs** like first aid, medicine, food, clothing, shelter and other necessities essential to bring life of the affected back to a degree of normalcy.

### iii. Post Crisis: The Three Rs (Recovery Rehabilitation and Resettlement)

- Post crisis activities can be summed in 3 R's: Recovery, Rehabilitation and Resettlement
  - a. **Early Recovery:** This is the stage when efforts are made to achieve early recovery and reduce vulnerability and future risks. It comprises activities that encompass **two overlapping phases of rehabilitation and reconstruction.**
  - b. **Rehabilitation** refers to actions taken in the aftermath of a disaster to enable basic services to resume functioning, assist victim's self-help efforts to repair dwellings and community facilities, and to facilitate the revival of economic activities with more sustainable livelihoods.
  - c. **Reconstruction** refers to permanent construction or replacement of severely damaged physical structures, the full restoration of all services and local infrastructure, and the revitalization of the economy (including agriculture). It should include **development of disaster resilient infrastructure** and must be fully integrated into long-term development plans.

## 2) DISASTER VULNERABILITY PROFILE OF INDIA

- India has recorded the **third highest number of natural disasters** (after China and USA) in last 20 years (2000-2019): Report "**Human Cost of Disasters**" by UN Office for Disaster Risk Reduction (UNDRR).
- **Vulnerability Profile of India:** India faces very high vulnerability due to various factors:
  - » **Adverse geo-climatic conditions**

- **The geo tectonic features** of the Himalayan region and adjacent alluvial plains make the region susceptible to earthquakes, landslides, water erosion etc.
  - **58.6 percent of landmass** is prone to earthquake of moderate to high intensity.
  - **Hilly areas** are at risk from landslides and avalanches.
- Of close to 7516 km long coastline, close to 5700 km is prone to cyclones and Tsunamis.
- **Droughts: The Western Parts of the country, including Rajasthan, Gujarat and some parts of Maharashtra** are hit very frequently by drought situation. If Monsoon worsens the situation spreads to other parts of the country as well.

#### » Socio-Economic Factors

- **High levels of poverty and risk to disasters** are inextricably linked and mutually reinforcing.
  - For e.g., poverty forces people to live in disaster prone regions. The quality of infrastructure, houses etc. available to them are poor.
- High **population density** -> easy spread of pandemic; More pressure on infrastructure - Road/Railway accidents etc.
- **Unplanned Urbanization and unscientific development** -> Urban Floods, Building fires etc.
- **Unregulated industrialization** -> River Pollution; Chemical accidents
- **Development within high-risk zones**

#### » Environmental Factors

- » **Increased land-degradation** -> Famines
- » **Water Pollution** and unsustainable ground water extraction -> Drought

#### » **Climate Change** is expected to further increase the frequency and intensity of current extreme weather events and give rise to vulnerabilities with differential spatial and socio economic impacts on communities.

- » Sea-level rise - coastal flooding
- » Melting of glaciers - River overflow and flooding
- » Higher temperature - Heat waves
- » Variation in weather pattern - Floods and Droughts

- Inspite of this, **India** doesn't have a **database at national level** to record these disasters. In 2018, India had announced that as part of its commitment to Sendai framework, the government would launch "a Uniform and credible national-level disaster database with locally obtained and validated data". But, it hasn't happened yet.

#### » Disadvantages of not having a Central Statistical database

- Major constraints for risk assessment and compilation of disaster history in the country.
- Different sources have different figures for casualties and impact - thereby hindering the objective analysis.
- SFDRR sets various targets, which can't be measured unless there is database.

### 3) WORLD CONFERENCE ON DISASTER RISK REDUCTION AND SENDAI FRAMEWORK

- **Introduction:** WCDRR is a series of United Nations conferences focusing on disaster and climate risk management in the context of sustainable development. The conference has been convened three times, with each edition to date having been hosted by Japan, in **Yokohama in 1994**, in Kobe in 2005 and in Sendai in 2015. UNISDR served as the coordinating body for the second and third conference in 2005 and 2015.
- The conference **brought together** government officials and other stake holders such as NGOs, civil society organization, local government and private sector representatives from around the world to discuss the sustainability of development by managing disaster and climate risk.
- **Three Conferences and Outcomes**

Conference	Outcome
First (1994)	Yokohama strategy and Plan of action of a safer world
Second (2005)	Hyogo Framework for Action 2005-2015 : Building the Resilience of Nations and Communities to Disasters
Third (2015)	Sendai Framework for Disaster Risk Reduction 2015-2030

- **Sendai Framework for Disaster Risk Reduction 2015-2030**
  - **Introduction:** It is a **15-year non-binding agreement** which recognizes that the state has the primary role to reduce disaster risk, but that responsibility should be shared with other stakeholders including local government and the private sector.
  - **Aim:** It aims at following outcome: "The substantial reduction of disaster risk and losses in lives, livelihood and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries".
  - **Sendai Framework sets four specific priorities for action :**
    - Understanding disaster risk
    - Strengthening disaster risk governance to manage disaster risk.
    - Investing in disaster risk reduction for resilience
    - Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.

## The Seven Global Targets



### 4) HOW IS SENDAI FRAMEWORK DIFFERENT FROM HYOGO FRAMEWORK FOR ACTION?

- **Time Frame:** Hyogo Framework (2005-2015); Sendai Framework (2015-2030)
- **Focus and Scope:** Sendai Framework has wider scope than Hyogo.
  - **Hyogo Framework** focused on reducing disaster losses and tried to minimize the impacts of disaster
  - **Sendai Framework** broadens the scope by emphasizing the importance of understanding disaster risk and addressing it across multiple sectors. It recognizes that disaster risk is not limited to specific hazards but encompasses all types of hazards, both natural and human-induced.
- **Sendai framework** has also put greater emphasis on **Recovery, Rehabilitation and Reconstruction**.
- **Inclusivity and Participation:** The Sendai Framework places a strong emphasis on involvement of all stakeholders, including governments, local communities, civil society organizations, private sector entities, and others. It recognizes that effective disaster reduction requires collaboration, knowledge sharing, and participation from diverse sectors.

### 5) INDIA HAS TAKEN SEVERAL STEPS FOR DISASTER RISK REDUCTION BOTH BEFORE AND AFTER SIGNING THE SENDAI FRAMEWORK FOR DISASTER RISK REDUCTION (2015-2030)

#### A) PRE SENDAI STEPS:

- i. **Disaster Management Act, 2005** was enacted to provide legal framework to disaster risk reduction in India. It established various institutions and elaborated on their roles and responsibilities.
- ii. **National Disaster Management Authority (NDMA)** was established in 2005 as the apex body for disaster management in India. It is responsible for policy formulation, coordination and implementation of DRR measures across the country.

- iii. **National Disaster Response Force (NDRF)** was established in 2006 as a specialized force for disaster response. It consists of personnel trained in various aspects of disaster management and plays crucial role in rescue, relief, and response operations.
- iv. **National Policy on Disaster Management**, 2009: It outlines the framework for disaster management in India and emphasizes on risk assessment, capacity development, and involvement of multiple stakeholders.

## B) POST SENDAI INITIATIVES TAKEN BY INDIA AND THE WAY FORWARD

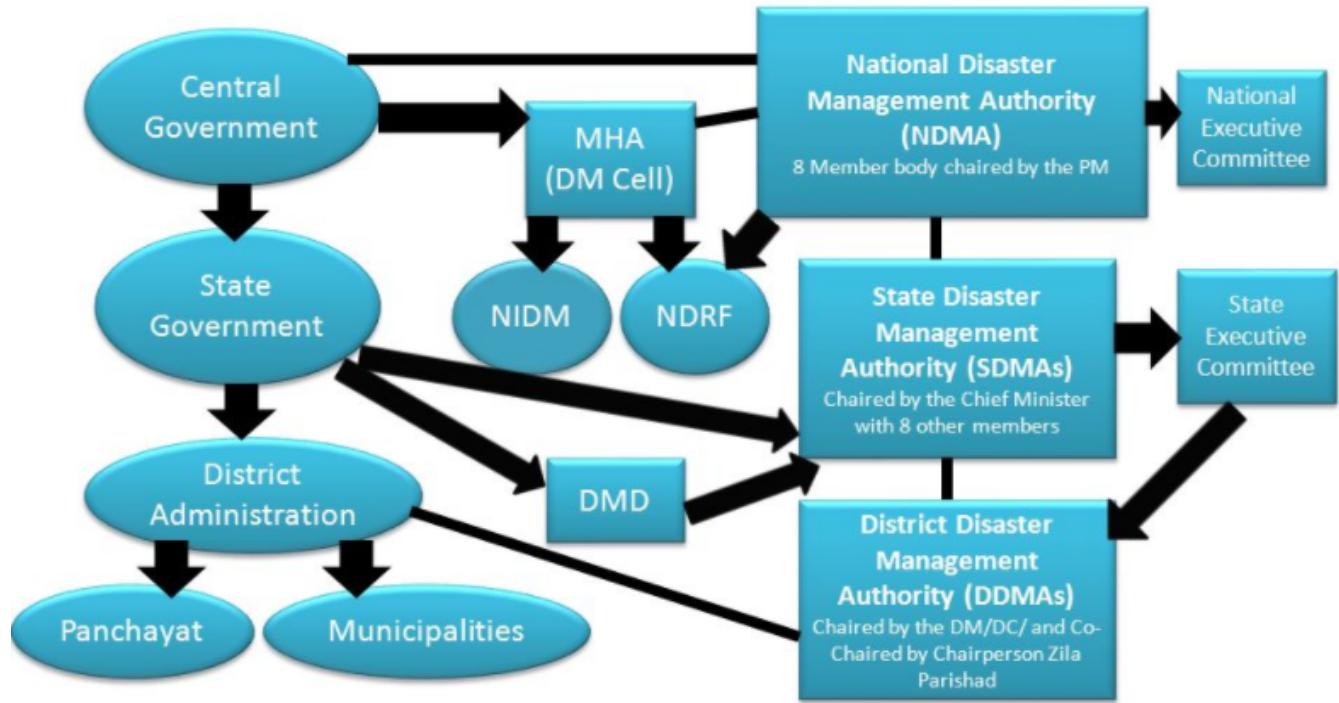
- In furtherance to its commitment to the Sendai framework, Government has taken up several important initiatives post Sendai Declaration.
  - i. India has hosted AMCDRR in Nov 2016 and adopted '**New Delhi Declaration**' and '**Regional Action Plan for implementation of Sendai Framework**'.
  - ii. GoI has issued a set of priority actions to all the state governments based on the goals, targets and priorities of Sendai Framework.
  - iii. **National Disaster Response Force (NDRF) has been strengthened**, both in terms of state of art training and equipment to further empower the professional disaster response force.
  - iv. Government has expressed its keenness to share India's expertise and help other countries in disaster response as it did during the Japan Earthquake in 2011 or the Nepal earthquake in 2015.
    - The government hosts SAARC Disaster Management Centre to reduce disaster risks in the region promoting knowledge sharing among the SAARC countries.
    - Similarly, INCOIS (Indian National Centre for Ocean Information Services) INCOIS, provides early warning not only to India but also to 28 countries in the Indian Ocean Rim.
  - v. NIDM has also signed an MoU with Jawaharlal Nehru University for establishment of a Centre of Excellence in Disaster Research and Resilience Building in JNU for promoting higher education and research within the multi-disciplinary framework.
  - vi. **Disaster Management guidelines** for different kinds of disasters have been prepared
  - vii. India is also in the process of creating National level Database for Disasters in India to help fulfill Sendai Framework requirements.

## 6) INDIA'S INSTITUTIONAL FRAMEWORK FOR DISASTER MANAGEMENT

- **Example Questions**
  - » "Ill-defined and conflicting institutional structures under the disaster management legal framework are among the major obstructions to effective disaster management" Discuss. [10 marks, 150 words]
- **Introduction:**
  - » **Constitution of India** does not mention disaster management under any of the three lists and thus it comes under **the residuary powers of the Union** under entry 97 of the union list. Thus, the power to legislate on the matter is with the Parliament.
  - » After the 2004 Tsunami, the Indian Parliament passed the **Disaster Management Act, 2005** which provides for institutional framework to deal with disasters in India.

- The Disaster Management Act, 2005 has created **new institutions** at the National, state, district and local levels. The new institutional framework is as follows:

## LEGAL – INSTITUTIONAL FRAMEWORK



### i. National Level

1. **National Disaster Management Authority (NDMA)** under chairmanship of the Prime Minister is responsible for policy formulation, making guidelines & best practices, and coordinating with SDMAs to ensure holistic and distributed approach to disaster management.
  - It also has the powers to approve National Plan and Plans of various ministries regarding DM.
  - Powers to superintendence and control of NDRF.
2. **National Executive committee**, chaired by home secretary, is responsible for preparing national plan, assisting NDMA to discharge their functions; monitoring the implementation of the National Policy and ensuring compliance to the direction issued by the Central Government.
3. **National Institute for Disaster Management (NIDM)** (earlier called National Centre for Disaster Management) is responsible for human resource development, planning and promoting training and research in the field of DM. It is also responsible for documentation

and creation of an information base relating to disaster management policies, prevention mechanisms and mitigation measures.

4. **National Disaster Response Force (NDRF)** is a specialized force responsible for quick response to a threatening disaster situation. It can also be deployed to provide assistance to civil authorities in case of impending disasters. It works under the overall supervision of the NDMA.

ii. **State Level**

1. **State Disaster Management Authority (SDMA)**- chaired by CM; responsible for policies and plans of DM at the state level. It also coordinates the implementation of state plan.
2. **State Executive Committee** draws up the state DM plan as prescribed by the national as well as state authorities.
  - It draws up the state disaster management plan as prescribed by the state and National authorities.

iii. **District Level**

1. **District Disaster Management Authority (DDMA)**- chaired by DM and have elected representatives of the local authority as co-chairperson. It is responsible for planning, coordinating and implementing Disaster Management at district level.

iv. **Funding mechanism under DMA, 2005 - Disaster Relief Fund and Disaster Mitigation Fund (at district, state and National Level)**

- See details separately
- **National Policy on Disaster Management, 2009**
- Approved in 2009
  - **Vision:** To build a safe and disaster resilient India by developing a holistic, proactive, multi-disaster oriented and technology driven strategy through a culture of prevention, mitigation, preparedness and response"
  - **Approach:** The policy seeks to evolve a holistic and integrated approach towards DM with emphasis on building strategic partnerships at various levels. The **key themes** of the policy are:
    - i. **Community participation** in the DM
    - ii. **Capacity development** in all spheres
    - iii. **Consolidation of past initiatives**
    - iv. **Cooperation** with agencies at national and international levels
    - v. **Multi-sectoral strategy**
  - The **key objectives** of the policy include
    - i. Ensuring efficient mechanism for identification, assessment and monitoring of disaster risks.
    - ii. Developing forecasting and early warning system.
    - iii. Promoting the culture of prevention, preparedness and resilience among all stakeholders
    - iv. **Encourage mitigation measures** with the help of traditional wisdom, environmental stability and technology.
    - v. Ensuring efficient response and relief with special focus on needs of vulnerable sections.

- vi. **Mainstreaming DM in developmental planning process.**
  - vii. Establishing institutional and technological framework for effective regulatory environment and compliance regime.
  - viii. Making reconstruction and opportunity to build disaster resilient structures and habitat.
- **National Disaster Management Plan, 2016**
- The plan focuses on aligning India's efforts towards Disaster Management to goals and priorities of Sendai framework.
  - **Analysis: Positives of the DMA, 2005**
    - The act rightly emphasizes the need to move from responding to disasters to effective preparedness, which has led to most states investing in resilient infrastructure, early warning systems and evacuation.
      - This has translated into timely warnings, relief shelters and massive evacuation exercises. All these have **reduced causalities**.
    - The **National Disaster Response Fund and State Disaster Response Funds** have helped in guiding immediate relief in the aftermath of disaster.
  - **Some limitations associated with the Disaster Management Act**
    - i. **Too Much Bureaucratization** -> top down approach -> ignores the role of local communities and civil society organizations
    - ii. **Poor Implementation** -> In Swaraj Abhiyan vs Union of India, 2016, the Supreme Court pulled government for poor and slow implementation of the law.
      - For e.g. the NDMF hasn't been created yet.
    - iii. **III-defined and Conflicting institutional structures** under the disaster management legal framework
      - Multiple authorities with overlapping jurisdictions -> lack of clarity in roles.
        - E.g. overlap in powers and functions of central and state governments in defining their ambit and demarcating their roles.
        - E.g. Overlap of role between NEC and already existing National Crisis Management Cell (NCMC).
      - There is absence of transparency and accountability mechanisms under the act.
    - iv. **Need of clarity and transparency on how the political and administrative authorities respond to a tragedy.**
      - For e.g. **multiple nomenclature**.
        - For e.g. in 2018, the Kerala state government didn't know that there is no provision for declaration of the situation as a "national disaster".
        - According to National Disaster Management (NDM) Guidelines, the floods were of "**L3 Level**" severity, i.e. a nearly catastrophic or a very large scale disaster that overwhelms the state and district authority.
        - Disaster Management Division of the Home Ministry declared it a "**Calamity of severe nature**".
    - v. **Neglected NDMA, NEC:** Vacancies, excessive executive incursion by MoHA, lack of regular meeting of NEC (reported in CAG report) etc.

vi. **Funding Misappropriation** (especially from SDRF)

vii. **Lack of Focus on Long Term Recovery**

- The DMA, 2005 largely focuses on improving preparedness, providing immediate relief, and protecting infrastructure. However, it neglects a key aspect of disaster management: Long term recovery.
- Post disaster relief and recovery **have been left to respective ministries and departments**.

- **Key Recommendations of ARC on NDMA, 2005**

i. **Decentralization:**

- **States should play primary role** -> Disaster Management should be the primary responsibility of state governments and union government should only play supportive role.
- **Local government's role should be brought to forefront** in disaster management.

ii. **Ending conflicting institutional structures**

- 2nd ARC recommended the scrapping of NEC as its function coincides with that of the already existing National Crisis Management Committee (NCMC) chaired by Cabinet Secretary.

iii. **Standardize the methodology for assessing a Disaster**

- The act should provide for the categorization of the disaster, this categorization will help in determining the level of authority primarily responsible for dealing with the disaster as well as the scale of response and relief.

iv. **Preventing misuse of the funds**

- The act must provide for stringent punishments and penalties in case of misuse of funds for disaster management

- **Other Important Recommendations**

i. Place Disaster Management in the concurrent list to ensure vertical and horizontal linkages in effective disaster management.

ii. **Long term recovery** needs to be thought of alongside development in an integrated and comprehensive manner by combining with health, skill building, and livelihood diversification schemes.

- **Conclusion**

- There is a need to move towards a regime that exists on a unified, codified and systematic approach to disaster management in which duties of center and states are well defined.

## 7) MANAGING DISASTER RISK REDUCTION FOR SUSTAINABLE DEVELOPMENT

- **Example Questions**

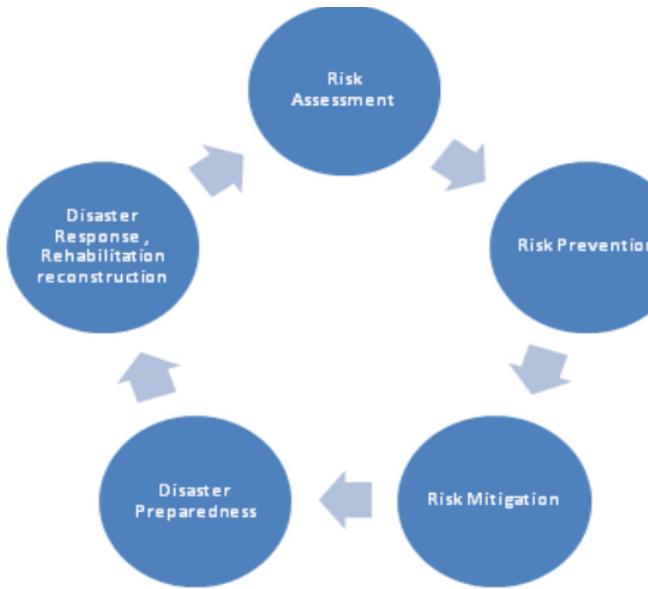
» 'Disaster Risk reduction is the most crucial component of Crisis Management' Discuss [10 marks, 150 words]

- **Introduction**

» Over the years disaster management has evolved from managing events of a disaster to managing the risks of a disaster. In the risk management approach to disaster, various risks of

hazards are analyzed and steps are taken to reduce and control these risks. Here both structural and non-structural steps can be taken for disaster risk reduction.

- » For the residual risk which can't be prevented, there has to be **disaster preparedness** i.e. getting ready to respond to disaster effectively. It involves preparing for early warning, evacuation, search rescue etc. Preparedness further means having policies, strategies and resources in place for 'building back better' livelihoods, houses, infrastructure etc. devastated during the floods.



**Figure 1 From Disaster Management to Disaster Risk Management**

- **Significance of Disaster Risk Reduction**
  - i. Reduces the negative impact of disaster on lives, livelihood and infrastructure.
  - ii. Disaster risk management has assumed critical importance for sustainable development as damage and losses due to disaster are spiraling despite plethora of measures taken to reduce such losses.
  - iii. Economic advantages - WB estimates that India has lost at least 2 percent of our GDP because of disaster.
  - iv. Help in fighting poverty as disaster without risk reduction would undermine hard earned development gains.
    - Disasters generally exposes vulnerable communities and aggravates poverty situation.
- **Disaster Resilient Sustainable Development got a new momentum in 2015** when three parallel yet inter-dependent processes converged to define the development agendas for the next one and a half decade and beyond.
  - » **Sendai Framework on DRR 2015-2030**
  - » **The 2030 Agenda for Sustainable Development** adopted by UNGA in Sep 2015
    - It embedded disaster risk management in as many as 8 out of 17 sustainable development goals.

- » The **Paris Agreement on Climate Change** signed in Dec 2015 outlined 8 specific action areas for enhancing 'understanding, action and support for disaster risk reduction'.
  - These include Early Warning System; Emergency Preparedness; Slow onset events; Events that may involve irreversible and permanent loss and damage; Comprehensive risk assessment and management; Risk insurance facilities; climate risk pooling and other insurance solutions; Non-economic losses; Resilience of communities, livelihoods and ecosystems
- **Steps taken so far**
  - » India has put in place legal and institutional mechanisms at various levels and deployed scientific and technological capabilities for disaster risk management with clearly visible impact on loss of lives, as was demonstrated during some of the recent meteorological disasters like cyclones.
- **Challenges**
  - » **Disaster Preparedness and risk reduction** is invisible as compared to disaster response and **thus is sometimes ignored.**
    - Neither NDMA, nor various ministries and departments have come up with guidelines or concrete plan of action for building disaster resilience in their respective sectors.
  - » **We have not been very successful** in dealing with
    - **Hydrological disasters** like floods or cloudbursts (Uttarakhand, Srinagar, Chennai, Kerala etc) or **geological disasters** like landslides (Malign and north Sikkim)
    - **Technological disasters** like road accidents or industrial accidents continue to spiral;
    - **Threats of biological disasters** like epidemics and pandemics loom large, while **environmental disasters** like depleting water resources and rising level of air pollution in rapidly growing urban settlements are causes of major concerns.
    - India's **ability to manage earthquakes** have not been tested yet since the 2001 Kutch earthquake.
  - » **Our strong scientific base and traditional knowledge and understanding** of the natural and anthropogenic processes of risks of disaster are not being used in process of designing and implementation of social and economic development programmes, activities and projects, with the result that benefit of these projects for disaster risk reduction are not optimized and on the contrary some of these projects are directly or indirectly contributing to creation of new risks of disasters or exacerbation of existing risks of disasters.
- **Way Forward**
  - » **Mainstreaming Disaster Risk Reduction**
    - Implementation of Sendai framework in conjunction with SDG goals, and Paris Climate Agreement provide an opportunities for addressing this hitherto neglected but challenging tasks of disaster risk management in India.
  - » There is a need to **promote awareness generation** regarding adoption of disaster resilient building by laws, land use zoning, resource planning, establishment of early warning systems, and technical competence.
  - » **Promote Knowledge sharing** among Disaster Management community
    - We need a common platform to create a versatile interface among policy-makers in the Government and disaster managers at all administrative levels.
- **Conclusion**

- » If national targets for growth and development - including employment and trade - are to be realized, the shift from managing crisis to managing risk must be reflected in public policy frameworks and planning decision processes so as to enable risk informed investment and practices.

### 3. FLOODS

#### 1) FLOODS – THE MOST RECURRENT DISASTER FOR INDIA

- **Past year Questions**
  - » Why are floods such a recurrent feature in India? Discuss the measures taken by the Government for flood control (1985, 20 marks)
  - » In what way can flood be converted into a sustainable source of irrigation and all-weather inland navigation in India. [2017, 250 words]
- **Other Practice Questions**
  - » "Floods - fluvial or pluvial - are often triggered by extreme weather events, but they translate into disaster risk due to anthropogenic factors" - Elaborate [15 marks, 250 words]
  - » "Floods are natural, but disasters are manmade" Discuss [12.5 marks, 200 word]
- **Introduction**
  - » Inundation of land and human settlements by the rise of water in the channels and its spill-over presents the condition of flooding. Flood is a natural disaster which affects some or the other part of the country for almost every year now. (Kerala, Chennai, Assam, Bihar, UP etc.).
  - » According to ADB, floods are the most devastating among climate related disasters in India. They account for more than 50% of all climate related disasters in the country.
- **Situation in India**
  - » In India, around 40 million hectares area is flood prone, which is 1/8th of the total area.
- **Causes of Floods**
  - » **Natural Causes:** Flood is generally seen as a natural phenomenon. It is associated with:
    - **Heavy Rainfall**
      - Cyclones etc.
      - Monsoon Climate - all rainfall confined to a period
    - **What caused heavy torrential rain in Himachal, Punjab, J&K and Delhi** in the first week of July 2023
      - **Interaction of Western Disturbance with the Monsoon Low Pressure System.**
        - **A western disturbance (WD)** is an extra tropical storm in the upper layers of the atmosphere that is carried towards India by the subtropical jet stream, a band of fast flowing winds that circulates the Earth.
        - **A Low Pressure System (LPS)**, is an area of low pressure that generally forms over seas and oceans and cause rainfall.
        - **This is rare phenomenon** as the WD generally don't occur during Monsoon season. But, global warming have brought variability and have increased the instances of WD during monsoon.

- **A Heat wave in northern Bay of Bengal:**
    - The Bay of Bengal, especially its northwestern part, is usually warm. This enables it to play an important role in NW Monsoon trajectory.
  - **Deep Convection** triggered by orographic uplift combined with the steep terrain of Himalayas.
- **Sediment Deposition**
    - Causes rivers to overflow or change paths
- » **Manmade causes:** Experts believe that the recent increase in intensity of floods have to do a lot with human activities:
  - i. **Climate Change** has led to extreme variability in the intensity of rainfall which has increased the chances of floods.
    - For e.g., global warming has caused rainfall due to western disturbances even in Monsoon season in July 2023 causing huge rainfalls in NW India.
  - ii. **Unplanned development along the natural drainage system** has led to rivers losing its buffer areas and thus any increase in the water levels is causing floods. This include colonization of flood plains and river beds.
    - The number of people living in floodplains across the world increased by 58-86 million during 2000-2015
  - iii. **Indiscriminate Deforestation** has led to increased devastation due to floods. Trees generally acted as a breaker in the intensity of floods.
    - For e.g. According to Madhav Gadgil, if we would have protected Western Ghats, the loss and devastation by the Kerala floods of 2018 would have been less severe.
  - iv. **Unsustainable agri-practices** can also be considered an important factor behind the recent rise in floods.
  - v. **Inefficient Dam Management** sometimes lead to large scale release of water in small time period leading to flood conditions
    - E.g. Kerala floods pf 2018
  - vi. **Urban Floods** are also mostly a result of human made factors
    - **Blocking the natural flow of rivers**
    - **Destroying the natural sinks** like ponds, lakes etc.
    - **Concretization** - Reduces the seepage of water - all water flows and cause floods
    - **Improper Urban Planning** -> siltation of drainage system, Insufficient drainage system
- **Consequence of floods** - Life, Property, Infrastructure, Agriculture, Water Borne diseases etc.
  - » According to Central Water Commission, the total flood related losses in the country were estimated to be over 37 lakh crore from 1953 to 2017.
  - » As per the the State of the Climate in Asia 2021 report, loss and damages from floods, storm cost India **\$7.6 billion in 2021** alone.
- **Some positive impact**

- » It deposits fertile alluvial soil and thus perpetuates the fertility of the area.

- Dealing with Flood Disasters/ Flood Management in India

- a. Risk Reduction, Preparedness

- **Flood Plane Zonation (FPZ)** to mitigate damages caused by floods and to allow rivers their '**Right to Way**'. As a policy flood plain zonation has two major components: Removing Encroachment and Regulating Land Use.

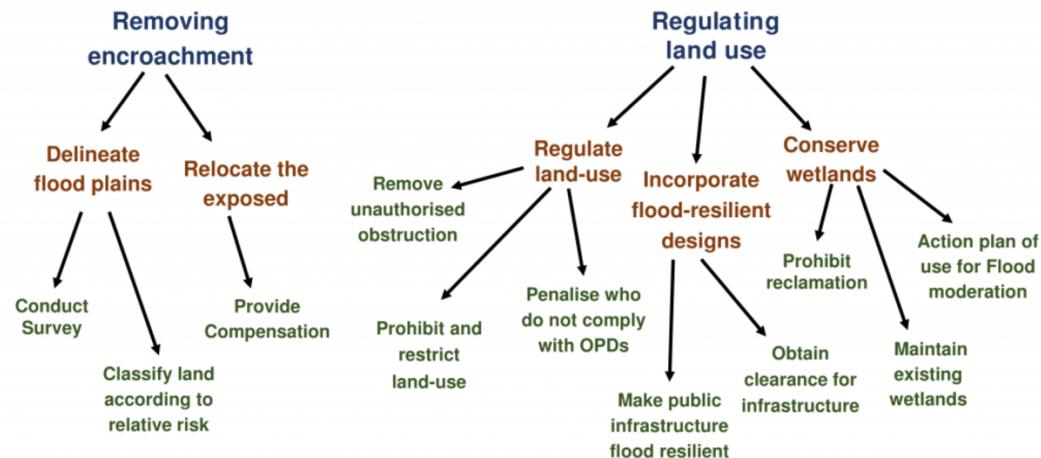


Figure 2: Flow Diagram showing the Operational Attributes of the proposed Floodplain Zoning Policy in India. Source – Modak and Kaduria (2020)

- **Other River Related Steps**

- **Embankments:** e.g. Embankments on Yamuna in Delhi has been successful in controlling the flood to large extent.
    - **Periodic desilting of river**
    - **Watershed based master planning** and development legislated guidelines for **each major river basin** is needed.
      - It should demarcate ecologically sensitive zones.
        - There must be clear land use plan for these zones specifying flood plains, protected forest areas, agricultural and plantation zones.
    - **Continuous modernization of flood forecasting, early warning and decision support systems**
      - There is a need of **more accurate rain forecast** and **more detailed warnings** in place of the current categorization as "heavy" or "very heavy".
      - **IMD** needs more **Doppler weather Radars** which can extend the lead time of forecast by three days.
        - E.g. **IFLOWS-Mumbai** was launched in June 2020 as an state of art integrated flood Early Warning system for Mumbai to enhance the resilience of Mumbai specially during high rainfall events and cyclones.
    - **Reservoirs:** Construction of reservoirs in the course of rivers could store extra water at the time of flood.

- Such measures **have not been much successful**. Moreover it has led to increased deposition of silt in the river and reducing the water flow and further increasing the flood. (e.g. Farakka Barrage causing problems in Bihar)
- Moreover, **during huge floods, dams are double-edged sword**. (e.g. Kerala floods of 2018)
- **Afforestation:** the fury of flood could be minimized by planting trees in catchment areas of the river
- **Planned Scientific Development of Cities**
  - Protect natural sinks like Ponds, lakes etc., development away from the river channel, proper drainage infrastructure, regular cleaning of this infrastructure.
  - Review and revise **building by laws** to focus more on environmental sustainability. They should clearly provide that natural drainage and streams shall not be obstructed by this development/ building permit.
- **Improving awareness and preparedness of all stakeholders** in the flood prone areas.
  - **Regular Drills in Flood Prone Areas** to ensure preparedness of NDRF and awareness among masses regarding steps to be taken during floods.
  - Introducing **capacity development interventions** for effective Flood Management (including education, training, capacity building, R&D, documentation) etc.
- **International Cooperation** with neighboring countries on flood controls as a number of rivers which cause flood in India originate from other neighboring countries.
  - For e.g. Dams on Rivers in Nepal can play an important role in controlling floods in the state of Bihar.

#### b. Response

- Improve the response system of NDRF especially for rural states like Bihar and Odisha.
- Need to enhance capacity building for catastrophic weather events
  - Serious attention needs to be given to fast tracking the setting up of relief camps, crisis proof health infrastructure and stockpiling of dry ration and medicines.
- Increased use of technologies like drones to identify people who are trapped in flood

#### c. Recovery

- Special Focus on Water borne diseases as they are the biggest killer in the post flood situation.
- Ensure that the new infrastructure created is resistant to floods.
- Bring in changes like broadening ecologically sensitive domain to protect more area from environmental degradation.

#### - Conclusion1:

- By recognizing the increasing threat of extreme precipitation and implementing proactive measures, India can improve its resilience to extreme weather events.

- **Conclusion2:**
  - India being a sub-tropical country with Monsoon kind of climate will remain vulnerable to floods due to heavy rainfall and increased climate variability. An efficient disaster management mechanism will ensure that these floods remain a natural phenomenon and doesn't become a natural disaster.

## 2) ASSAM CASE STUDY

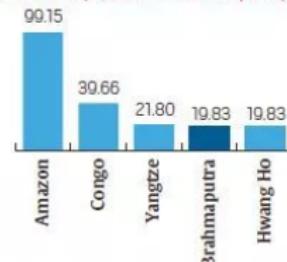
- **Why in news?**
  - Most of the districts of Assam face flood every year. For e.g. in June 2023, more than 11 districts were affected by the first wave of flash floods in Assam (June 2023)
- **Why is Assam so vulnerable to floods?**
  - **Incessant Monsoon Rainfall**
  - **Nature of River Brahmaputra** -> Dynamic and Unstable
    - It figures amongst the world's top five rivers in terms of discharge as well as the sediments that it brings.
    - Because of earthquake prone nature of the region, the river has not been able to acquire a stable character.

### AREA OF INFLUENCE

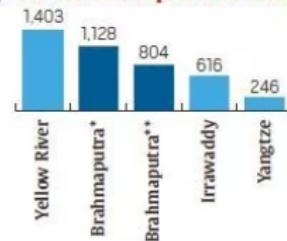


### STRONGEST & SILTIEST

AVERAGE DISCHARGE AT MOUTH (1,000 CUBIC m/sec)



SEDIMENT YIELD (TONNES PER sq km PER YEAR)



\*at Bahadurabad, Bangladesh; \*\*at Pandu, Guwahati

- **Man-Made Factors**
  - Habitation, deforestation, population growth in catchment areas also lead to higher sedimentation in the region.
  - **Destruction of wetlands:** For e.g. Sylhet districts traditional wetlands called 'haor' used to act as sponges absorbing runoff, have been destroyed, thereby enabling the recent floods.
- **How has government tried to address the factors that cause flood in Assam**

- In its master plan on the river in 1982, the **Brahmaputra Board** has suggested that dams and reservoirs be built to mitigate floods .
  - But, the idea has been seen as a double edged sword.
  - Further, opposition from locals, and environmentalists on the grounds of displacement and destruction to ecology, prevented the plan from moving forward.
- **Building Embankments** were proposed as an interim measure to deal with floods and government has recently used this as the only major approach to control floods.
  - But since, there were temporary measures, most embankments which were built in 1980s were not strong enough and thus easily give way in case of overflow of rivers.
- **Dredging** is another thing that government has considered, but experts have opposed it as Brahmaputra sediment yield is amongst highest in the world and next year sediments will reverse the efforts of this dredging. So, even this hasn't been done.

- **Conclusion**

- The above initiatives are clearly not the sustainable solution to floods. There is a need of a **basin wide approach** to the problem. There is a need of integrated basin management system that should ideally bring in all basin-sharing countries on board.

### 3) GLACIAL LAKE OUTBURST FLOOD

- **Why in news?**

- India and Pakistan make up one-third of the total number of people globally exposed to GLOF - around three million people in India and around 2 million people in Pakistan (Feb 2023)
- Scientists suggest that the outburst of a Glacial lake was the primary reason for the Feb 2021 flash flood in the Chamoli district (Feb 2021)
  - The DRDO have said that a portion of the Nanda Devi glacier broke off, creating an avalanche, releasing water trapped behind the ice.

- **Example Questions**

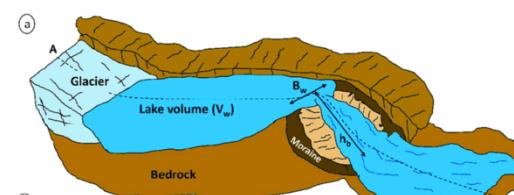
- » Discuss the key factors which is making Himalayan region more vulnerable to Glacial Lake Outburst floods (GLOF). In light of the recent NDMA guidelines, suggest measures to reduce risks of GLOF disasters (15 marks, 250 words)

- **Introduction**

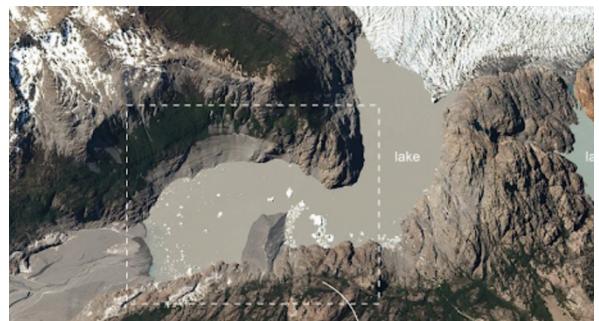
- » GLOFs are sudden fast flowing release of glacial lake water that move downslopes as a result of dam failure. They are recognized in the National Disaster Management Plan (NDMP) 2019 of India as a potential climatological disaster.

- **Glacial lakes** are either moraine dammed or ice margin dammed.

**Moraine Dam Glacial Lakes** are formed due to the retreating of glaciers, which leave behind soil and rocks and lead to an increase in capacity of lake, making it prone to bursting.



**ICE Dam Lakes** are created when ice from upper parts of glaciers fall and block passing rivers, giving rise to glacial lakes.



- **Different types of lakes may have different hazard potential:**
  - For e.g. Moraine-dammed lakes have high probability of breach and hazard potential, whereas the rock dammed lake have little chance of breach and low hazard potential.
- **Current Situation:**
  - A study, 'Glacial Lake outburst floods threaten million globally' published in the journal **Nature** in Feb 2023 highlights that:
    - Around 15 million people globally face the risk of GLOF.
    - Around 20% of them (**3 million**) live in India.
    - India, Pakistan, Peru and China have more than 50% of the vulnerable people.
- **Causes of increasing GLOF**
  - **Global Warming -> Climate Change**
    - Increasing number of Glacial Lakes due to acceleration of glacier melt in recent decades.
    - Increased water pressure due to more water being available due to Global Warming.
  - **Ice or rock avalanches, Erosions or other natural disruptions**
  - **Earthquakes** - Himalayan region is especially prone to earthquakes
  - **Human Activities ->** increased tourism, expansion of roads and hydropower projects, deforestation etc have also increased the vulnerability of burst in these lacs.
- **Recent Examples:**
  - **Flash Floods in Sikkim in Oct 2023** which killed 90+ people, destroyed infrastructure like bridges and roads, and damaged state's largest hydropower project, the 1.2 GW Teesta-III.
    - The flash floods were caused by access rainfall and Glacial Lake Outburst Floods (GLOF).
    - South Lhonak lake, the site of GLOF in Sikkim, was already recognized as potentially hazardous and scientists at the National Remote Sensing Centre had warned of a 42% chance of GLOF in as early as 2013.
    - **How it happened in Oct 2023:**

# WHAT CAUSED THE FLOOD IN SIKKIM



- The GLOF overflowed into Teesta river, creating flash floods that destroyed the Chungthang dam which is the key component of the state's largest hydro-electric project, and washed away highways, villages and towns. The worst affected districts are Mangan, Gangtok, Pakyong and Namchi.
  - The economic loss will be thousands of crores. Chungthang dam itself cost about Rs 14,000 crores.
- **Note:** Scientists have said that Sikkim's Glacial Lake is still at risk of GLOF, floods as there is a slight reduction in the ice area but almost half of the glacier hasn't deglaciated yet. Thus, the lake will further increase in size due to glacier melting and inflow from the North Lhonak glacier.
  - Therefore, it should be monitored to prevent another GLOF.
- The **Chamoli Flash floods of 2021** may have caused economic damages worth Rs 4,000 crore. It swept away the Rishiganga Hydel Power Project and inflicted substantial damage on the Tapovan Power Project.
- **2013 Kedarnath** flash floods was also result of GLOF.
- **Adverse Impact**
  - These floods pose **severe geomorphological hazards and risks**
    - It can wreck havoc on all man made structures located along the path and thus endanger people, infrastructure, fields and livestock.

- For e.g. the **Chamoli Flash floods of 2021** may have caused economic damages worth Rs 4,000 crore. It swept away the Rishiganga Hydel Power Project and inflicted substantial damage on the Tapovan Power Project.
- Similarly, the Kedarnath flash flood in 2013 was caused by GLOF.
- **Long term Climate Impact** may be caused by large glacial lake as they would increase the amount of water in ocean and reduce it in Himalayas.

- **Steps taken so far:**

- **CWC** has done some work towards identification of such lakes;
  - Some other aspects are still work in progress including a robust early warning system, and a broad framework for infrastructure development, construction and excavation in vulnerable zones.
- **Geological Survey of India (GSI)** carries out assessment of the GLOF threats and provide input to the National Disaster Management Authority (NDMA) for developing risk mitigation strategies.
- **National Disaster Management Authority (NDMA)** in collaboration with Swiss Agency for Development and Cooperation (SDC) have prepared **Guidelines on the Management of Glacial Lake Outburst Floods (GLOFs)** (Oct 2020)
  - The guidelines are aimed at improving the administrative responses, drawing on international best practices; and bringing together the relevant scientific capabilities of the nation to eliminate potential losses from glacial hazards.

- **Key Highlight of the NDMA Guidelines**

- i. **Inventorization: Hazard and Risk Mapping**
  - Regular monitoring of glacial lakes using satellite observations.
  - Cooperation with neighbouring countries (Nepal, Bhutan and China) to identify transboundary threats and manage it properly.
- ii. **Reduction of Hazards**
  - **Short term actions** - lowering the lake level through siphoning
    - For instance, high density PVC pipes were installed in **South Lhonak lake in Sikkim**, to reduce the pressure on the lake
  - **Long Term Actions**
    - **Artificial drainage channels** to lower lake levels
    - Reinforcement of dam
    - Enhancement of river cross section/ protection from erosion
  - **Restricting constructions and development** in GLOF prone areas is a very efficient means to reduce risks at no cost.
  - **Develop regulation for Land Use Planning** in GLOF areas.
- iii. **Reduction of Exposure**
  - Establishment of Early Warning System.
  - **Comprehensive alarm system** - including classical alarming infrastructure as well as modern technology using smart phone notifications etc.
  - Evacuation based on EWS

- Involve local population closely from the beginning in the design, planning and implementation of risk reduction and management strategies in a transparent collaboration mechanism.
- iv. **Awareness and Preparedness** through posters, social media, apps etc.
- v. **Capacity Development -**
  - Apart from specialized forces such as **NDRF, ITBP**, and the **ARMY**, the guidelines emphasize on need for trained local manpower.
  - Training of professionals and practitioners;
  - Strengthening Academic Education in relevant disciplines from natural and social sciences.
  - **Heavy earthmoving and search and rescue equipment**, as well as motor launches, country boats, inflatable rubber boats, life jackets etc.
  - Setting up **Quick Reaction Medical Teams, mobile field hospitals, Accident Relief Medical Vans**, and **heli-ambulances** in areas inaccessible by roads.
- vi. **Promote R&D in GLOF Management**
  - Promote development of **Modelling tools** to simulate the entire chain of mass movement and outburst process
  - **Historical records** should be effectively used to understand flood processes.
  - Expand the use of local knowledge, experience of local people. Engaging the local population in **joint-knowledge production** is considered indispensable for effective community based disaster risk management.
- vii. **Regulation and Enforcement**
  - A well drafted **techno-legal regime** is necessary to prevent future development of GLOF and protect existing Glaciers.
  - The regime should include a Himalaya GLOF mitigation Policy, no habitation and construction zones; and provisions for strict implementation.
- **Other steps**
  - Need of a **nodal agency** to coordinate all the researches related to glaciers in the region .
  - Fighting Climate Change
  - **Sustainable Development**
    - Restricting Tourism in these areas or promoting only sustainable tourism
    - **Detailed Project Reports and Environmental and Social Impact Assessment** needs to take into account the **Glaciology study** to better understand the impact of these projects on glaciers and glacial lakes.
  - **International Cooperation:** GLOF risk is transboundary in nature, thus there is an urgent need for a comprehensive regional risk governance framework including India, Nepal, Bhutan etc

## 4) URBAN FLOODS

- **Practice Questions**
  - The frequency of urban floods due to high intensity rainfall is increasing over the years. Discuss the reason for urban floods, highlight the mechanisms for preparedness to reduce the risk during such events. [12.5 marks, 200 words] [CSE Mains 2016, GS3]
  - Major cities in India are becoming vulnerable to flood conditions. Discuss [12.5 marks, 200 words] [CSE Mains 2016, GS1]

- Account for the huge flooding of million cities in India including the smart ones like Hyderabad and Pune. Suggest lasting remedial measures [CSE Main 2020, GS1]
- Urban floods are a result of ecological disturbance and socio-political apathy. Discuss [15 marks, 250 words]

- **Introduction**

- Recent instances of floods such as the one in Bengaluru in Sep 2022, Chennai in 2015 and Mumbai in 2005 illustrate the increasingly vulnerability of Indian cities to this disaster. A complex set of factors have worked together to deteriorate the condition of our cities and increase their susceptibility to this devastation.

- **Main Causes of Urban Floods**

i. **Unplanned Urban Development:**

- **NDMA Report: Increasing Concretization** of city land reduced the seepage of water in the ground and has increased the runoff.
- **Loss of Natural flood storage** in urban areas by filling of ponds and lakes to reclaim land for development.
  - For instance, in Chennai the number of water bodies have come down to less than 50 from 600 in 1980s. This became a major cause of 2015 floods.
  - Similarly, Bengaluru had 1,452 water bodies in 19th century, this has now reduced to only 193 lakes.
  - Here about 10,787 acres of lakes worth Rs 1.5 lakh crore has been encroached upon.
- **Encroachment of Flood Plains** of the rivers have led to loss of natural flood storage.
  - 2013 Uttarakhand floods
- **Rapid urbanization** has led to massive changes in land use patterns, as residential areas had sprung up in farmlands

i. **Improper and Inadequate Drainage system**

- A lot of sewerage and drainage network is old and lack volume to carry flood water.
  - » For e.g. The current drainage system of Delhi is based on the 1976 master plan.
- **Poor Desilting and blockage of drainage systems**. This was the main reason for 2005 Mumbai floods and a major factor in Sep 2022 Bengaluru floods.
  - » **Improper Waste Management** leads to a lot of solid waste blocking the drains. This hinders the flow of water during rainfall and contributes to floods.

iii. **Global Climate Change** have led to change in weather pattern which is sometimes causing unusually heavy rainfall thus causing floods in urban areas.

- For e.g. On 5th Sep 2022, Bengaluru received 131.3 mm of rainfall.

iv. **Social and Political apathy**

- **Religious practices** such as dumping of religious symbols, dead bodies etc. in rivers also lead to blocking of rivers. Inefficient management of gathering like Kumbha contribute to unnecessary concretization and thus floods.
- **Socio-economic factors** contribute to illegal encroachment of flood plains by slums etc. which increases the intensity of the urban floods.

- At the same time we have seen **an absence of political will** to give priority to the issue. This has happened both at national and international level.
- This lack of political will has resulted into **paucity of funds** which delays the key drainage infrastructure
  - **The river water information sharing** has remained a major issue between **India-Bangladesh and India China**.

#### - Consequences

- **Human and Infra Loss** - deaths and devastation; loss of telecommunication, road and railway lines; increased probability of disease epidemic
- **Economic Losses:**
  - » Other than economic losses because of destruction of infrastructure, floods result in **traffic jams, temporary closure of business, destruction of property etc.** which leads to **loss of manhours**, hindering of economic activities etc.
- **Environmental Pollution**
  - » Urban floods also lead to **washing away of various pollutants including industrial waste into water bodies** thus intensifying river pollution.

#### - Way forward

- **Promote the ideas of Sponge Cities** -> **Urban planning should keep in mind the geological and hydrological cycle:** Planned Development of cities should ensure that **flood plains are not encroached upon, sinks like ponds are protected/restored and pavements are porous to allow infiltration of rainwater in the ground.**
  - » There should be increased focus on these goals through an **Mission on Sponge Cities**.
- **Improvement of drainage system.**
  - » Proper maintenance, desilting of existing drainage system
  - » Providing **alternative drainage path** for flood waters (may be underground)
  - » **Control of solid waste entering** the drainage systems through proper Solid Waste Management
- **Change in social attitude of Common Citizen** will go a long way in controlling urban floods
  - » **Reduction of solid waste**, promoting **environment friendly religious practices** can all contribute towards limiting urban floods.
- **Disaster preparedness**
  - » Even after all proper steps, nature may cause havoc and cause floods, therefore a **proper disaster management plan** should be prepared by the ULBs to be battle ready in emergency situations. Fresh **Hazard profiles** should be created for the cities based on the historic as well as recent flood vulnerabilities.

#### - Conclusion

- We must not allow nature, human conduct, and urbanisation to be mystified and rendered as trans-historic villains. **We can learn to live with nature, we can regulate human conduct through the state, and we can strategically design where we build.** We need to urgently rebuild our cities such that **they have the sponginess to absorb and release water without causing so much misery**

and so much damage to the most vulnerable of our citizens, as we have seen in case of Mumbai, Chennai and Bengaluru.

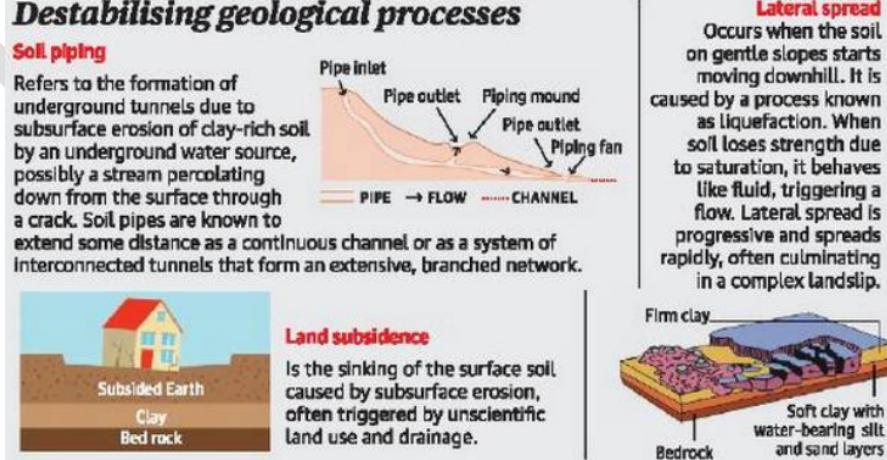
## 5) CLOUD BURST

- **Practice Questions:**
  - Explain the mechanism and occurrence of cloudburst in the context of the Indian subcontinent. Discuss two recent examples. [Mains 2022, 10 marks, 150 words]
  - Cloudbursts are often associated with flash floods. Explain the relationship between cloudbursts and flash floods, and discuss the challenges in managing flash flood events. [10 marks, 150 words]
- **What is cloudburst?**
  - A cloudburst refers to an extreme amount of rain that happens in a short period, sometimes accompanied by hail and thunder. IMD defines it as unexpected precipitation exceeding 10 cm per hour over a geographical region of approximately 20-30 sq km.
    - For e.g. the 2013 floods in Kedarnath were caused by Cloud Burst. In 2021, Amarnath region was impacted by cloudburst.
  - **Impact:** This sudden discharge of rain leads to floods including flash floods, landslides etc. which may result into human casualties, and property loss.
- **Mechanism: How does cloudburst occur?**
  - When cumulonimbus clouds (which stretch to even 13-14 kms in height) are trapped over a region or there is no air movement for them to disperse, they discharge over a specific area.
    - Here, saturated clouds ready to condense into rain can't produce rain, due to the upward movement of the very warm current of air.
    - Instead of falling downwards, raindrops are carried upwards by the air current. New drops are formed and existing raindrops increase in size. After a point, the raindrop are too heavy for the cloud to hold on to, and they drop down together in a quick flash
- **Other key aspects:**
  - It is very difficult to forecast the event due to its very small scale in space and time.
    - To monitor or nowcast (forecasting few hours of lead time) the cloudburst, we need to have dense radar network over the cloudburst-prone areas or one need to have a very high resolution weather forecasting models to resolve the scale of cloudburst. Doppler radar can be very useful in predicting them.
  - **Mountain regions are more prone to cloudburst due to orography (terrain and elevation)**, though they may occur in plains as well.
- **Way forward:**
  - **Hazard zonation mapping:** Identifying the areas vulnerable to flash floods.
  - **Improving forecasting (nowcasting) Infrastructure:** Increasing the coverage of doppler radars. Currently Himalayan region has 7 doppler radars (2 each in J&K and Uttarakhand, 1 each in Assam, Meghalaya and Tripura).
  - **Building flood resistant infrastructure:** To reduce damages due to flash floods
  - **Regulating settlements** in the river banks
  - **Strengthening institutions** to provide quick response at the time of cloudburst in the form of emergency evacuation, medicine etc.

- **Conclusion:**
  - By taking steps to predict, prepare, and respond to these events, we can reduce the loss of life and the property damage that they cause.

## 4. LANDSLIDES

- **Why in news?**
  - Landslide near Gangtok in March 2023
  - Around 50 people died due to landslide in Makhuam village of Manipur's Noney district on June 30, 2022. These people were working on the railway project (June 2022)
- **Example Questions**
  - While the **Himalayan region was always vulnerable to landslides**, the recent years have seen the peninsular hills also becoming increasingly prone to this natural disaster. Give reasons. What are the NDMA guidelines for management of landslides? [15 marks, 250 words]
- **Introduction**
  - Landslide is defined as the **movement of a mass of rock, debris or earth down a slope**. This is a type of mass wasting, which denotes any down-slope movement of soil rocks under the direct influence of gravity.
  - The term "landslide" encompasses five modes of slope movement: Falls, topples, slides, spreads, and flows.
  - There are **two landslide hotspots** that exist in India - along the **southern edge of the Himalayan arc** and the **Western Ghats region**.
- **Key causes of landslides:**
  - **Himalayas** are prone to landslides because of several **morphological and geological factors** like:
    - Tectonic movement
    - Glacial movements
    - Freeze and thaw effect
    - Unstable rock structure
    - Steep slopes etc.
      - Most regions with more than 20 degrees are prone to landslides.
    - Types of rocks, weaknesses, zone of rupture etc.
- **Destabilizing Geological Processes - Soil Piping, Land Subsidence, Lateral Spread etc.**



- But in recent years, we have also seen the stable Peninsular Hills like in Western Ghats becoming vulnerable because of the human made factors.
- **Human Induced Causes**
  - o **Climate Change: Extreme Rainfall Events trigger slope failure** where lateral spread and soil piping have occurred.
    - For instance, unusually high rainfall in Kerala since Aug 2018 has destabilized the already vulnerable hill slopes in the high ranges and has caused many landslides.
  - o **Illegal Mining, deforestation etc** have made the **surface weak and vulnerable to landslides**
    - For e.g. the railways have blamed two successive land slides along their project site in Manipur on the traditional practice of Jhum or shifting cultivation.
  - o **Unscientific Farming and Construction Activities**
    - UNDP's assessment after the 2018 flood says that changes in land cover, blocking of natural drains, and poor agricultural practices such as monocropping have all exacerbated the risk of landslides in Kerala.
    - Since 19th century, 50% of the land with tropical forests and grasslands has been converted to monoculture plantations and agricultural fields.
  - o **Illegal landgrab** using fake deeds have contributed to unscientific land use and thus landslides.
  - o **Inadequate Early Warning Systems** makes the impact of the disaster worse.
- **Government Efforts and Way Forward**
  - o **A national landslide susceptibility map** has been created by Geological Survey of India (GSI) under the **National Landslide Susceptibility Mapping Project.** This national landslide susceptibility map should be integrated with infrastructure development and planning in hilly areas.
  - o Union Ministry of Earth Science has also **initiated steps to establish a network of landslip monitoring stations** in the highlands.
    - » The units which will be based on acoustic emission technology will also have an early warning mechanism to alert the local community.
  - o **NDMA guidelines for management of Landslides**
    - » **Inventorization and regular update**
    - » **Landslide Susceptibility Map** at macro and meso scales
    - » **Awareness Generation and preparedness** among various stakeholders through setting up of institutional mechanisms.
    - » **Capacity Building to deal with Landslides**
      - Enhancing education and training of professionals involved in landslides management.
      - Capacity development of organizations working in the field of landslides
    - » **Create an Autonomous National Centre** for landslide studies research and management.
  - o **Other steps that can be taken**
    - » **Deploy Early Warning Systems** based on rainfall thresholds in various vulnerable regions.
  - o **Note: In way forward also suggest** things like increase afforestation, banning of mining in sensitive areas, sustainable forms of agriculture etc.

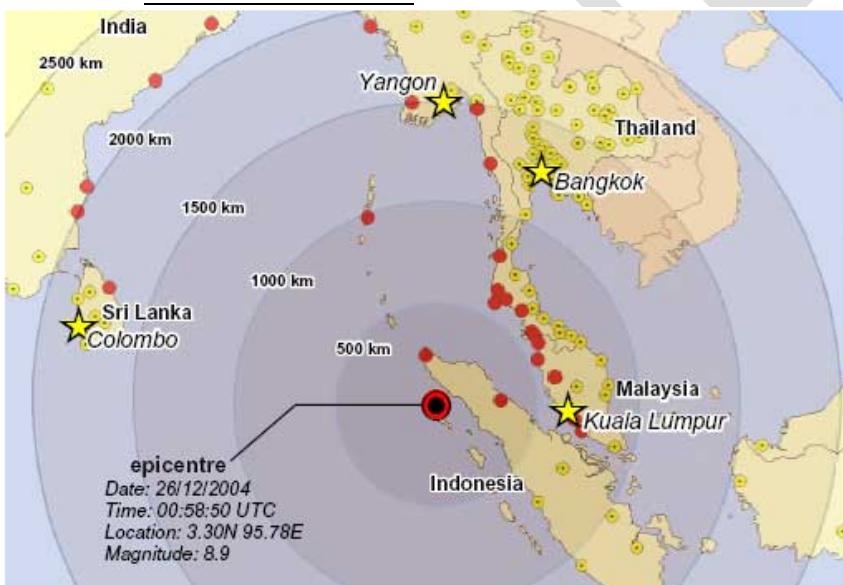
## 5. TSUNAMI

### - Example Questions

1. On December 2004, tsunami brought havoc in 14 countries including India. Discuss the factors responsible for the occurrence of Tsunami and its effects on life and economy. In the light of guidelines of NDMA (2010) describe the mechanisms for preparedness to reduce the risk during such events. [15 marks, 250 words][CSM 2017]
2. Discuss the key steps taken by India towards Tsunami Disaster Preparedness since the 2004 Tsunami? [10 marks, 150 words]

### - Introduction

- The term Tsunami has been derived from the Japanese term 'Tsu' meaning harbour, and 'nami' meaning waves. Thus tsunami means 'harbour waves'..
- Tsunami consist of a series of waves which rise as high as 10 meters or more. They move inland, several hundred kms causing untold disasters. These waves move at great speed and sometimes they move even 50 km/h on the coastal plains.
- **26th Dec 2004 Tsunami/Great Sumatran Andaman Earthquake / Asian Tsunami / Boxing Day Tsunami**
  - An undersea earthquake occurred on Dec 26, 2004, with an epicenter off the west coast of Sumatra, Indonesia. The earthquake triggered a series of devastating Tsunamis along the coasts of most of the countries bordering the Indian Ocean. 225,000 people were killed in 11 countries.



- The earthquake which triggered the Tsunami was of a magnitude between 9.1 to 9.3 on the Richter scale. It is second largest earthquake ever recorded on a seismograph. This earthquake lasted for about 10 minutes. It caused entire planet to vibrate as much as 1 cm and triggered other earthquakes as far as Alaska.

### - Causes of Tsunami

1. **Earthquake** of more than 6.5 on the Richter Scale, with a vertical disruption of water column due to vertical tectonic displacement of the sea bottom along a zone of fracture in the earth's crust is the most important cause of Tsunami.

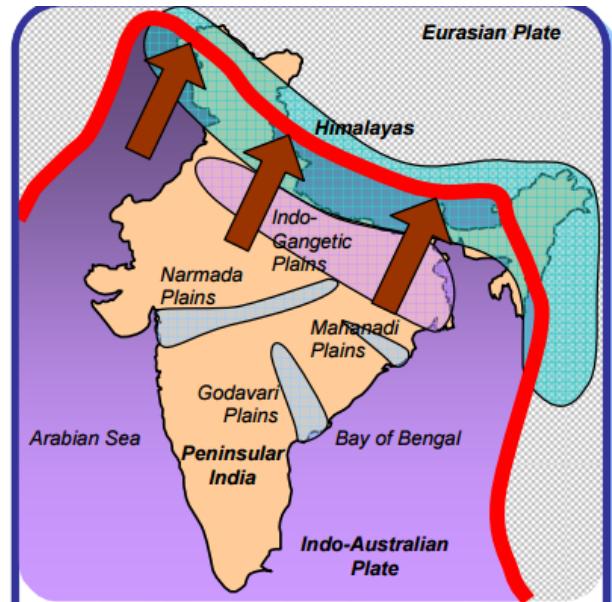
2. **Volcanic Eruption**, and **submarine landslides** are other reasons which may displace water and cause it to inundate coastal region.
  3. **Nuclear Explosion**, **fall of large celestial bodies** (like asteroid, meteorites, comets etc can also cause Tsunami)
- **Tsunami Detection**
    - i. **Different Ways to detect Tsunamis – Coastal tidal gauges, Satellite technologies; deep ocean assessment and report** (using pressure changes)
    - ii. **State Preparedness Measure Before Tsunami**
      - Hazard Mapping: Identify Tsunami prone areas
      - Establishment of Early Warning System
      - Educate people in these regions about Tsunamis - inform them about the evacuation routes in case a Tsunami hits the coast.
      - Mock Evacuation drills should be conducted periodically so that people are aware of it
      - Capacity Building to deal with Tsunami disaster
      - Provisions for sufficient provisions during emergency
      - Land use planning and engineering solutions
        - Increasing plant biodiversity along the coast.
    - iii. **Preparedness by citizens**
      - Live at safe distance from coastline; in elevated houses; well managed drainage system; easy access to information system like TV radio etc; following SOP during Tsunami.
    - iv. **Tsunami Response**
      - **People on Land:** After warning sound move to safer places with cattles (top floor of the multi-storied buildings); stay away from rivers that flow into the oceans; Listen to radio and TV for updates regularly.
      - **People on Sea:** Don't return to coast; if time is available move to deeper waters;
      - **Government:** Search and rescue; basic services like water, first aid etc.
  - **Nodal Agency for Tsunami Forecast:** Indian National Center for Oceanic Information Services (INCOIS)
  - **Steps taken by India Since 2004 Tsunami:** The **2004 Tsunami highlighted the clear lack of preparedness** about Tsunamis all over the world. None of the affected countries, including India had any system for early warning of such Tsunamis, nor was there any plan for emergency response. Learning a lesson from 2004 Tsunami, GoI have taken a number of steps:
    1. **Early Warning System:** GoI has established the state-of-art India Tsunami Early Warning Centre (ITEWC) (operational since 2007) at the Indian National Centre for Ocean Information Services (INCOIS) as an autonomous body under Ministry of Earth Sciences.
    2. INCOIS has extended **GIS-based 3D protocol on Tsunami warning to all vulnerable areas** in the country with new methodologies and improved warning procedures.
    3. **Strengthening Tsunami Research** has been a key focus of GoI since 2004.
    4. **National Disaster Management Guidelines** for management of Tsunami, 2010
    5. **Regular Mock Drills** are conducted by NDMA, INCOIS and Ministry of Home Affairs

- These exercises help familiarize participants with their responsibilities, actions required and further help them evaluate the Standard Operating Procedure (SOP) for Tsunami warnings.

## 6. Awareness generation programs in coastal area is also conducted regularly since 2004.

### - Steps that we further need to take

- Improve EWS: Advanced technology such as Artificial Intelligence and Machine learning should be incorporated to improve the Early Warning System in the country.
- Increased International Collaboration in real time monitoring will help support each other during emergencies.
  - BIMSTEC can play a very important role in promoting this collaboration in Bay of Bengal region.
- Regular training and Capacity building through workshops, drills etc. can help us avoid the 2004 scenario.
- Land use planning is one area which has been mostly ignored.
  - There is a requirement of more vegetation cover in coastal region, but various studies have shown that mangrove cover has gone down over the years.
- Removing the limitations of India's disaster management institutional framework



**Figure 1: Geographical Layout and Tectonic Plate Boundaries at India**

## 6. EARTHQUAKE

### - Introduction

- India lies at the northwestern end of the Indo-Australian Plate, which encompasses India, Australia, a major portion of the Indian Ocean and other smaller countries.
- The major reason for the high frequency and intensity of earthquakes is that Indian plate is driving into Asia at a rate of approximately 47 mm/year.
- According to NDMA, about 59% of India's land could face moderate to severe earthquakes.

### - Different zones

- Bureau of Indian Standards, based on the past seismic history, grouped the country into four seismic zones, viz. Zone-2, Zone-3, Zone-4 and Zone-5. Of these, Zone 5, is the most seismically active region, while zone 2 is the least.
- The Modified Mercalli (MM) intensity, which measures the impact of the earthquakes on the surface of the earth, broadly associated with various zones, is as follows :

#### ▪ Seismic Zone Intensity on MM Scale

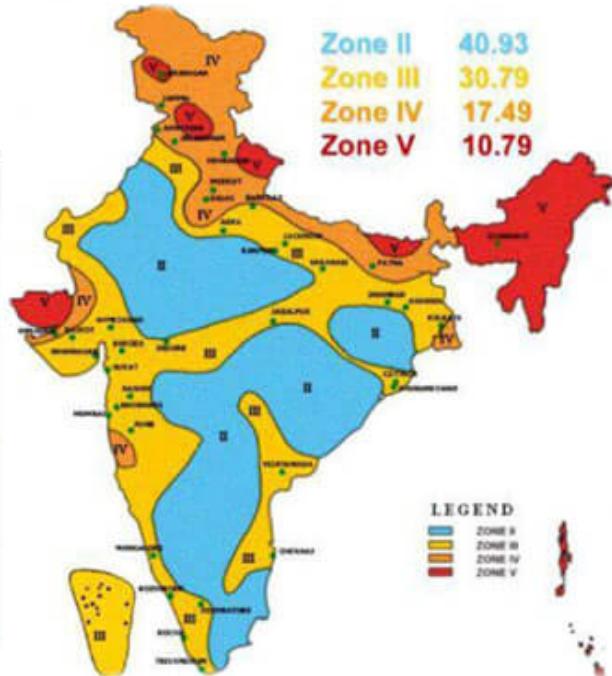
Seismic Zone Intensity	MM Scale
Zone - V ( Very High Intensity zone)	IX (or more)

Zone -IV (Severe Intensity Zone)	VIII
Zone - III (Moderate Intensity Zone)	VII
Zone - II (Low Intensity Zone)	VI (or less)

- **Zone 5:** Areas with highest risk; suffers earthquakes of intensity MM IX or greater; IS code assigns zone factor of 0.36 for Zone 5.
  - **Regions in India:** Parts of J&K, Himachal Pradesh, Uttarakhand, Parts of North Bihar, Entire North eastern region, and Andaman and Nicobar Islands.
- **Zone 4:** Areas within High Damage Risk Zone and covered areas are liable to MM VIII; IS code assigns a zone factor of 0.36 for Zone 4
  - **Regions in India:** Parts of J&K and Himachal Pradesh, UT of Delhi, Northern Part of UP, Bihar and Bengal, Sikkim, Parts of Gujarat, Small Portion of MHA near the west coast and Rajasthan.
- **Zone 3:** Classified as Moderate Damage Risk Zone; liable to MM VII; IS code assigns zone factor of 0.16 for zone 3.
  - **Regions in India:** Kerala, Goa, Lakshadweep islands, and remaining parts of Uttar Pradesh, Gujarat and West Bengal, parts of Punjab, Rajasthan, MP, Bihar, Jharkhand, Chhattisgarh, Maharashtra, Orissa, Andhra Pradesh, Tamil Nadu and Karnataka.
- **Zone 2:** The region is assigned low damage risk. The IS code assigns zone factor of 0.10 (maximum horizontal acceleration that can be experienced by a structure in this zone is 10% of gravitational acceleration) for Zone 2.
  - **Region:** Rest of India.
- **Zone 1**
  - Since the current division of India into earthquake hazard zones does not use Zone 1, no area in India is classed as Zone 1.

**Seismic Zone, Map of India 2002**  
About 59 percent of the land area of India is liable to seismic hazard damage

Zone	Intensity
Zone V	Very High Risk Zone Area liable to shaking intensity IX (and above)
Zone IV	High Risk Zone Intensity VIII
Zone III	Moderate Risk Zone intensity VII
Zone II	Low Risk Zone VI (and lower)



### - Causes of Earthquakes

- The important causes of earthquakes can be divided into two categories: Natural and Manmade

#### i. Natural Causes

1. **Tectonic Movements**
2. **Volcanic Activities**
3. **Adjustment in the inner rocks beds (Plutonic Earthquakes)**
  - Adjustment between Sima and Sial in the interior of the earth's crust.
4. **Pressure of Gases in the interior**
  - The expansion and contraction of gases in the interior of the earth sometimes cause a sudden shake on the earth's surface
5. **Other causes**
  - Landslides and avalanches
  - Denudation of landmasses and deposition of materials

#### ii. Man-made causes

1. **Dams:** Impounding of large quantity of water behind the dams disturb the crustal balance and can cause earthquakes
2. **Nuclear Bombs**
  - The shockwaves through the rocks set up by underground testing of Atom bombs or Hydrogen bombs may be severe enough to cause an earthquake.

#### iii. Causes which make India very vulnerable

- Fragile built environment (Similar sized earthquake in Japan or USA will cause much smaller damage)

### - Consequences of Earth Quakes

- Human and livestock loss
- Damage to Property
- Tsunamis
- Change in river course - floods
- Fountain of muds
- Landslides

- **NDMA Guidelines for Management of Earthquake: Six Pillars of Earthquake Management in India**
  - a. Ensure the incorporation of earthquake resistant design features for the construction of new structures.
  - b. Facilitate selective strengthening and seismic retrofitting of existing priority and lifeline structures in earthquake-prone areas.
  - c. Improve the **compliance regime** through appropriate regulation and enforcement.
  - d. Improve the **awareness and preparedness** of all stakeholders.
  - e. Introduce **appropriate capacity development interventions** for effective earthquake management (including education, training, R&D, and documentation).
  - f. **Strengthen the emergency response capability** in earthquake-prone areas
- **Earthquake hazard Reduction and Mitigations**
  - Earthquake is a natural phenomenon which is **difficult to prevent and therefore we can only prepare for the earthquake and post-earthquake response**. The foreknowledge of potential danger areas can help mitigate the impact of a disaster.
- **Steps that needs to be taken**
  - **Short Term Steps:**
    1. **Preparing Vulnerability Map** of the country
      - Establishing infrastructure for early warning system in vulnerable areas.
    2. **Strengthening Early Waring Infrastructure** -> for providing those crucial extra seconds of a minute in disaster scenario.
    3. **Strengthening Institutional Framework** -> Shortage of manpower in SDRF and NDRF should be rectified. Local governments, NGOs etc also need to be prepared for post disaster response especially in vulnerable areas.
    4. **Implementing Building Codes** -> Municipalities need to ensure that BIS codes and guidelines are properly being followed in new buildings.
      - The lifeline buildings which have been built in the past and are not earthquake resistant needed to be upgraded by retrofitting techniques
    5. **Improving building code** through a new architecture regime and this be made mandatory for all builders and developers.
    6. **Educating people** through dissemination of information about the ways and means of minimizing the adverse impacts of earthquakes. Dissemination of techniques such as 'Drop, Cover and Hold' is very important reducing the loss of life during earthquakes.
      - **Community preparedness** is very important for dealing with earthquake. Though we have NDRF and other bodies to do search and rescue operations, but experience shows that most of the time it is the community which plays the first

hand role in disaster situation and therefore they have to be given proper training regarding search and rescue as well.

- Community should have a disaster emergency kit ready for disaster situation
  - Community also needs to participate in planning, implementation and monitoring process of any method being used.
- **Long Term steps:**
    1. **International Collaboration**
      - We should collaborate with other countries in development of earthquake resistant infrastructure. Our collaboration with countries like Japan will be very crucial in enhancing our preparedness for earthquakes.
    2. **Decongesting of Cities** to reduce risk and vulnerabilities
- **Conclusion**
    - Earthquake may not yet be predictable and certainly not preventable, still if effective and timely steps are taken, the adverse impact of Earthquakes can be considerably blunted.
- ## 7. HEATWAVES - ALREADY COVERED IN PREVIOUS BOOKLETS
- **Why in news?**
    - » Many Heat wave deaths in Uttar Pradesh and Bihar (June 2023)
    - » Earlier in April 2023, **13 people died from apparent heatstrokes** while attending a government award function in an open space in Navi Mumbai. This is possibly the biggest ever heatwave-related death toll from a single event in the country, and brings back to spotlight on potential risks from heatwaves, whose intensity and frequency is expected to rise because of climate change.
  - **Example Questions**
    - » What are heat waves? Suggest a strategy to reduce India's vulnerability to heatwaves. [15 marks, 250 words]
    - » With a focus on the Oct 2019 guidelines from the National Disaster Management Authority (NDMA), discuss the mechanisms for preparedness to deal with Heat Waves in India. [15 marks, 250 words]
    - » Heatwaves can pose economic challenges to various sectors. Evaluate the economic consequences of heatwaves on industries such as agriculture, tourism, and energy, and suggest some measures to minimize their adverse effects [15 marks, 250 words]
  - **Definition**
    - A heat wave is a **period of abnormally high temperatures, more than the normal maximum temperature** that occurs during the summer season usually in the north-western parts of India. In India, heat waves typically occur between March and June, and in some rare cases extend till July.
    - **Indian Meteorological Department (IMD)** has given following criteria for heat waves.
      - **Maximum Temperature of at least 40 degree Celsius for Plains, 37 degree Celsius for coastal regions** and atleast **30 degree Celsius for hilly regions**.
  - Following conditions are used declare heat waves:

- a. **Based on Departure from Normal**
  - **Heat Wave:** Departure from normal is 4.5 degree to 6.4 degree
  - **Severe Heat Wave:** Departure from normal is > 6.4 degree
  
- b. **Based on Actual Maximum Temperature (for plains only)**
  - **Heat Wave:** When actual maximum temperature  $\geq$  45 degree Celsius
  - **Severe Heat Wave:** When actual maximum temperature  $\geq$  47 degree Celsius.
  
- **Note:** Heat wave has not been notified as a disaster by the Government of India yet and hence is not eligible for relief under National/State Disaster Response Fund norms.
  
- **Increasing cases of Heat Waves in India:** According to Lancet Report, India faced 60 million heatwave exposure events in 2016, a rise from 40 million exposures in 2012. Similarly, the average length of heat waves in India ranged from 3-4 days, which is more than double of global average of 0.8 - 1.8 days. The key factors responsible for this are:
  - » **Climate change -> higher temperatures**
    - According to a report by UNICEF "*The Coldest year of the Rest of Their Lives*" - nearly every child will face frequent heatwaves by 2050.
  - » **Sparser Pre Monsoon shower and Delayed Monsoon**
    - This weather pattern coupled with El-Nino effect, which often increases temperature in Asia, combine to create the record high temperatures.
  - » **The Loo (hot and dry winds) originating from Pakistan and Northwest India**, has also contributed to increasing temperature in India.
  - » **Urbanization and its problems like Urban Heat Island (UHI) Effect** exacerbates the problem of heat wave in many parts of our country.
  - » **Decreasing Tree Covers ->** concrete jungles, land heats up more.
  
- **Impact of Heatwaves**
  - » **Health Impacts**
    - The heat waves are associated with increased rate of heat stress and heat stroke, worsening heart failures and acute kidney injury from dehydration.
    - Children, elderly and those with pre-existing morbidities are particularly vulnerable.
    - According to NDMA, more than 24,000 people have died in India due to heat waves between 1992-2015.
  - » **Economic Loss**
    - According to Lancet, the output of workforce in India declined by 7%, equivalent to 75 billion labor hours every year.
  - » **Worsening of air pollution problems** -> increased electricity use -> more fuel burned.
  
- **Steps Taken So Far**
  - » The **IMD** has regularly issued heat wave warnings in different parts of the country to make people aware of the worsening situation.
  - » The **NDMA** has suggested things like covering of head, cross-ventilating rooms and sleeping under a slightly wet sheets.

- **NDMA's revised guidelines for prevention and management of Heat Waves in India (Oct 2019)**
  - » **Aim/Objective**
    - The guideline aims to provide framework for developing Heat Action Plans for implementation, inter-agency coordination and impact evaluation of heat wave response activities in cities/towns.
  - » **Developing a Heat-wave Plans**
    - Generating heat wave risk and **vulnerability map and mapping hotspots** for developing a strategic mitigation action plan.
    - Identifying **Vulnerable Population** - elderly, pregnant women, chronic disease patient, resident of a particular type of housing, certain type of occupations etc.
    - **Identification and Evaluation of factors** leading to disproportionate increase in temperature in the city
  - » **Reducing Temperature** in the cities through vertical gardens, small parks with water fountains etc.
  - » **Coordinate with Research institutions** for better built environment.
    - Government budget should allocate funds for R&D in this field
  - » **Curb Future UHI manifestation** by incorporating findings from the built environment assessment
  - » Adhere to city building codes.
  - » **Preparedness at the local level** for health eventualities.
  - » **Health care system capacity building**
  - » Collaboration with private and Non-Government and Civil Society
  - » Establish Early Warning System and Communication Systems
  - » Developing inter-agency response plan and coordination in the field.
- **Other Steps that can be taken:**
  - » **Preparedness:** Already discussed with NDMA guidelines
  - » **Response:**
    - Ensuring quick advanced communication and guidelines during heatwave condition.
    - Drinking water supply should be increased along the roadside during heatwave conditions
    - Health facilities should respond with all the relevant facilities.
- **Other steps:**
  - » **Reviewing the existing occupational health standards, labor laws, and sector regulation** for worker's safety.
    - **Special focus on farm laborers** as the agricultural sector was more vulnerable compared to the industrial and service sectors because workers there were more likely to be exposed to heat.
  - » Increased work on amenities like increased access to drinking water, indoor ventilation, healthcare, regular work breaks, and protection against wage loss.
  - » **Promoting more greenery throughout the city** especially on both sides of the roads to ensure cooler roads.
  - » **Making communities more aware and resilient** to after effects of the heatwaves.

- » Internationally, the **global community** should work towards achieving the **climate change mitigation goals** by working towards Paris Climate targets and making the NDCs more ambitious.

## 8. DROUGHTS

- **Important Quotes:**
  - » "Indians know that the Monsoon is the real finance minister of India" - Environmental Activists Sunita Narain
- **Intro**
  - » Drought is a period of below average precipitation in a given region, resulting in prolonged shortages of its water supply, whether atmospheric, surface water or ground water. A drought can last for months or for years.
- **Types of droughts**
  - » **Meteorological drought** is brought about when there is a prolonged time with less than average precipitation. Meteorological drought usually precedes other kinds of drought.
  - » **Agricultural droughts** are droughts that affect crop production or ecology of the range. They are caused by shortfall in water available to the crops. It can be caused by extended period of low precipitation, poor water management, soil erosion or other such situations.
  - » **Hydrological drought** is brought about when water reserves available in sources such as aquifers, rivers, lakes and reservoirs fall below the statistical average. Hydrological drought tend to show up more slowly because it involves stored water that is used but not replenished. Like an agricultural drought this can be triggered by more than just a loss of rainfall.
  - » **Socioeconomic droughts** occur when water shortage starts to impact people's lives, individually and collectively.
- **Causes**
  - » **Natural Factors**
    - **Precipitation deficiency**
      - **El Nino Southern Oscillation:** All the severe meteorological and hydrological droughts between 1870-2018 were found to be caused due to positive phase of ENSO (El Nino Southern Oscillation)
      - Lack of pre-Monsoon shower. For e.g. in 2019, India witnessed the second driest pre-monsoon season in 65 years.
    - **Dry Season**
    - **Land Degradation** - Desertification, erosion etc.
  - » **Anthropological factors**
    - **Poor water management**
      - Subsidies on equipment and electricity usage has encouraged over-exploitation of ground water.
      - Surfeit of dams have wreaked havoc on riverine system.
      - Poor rainwater conservation - Currently India captures only 8% of its rainfall - one of the lowest in the world.

- Too much focus on **water consuming power generation** (like coal based power plants)
  - **Agricultural inefficiencies** - Agriculture consumes more than 90% of India's water use. 80% of this water is used for water guzzling crops like rice, wheat and sugarcane. Further, less penetration of technologies like drip irrigation and other forms of micro-irrigation also leads to inefficient water utilization.
  - **Improper and Unsustainable implementations of Watershed Development Programs**
  - **Water pollution** - India ranks 120th among 122 countries in a global water quality index.
  - **Climate Change** - The global temperature is already higher by more than 1 degree Celsius from the pre-industrial era. This has also contributed in the spell of drought in India. For instance, drought continued in India post 2016 despite a change from El-Nino conditions due to climate change.
- **Impacts of Droughts in India:** For a developing country like India where more than 50% of the population is still dependent on agriculture, the drought comes as a bane. The negative impact of drought can be summed up under the following heads.
  - i. **Physical - Geographical-Environmental Impact:**
    - Meteorological drought adversely affects the recharge of soil moisture, surface runoffs and ground water. Rivers, lakes, ponds etc. tend to dry up.
    - **Exacerbates ground water extraction and depletion**
    - Increases **water and soil pollution** - for instance deeper borewell have higher chances of arsenic and fluoride contamination.
  - ii. **Economic Impact:** According to MoEF&CC - desertification, land degradation and drought cost India nearly 2.5% of GDP in 2014-15.
  - iii. **Impact on Agriculture** - Large percentage of agriculture rain dependent -> reduction in agri output
    - shortage of food and other agri-produce -> **inflation**
    - Reduced farmers income -> **increased farmer distress** -> increased farmer suicide
  - iv. **Other Economic and Social Impacts**
    - **Water Security:** Scarcity of drinking water -> **Health issues**
    - **Energy supply** may get impacted if the country increases its dependency on hydropower. (Note: India gets 17% of its electricity from Hydropower)
    - **Loss of livelihood** -> **unemployment** -> **Poverty** -> **Distress migration to cities, sale of property & livestock**
    - **Slowing down of secondary and tertiary activities** due to fall in agricultural production and decline in purchasing power.
    - **Increasing inequality** -> Drought hampers weaker section of society including farmers, landless workers, weavers, artisans etc.
    - **Social stress and tension**, disruption of social institutions and increase in social crime
      - Growth in superstition, increasing belief in supernatural powers etc.
  - v. **Increased inter-state and International river water dispute** -
    - e.g. the Cauvery water dispute between Karnataka and Tamil Nadu exacerbated during less rainfall year.
    - E.g. the disputes between India and China for the water distribution of 10 major rivers originating in Tibet

- **How is Drought Declared in India**
  - According to the Manual for Drought Management 2016 - **two factors** are considered for drought:
    - i. The extent of rainfall deviation (depreciation)
    - ii. The consequent dry spell
  - **Four indicators are used to assess the extent of drought**
    - Agriculture, Remote Sensing, Soil Moisture and Hydrology
    - Each impact indicator has various levels of severity
  - **For severely drought-hit** - at least 3 of the four indicators must indicate drought
  - **For Moderate drought-hit** - at least 2 (in addition to rainfall) must check out
  - **If only one indicator** (in addition to rainfall) checks out, the area is not considered to be drought affected.
  - **Impact of Drought Declaration**
    - In case of severe category of drought, assistance can be got from **National Disaster Response Fund** for mitigation and relief.
  - **Concerns of States**
    - States are unhappy with the recent drought manual as it has made it difficult to establish severity of drought and would drastically reduce assistance from the Centre's National Disaster Relief Fund (NDRF).
    - Sometimes only 10-20% of the state's area is under drought. In such cases Center has overlooked the severity of drought in a limited area and the state gets no assistance from the National Disaster Response Fund.
- **Drought Relief Measures / Coping with droughts**
  - Management of drought has now been outlined in much elaborate manner in the drought manual issued by the ministry of Agriculture and Cooperation.
    - **Drought Monitoring:** Continuously monitoring rainfall situation and the available water in various lakes, rivers, tanks etc. This will help us to plan better for the impending drought scenario.
    - **Contingency Crop Planning:** All the stakeholders need to prepare the contingency crop plan and disseminate it among farmers with the help to support agencies, mentioned below. The alternative crop planning involves choosing suitable crops and/ or crop varieties, alternative crop strategies, mid season's corrections and crop life saving measures.
    - **Relief Employment:** The most important relief component is the generation of employment provision during drought period. Extension of MGNREGA, Food for Work program of various states etc. can play a big role in relief employment.
    - **Water Resource Management** - One of the most critical task of relief operations - measures such as augmentation of water supply, rationing of water use, and efficient utilization and management of water resources, in both urban and rural areas
    - **Food Security** is one of the most important objective of drought management. It is provided through food for work programs etc.
    - **Relief through tax waivers and concessions**

- **Cattle Camp and Fodder Supply:** State governments need to support their farmers in protecting their cattle population during a drought situation by providing necessary assistance for fodder, feed, and cattle health. During the drought situation, every measure needs to be taken to save useful cattle. If the cattle wealth is depleted recovery will be slow.
  - **Health and Hygiene:** During drought health issues related to contamination of water and spread of infection among workers of public work program has been seen. Health relief is also an important component of drought relief.
  - **Institutional Response**
    - Drought management requires a strong institutional structure to monitor and provide a timely response to drought. While it is primarily the responsibility of the state government to manage drought, the central government also plays an important role in monitoring drought and providing financial assistance to the states.
    - The **district administration headed by the collector** plays the most critical role in responding to drought on the ground. At the central level, the ministry of Agriculture is the department responsible for drought monitoring and management.
  - **Role of Panchayati Raj Institutions**
    - It is necessary to include PRIs in all the operations as they are more connected to ground and have better understanding of the regional problems.
  - **Information management and Media Coordination**
    - The Central and State governments should provide information on all aspects of drought to people and media. It is necessary to inform the people about the severity and impact of drought and the measures being taken to alleviate the drought situation.
  - **Some Limitations of Drought Management in India**
    - Drought management continues to be inadequately addressed in India due to **improper planning and coordination** between different functioning units and **poor implementation** at the ground level.
      - There is a **lack of focus on long term sustainability and livelihood issues** and quick fix solutions are resorted too
    - **The process of declaration of drought** has been made **long and difficult** by the drought manual issued by central government in 2016.
      - This prevents timely relief measures like drinking water supply, subsidized diesel and electricity for irrigation, increasing number of days of work under MGNREGA etc.
- **Way Forward**
1. **Scientific mapping of Drought Prone areas**
  2. **A system of Early Warning** at least in drought-prone areas
  3. **Robust methodology for Drought declaration**
  4. **Holistic and Sustainable Development of Watershed** with community participation.
  5. **Efficient utilization of water in Agriculture** - since it accounts for 80% of India's water use
    - Awareness programs regarding the efficient use of water

- Using advanced improved methods of irrigation like micro-irrigation - sprinkler and drip irrigation.
  - **Change in cropping pattern.**
    - Awareness
    - Reform in MSP regime - to cover more millets, pulses, oilseeds etc.
  - **Rationalize electricity charges** for farmers - to prevent overuse and overexploitation of ground water.
6. **Preservation of Rain water in both Urban and Rural Areas** - Rainwater harvesting, Recycling of treated water.
- Improve and Implement building codes to promote water conservation and rainwater harvesting.
7. **Afforestation**
- It ensures water retaining capacity of the soil and also increases the chances of rainfall.
8. **Paris Agreement Targets**
- National Action Plan on Climate Change and State Action Plan on Climate Change needs to get into implementation mode very quickly.

## 9. DAM SAFETY

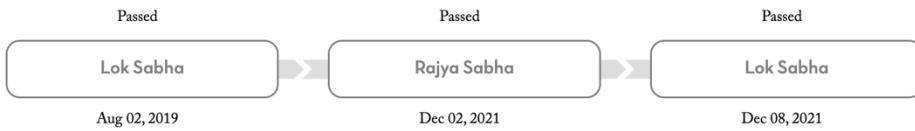
- **Why in news?**
  - In Oct 2023, Sikkim's highest Dam (Teesta-III Dam at Chungthang) was washed away after an GLOF which raised doubts about hydropower projects being developed in the country (Oct 2023)
    - Various reports have since revealed that there were no EWS, no risk assessment or preventive measures in place as required under the 2021 Dam Safety Act.
- **Example Questions**
  - Discuss the key provisions of the Dam Safety Act 2021. How far does it go in ensuring structural and operational safety of dams [12.5 marks, 200 words]
  - What are the key concerns related to Dam Safety in India? How far will the Dam Safety Act, 2021 be able to resolve these concerns? [10 marks, 150 words]
- **Introduction**
  - Dams are playing a very important role in the development of India. They not only supply water for irrigation, but also contribute in flood control and Energy generation (around 17% of India's total electricity).
  - In terms of **number of Dams**, India stands third in the world with more than 6,000 large dams in operation and another 400+ large dams under construction. Further, India has thousands of medium and small dams.
  - However, a **poorly maintained and ill-operated dam** can become a source of threat not only for human life and infrastructure, but also for the environment. Therefore, there has been a long felt need of a **uniform law and administrative structure** in the country for the purpose of dam safety.
- **Key concerns associated with Dam Safety in India**

- » **Very Old Dams** - around 4% (227) of large dams are more than 100 years old and 80% are more than 25 years old.
- » Many of these dams are located in earthquake prone zones.
- » India has faced 36 major dam failure in the past, the worst one of Machchhu Dam (Gujarat) in 1979 in which about 2000 people had died.
- » There are **varying degree of inadequacies** in meeting the current standards of dam health and safety.
  - **Poor Implementation** of the existing safety provisions
  - A report by CAG has found that
    - The structural strength of 348 large dams are suspect and they have not been inspected for over a decade.
  - Similarly, the **world bank report on Dam Rehabilitation and Improvement Project (DRIP) indicates** that the implementation of the program has been moderately unsatisfactorily.

- **Institutional Framework/Programs/Schemes dealing with dam safety in India**

- **The Central Water Commission**, Ministry of Jal Shakti through the National Committee on Dam Safety (NCDS), NDSO, SDSCO etc has been making constant endeavours in the direction of Dam Safety.
- **Dam Rehabilitation and Improvement Project (DRIP)** is being implemented by Ministry of Jal Shakti with assistance from World Bank.
  - The main objectives of DRIP are:
    - TO improve the safety performance of selected existing dams (223 dams across 7 states) in a sustainable manner
    - To strengthen the dam safety institutional set up in participating states as well as at central level.
  - The seven DRIP states are - Uttarakhand, Madhya Pradesh, Jharkhand, Odisha, Karnataka, Kerala and TN.
- **The Dam Health & Rehabilitation Monitoring Application (DHARMA)**
  - It is a webtool/app which is focused on digitizing dam related data effectively. It will help in easy identification of vulnerable dams and ensure need based rehabilitation.
- **Ministry of Power and DRDO have signed an MoU for vulnerable Hydro Projects/ Power Stations in Hilly Areas**
  - Under this they would work jointly together towards developing suitable mitigation measures against avalanches, landslides, glaciers, glacial lakes, and other geo-hazards
  - For vulnerable projects in hilly areas, expertise of DRDO will be used for developing comprehensive EWS.

## 1) DAM SAFETY ACT, 2021



- The act is aimed at helping states and UTs to adopt uniform safety procedure and thus ensure safety of the dams. It also gives statutory backing to various dam safety institutions and provides for strict punishment in case of the violation of the law.
- It provides for surveillance, inspection, and maintenance of all specified dams across the country.
  - » These dams are with height more than 15 meters, or height between 10 meters to 15 meters but with certain design and structural principle.
  - » The act establishes a **robust Institutional Framework for Dam Safety**.
    - It sets up **two national bodies**
      - i. **The National Committee on DAM SAFETY** which would evolve policies and recommend regulations regarding dam safety.
      - ii. **The National Dam Safety Authority** which would implement policies of the National Committee, provide technical assistance to State Dam Safety Organizations (SDSO) and resolve matters (dispute resolution) between SDSOs of states or between SDSOs and Dam Owners.
    - » The law also sets up **two state bodies**
      - i. **State Committee on Dame Safety** which will review work of SDSO, order Dam Safety Investigation, recommend dam safety measures and review the progress of such measures.
      - ii. **State Dam Safety Organization (SDSO)** will be responsible for surveillance, inspection, monitoring, operation, maintenance and investigation of dams.
- **Jurisdiction over dams**
  - » All specified dams will fall under jurisdiction of the SDSO of the state in which dam is situated.
  - » For dams owned by CPSU or which extends in two or more states or when a dam owned by one state is situated in other state, NDSA will have the jurisdiction and will play the role of SDSO.
- **What are states required to do?**
  - » Provisions require states to classify dams based on hazard risk, conduct regular inspections, create emergency action plan, institute emergency flood warning systems, undertake safety reviews and period risk assessment studies.
- **Duties and Functions of DAM owners** ( sufficient funds, trained manpower, dam safety units to conduct regular inspections, mandatory presence of engineers during floods and emergency, install emergency flood warning system; carry out risk assessment at regular intervals)
- **Comprehensive DAM Safety Evaluation (CSE)**
  - The act provides for comprehensive safety evaluation by independent panel of experts at regular intervals.
- **Offences and Penalties** for violation of provisions

- **Analysis of the act : Key challenges/Limitations**
  - **Jurisdiction of Parliament on the issue** (**Entry 17 of the State List read with Entry 56 of the Union List**, gives powers to state to make laws on water supply, irrigation and canals, drainage and embankments, storage etc for intra state rivers) .
  - The **functions** of the NCDS, NDSA, SCDS are listed in the schedule of the act which can be modified by government through notification. Experts have raised concerns over this kind of overwhelming powers with central government.
  - **States Raising Concerns** regarding NDSA having jurisdiction over dams owned by one state but situated in others. Some states feel that this takes away rights of states over their dams.
    - Note: TN own dams in the state of Kerala (in Mullaperiyar, Parambikulam, Tunakadavu, and Peruvanipallam)
  - **States lack technical capability** to really implement the act in terms of number of trained personnel's, engineers etc.
    - The Sikkim GLOF reveals poor compliance at all levels of dam safety, from the dam's design to the spillway capacity.
  - **Environment Impact ignored**
    - The act does not contain any norms which relates to environmental impact in the upstream and downstream of the rivers.
  - **Lack of focus on operational safety** (like rate of filling or rate of water release) could lead to continuance of cases of Dam induced floods (e.g. Kerala floods, 2018)
- **Other problems related to Dam**
  - **Lack of coordination between states** leads to faulty management of dams.
    - For e.g., the recent floods in Odisha was caused by faulty management of Hirakud Dam. One of the reasons for it was lack of information from Chhattisgarh to Odisha regarding the flow of water.
- **Way forward**
  - **Set up the institutional framework envisaged under the law**
    - **Dam Safety Policy** should be finalized quickly to act as a guiding principle towards protection of Dams.
  - **Promote More transparency:**
    - Dam Safety is a public purpose and thus everything about dam safety, functions of institutions, their reports, decision minutes and agendas, everything should be promptly available to public.
  - **Human Resource development:**
    - We will need huge human resource for ensuring that trained people man dams, engineers are available for inspection and monitoring, emergency action plan etc.
  - **Land use plans** should have dam safety issues integrated in it.
  - **Operational Safety and Environment Impact** needs to be better integrated in the act and any future policies.
  - **Increased coordination between states:**
    - E.g. of the **United States web-based integrated risk management tool** called Dam Sector Analysis tool. The tool was developed using variables from dam failure models and decision support systems, which enables the software to project downstream risk in the case of a dam failure.

**- Conclusion:**

- India's first prime minister, Pandit Jawaharlal Nehru, had referred to dams as the 'temples of modern India'. These temples would remain a boon, only if all the stakeholders work towards eliminating risks associated with Dam Safety.



# CURRENT AFFAIRS PROGRAM

## PRE CUM MAINS 2024

### DEC 2023: BOOKLET-1

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## 1. GENERAL STUDIES – 2

### 1) BHUTAN: BASIC GEOGRAPHY FACTS

- Located in eastern Himalayas, it is bordered by China in the north and India in the south.
  - » **Indian states touching Bhutan:** Sikkim, West Bengal, Assam and Arunachala Pradesh.
  - » **Thimpu** is the capital and the largest city.
  - » **Phuntsholing** is its financial center.
- **Enduring Independence**
  - » The independence of Bhutan has endured for centuries, and the territory was never colonized in its history.
- **Polity**
  - » In 2008, it transitioned from an absolute Monarchy to a constitutional Monarchy and held the first election to the National Assembly of Bhutan, that was a two-party system characterizing Bhutanese democracy.
- **Geography**
  - » 72% of land area under forest. Committed to stay carbon neutral for all the times to come.
- **Religion**
  - » Vajrayana form of Buddhism is practices here as in Tibet.
- **Welfare**
  - » Healthcare and primary and secondary education are free in Bhutan and aid is provided on the basis of merit for higher education also.



A map of Bhutan showing its borders with Tibet and India as of 2015.



### 2) INDIA-BHUTAN

## A) EVOLUTION OF INDIA-BHUTAN RELATIONS

- India and Bhutan enjoy long-standing and exceptional bilateral ties characterized by utmost trust, goodwill, and mutual understanding at all levels.
- **The Treaty of Punakha, 1910:**
  - Under this treaty, Britain (British India) guaranteed Bhutan's independence, granted increased stipend to Bhutan Royal Government and got control over Bhutan's foreign relations and defence. Thus, Bhutan had become a protectorate of British India.
- **1949 Treaty of Friendship:** After Independence of India, India and Bhutan came together for a new Treaty:
  - » The treaty called for peace between two nations and non-interference in each other's internal affairs.
  - » Bhutan agreed to let India "guide" its foreign policy and both nations would consult each other closely on foreign and defence affairs.
  - » The treaty also established free trade and extradition protocol.
  - » **Analysis**
    - The treaty had more or less succeeded in keeping India and Bhutan together.
    - On India-China issues, Bhutan has stood with India. This was seen in the 1962 war or later when Bhutan has not accepted the "package deal" for solving the boundary dispute between China and Bhutan.
- **Annexation of Tibet by China**
  - » **Brought India-Bhutan closer.**
    - Bhutan allowed India to build its first motorable road connecting Indian border to the country's capital Thimphu.
    - The period after this has seen increase in India's economic, military and development aid to Bhutan, which has also embarked on a programme of modernization to bolster its security.
    - » Indian leaders on a number of occasions have declared in the parliament that any aggression against Bhutan would be seen aggression against India.
    - » Further, both India and Bhutan have border disputes with China and thus are wary of China's misadventure in their territories.
- **Establishment of Direct Diplomatic Relations**
  - » Diplomatic relations between India and Bhutan were established in 1968 with the establishment of special office of India in Thimphu. Before this our relations with Bhutan were looked after by our political officer in Sikkim.
    - So in 2018, we have completed **50 years of diplomatic relations**.
- **Continuous Indian Support for Bhutan**
  - » Since 1960s, India has played a crucial role in infrastructure development of Bhutan. India constructed roads (under project Dantak by BRO), Bhutan's first airfield at Paro and provided grants/loans for a number of hydel power projects.
- **India-Bhutan Friendship Treaty of 2007**

» **Need of the new treaty**

- There was an increasing view among Bhutanese people that the 1949 treaty was an unequal one and that India may hold Bhutan hostage for its own geo-political interests under the treaty. This was creating friction in India-Bhutan relations.

» **Key Highlights**

- The treaty reaffirmed the two country's respect for each other's independence, sovereignty and territorial integrity.
- It has removed the provision requiring Bhutan to take India's "guidance" on foreign policy matter.
- The treaty also provides that India and Bhutan shall cooperate closely with each other on issues relating to national interest. Neither government will allow the use of its territory for activities harmful to the national security and interest of others.

» **Significance**

- The treaty has been good for India too as India had never invoked the "guidance" provision but the provision was used as an argument by our adversaries to portray India as a hegemon.
- Since this treaty, Bhutan has followed a more open foreign policy and have established diplomatic relations with many countries.

- **2007: Constitutional Monarchy** from absolute monarchy.

- **Efforts to strengthen Political Ties:**

▪ **Bilateral Visits:**

- Bhutan was the destination of PM Modi's first foreign visit in 2014. It showed the importance India gave to the political relations to our neighbouring countries and specially with Bhutan. The visit was seen as a 'charm offensive' that sought to check Bhutan-China relations that had recently been formalized. A number of steps were taken to strengthen India Bhutan relations. For e.g. India increased annual aid to Bhutan, increased scholarships to Bhutanese students and signed several agreements related to border infrastructure.

- In Nov 2014, the President of India visited Bhutan after a gap of 27 years. Agreements related to increased cooperation in the field of education and infrastructure was finalized.

- Visit of His Majesty, the Bhutanese King Jigme Khesar Namgyel Wangchuk to India (April 2023)

- India and Bhutan discussed the "entire gamut" of bilateral cooperation and issues of national and regional interests, and that the two countries share an "exemplary" relationship of "trust, goodwill and mutual understanding".

- Visit of His Majesty, the King of Bhutan to India (Nov 3-10, 2023)

• **Key highlights:**

- The visit saw discussions on the entire gamut of bilateral cooperation on regional and global issues of mutual interest.

- The two sides assessed the expanding partnerships between the two countries, including in new areas of connectivity in its broadest form, cross border trade infrastructure, trade and mutual investments, energy, Health, Education, Skill Development, Space technology, environment conservation, and close people to people contact.

## B) IMPORTANCE OF INDIA FOR BHUTAN

### 1. Security

- India acts as overall security provider for Bhutan.
  - E.g. In the Doklam crisis issue, India had stayed with Bhutan
- The Indian Military Training Team continues to train Bhutanese soldiers.
- The 2007 agreement legally obliges both countries to respect each other's interest.

### 2. India's support for Socio-Economic Development of Bhutan:

- India is committed to Socio-economic development of Bhutan and is Bhutan's biggest development partner. For the 12th five year plan of Bhutan, India contributed Rs 4,500 crores which constituted 73% of Bhutan's total external grant component.
  - India has also committed to continue the support for Bhutan's 13th five years plan.
  - During his visit in Nov 2023, His Majesty Jigme Khesar Namgyel Wangchuk conveyed appreciation for the invaluable support that the government of India continues to provide for Socio-Economic development of Bhutan.

Bhutan also thanked India for the timely release of development assistance to ensure smooth and uninterrupted conclusion of crucial projects.
- India has funded a number of infrastructure projects through grants/loans in Bhutan.

### 3. India is Bhutan's most important economic and trading partner: :

- India accounts for about 80% of imports and 80% of exports of Bhutan.
  - The bilateral trade between the two countries has increased from 94 billion in 2020 to 134 billion in 2022.
- Bhutan's currency, the ngultrum, is only exchangeable with Indian rupee.
- Further, Bhutan trades with other countries through India.
  - For e.g. in Nov 2023, the two countries agreed to facilitate Bhutan's trade with Bangladesh by allowing Bhutanese trade items to be carried further from Haldibari in WB to Chilhati in Bangladesh.

### 4. India's assistance with hydropower projects and Bhutan's hydropower exports form a significant component of the win-win relationship between India and Bhutan.

### 5. Socio-Cultural significance of India

- The two countries share a strong cultural tie. India in the past have provided assistance to Bhutan in preserving various cultural heritage.
- India also provides scholarships and facilities for Bhutanese students to come and study in India.

### C) WHY IS BHUTAN SIGNIFICANT FOR INDIA?

#### 1. Strategic Importance: Combating China

- Bhutan's Geographical location is very strategic for India.
  - Bhutan's border dispute with China on the western sector includes Doklam plateau which lies immediately east of Indian defences in Sikkim. This piece of dominating ground not only has a commanding view of the Chumbi valley, but also overlooks the Siliguri Corridor (Chicken Neck) further to the east.
    - Bhutan in past has not accepted generous package deals of China in 1996, that offered larger disputed areas, in exchange for sections of the 269 sq km of Doklam plateau.
    - India thus needs strong ties with Bhutan to prevent this area ever going to China.
  - During Doklam standoff in 2017, Bhutan allowed Indian troops to enter Bhutan to resist Chinese incursions.
  - Bhutan also acts as a buffer between India and China.
- Increasing Chinese Presence in Bhutan
  - India is concerned over increased Chinese presence in Bhutan and its security impact for India

#### 2. Internal Security

- Bhutan has taken action against North East Insurgent Groups
  - In the past, Bhutan undertook Operation All Clean (Dec, 2003 - Jan, 2004) to flush out thousands of BODO and ULFA militants from the jungles of southern Bhutan.

#### 3. Energy Partnership in Hydro and non-hydro renewables:

- Hydropower cooperation is an important pillar of Indian Bhutan bilateral economic partnership.
  - For e.g. during the visit of King of Bhutan to India, the two sides welcomed export surplus power by Basochhu hydro power project through the Indian Energy Exchange beginning Oct 2023 paving the way for access to another energy market. The two sides also expressed satisfaction with the progress in construction of the 1020 MW Punatshangchhu-II hydro power project and looked forward to its early commissioning in 2024.
- In Nov 2023, the two sides agreed to extend the existing India-Bhutan energy partnership in hydro and non-hydro renewables, such as solar as well as green initiatives for hydrogen and e-mobility.
- **Importance of Hydroelectric Projects:**
  - More capacity will help Bhutan reduce its trade deficit with India.
  - Cheap Power is imp for dev of North-East and reduce floods in Assam valley.

#### 4. Regional Connectivity and Sub-Regional Integration

- Nov 2023 visit of Bhutan's King Jigme Khesar was an important marker towards more bilaterally driven regional initiatives:

- A joint statement speaks of completing surveys for the Kokrajhar-Gelephu rail link that connects Bhutan to Assam, beginning discussions on another Bhutan to West Bengal rail link, while also facilitating Bhutan-Bangladesh trade, with yet another rail link, and upgrading checkpoints along the India-Bhutan border.
- These plans can contribute a lot in development of West Bengal and north-east India other than ensuring better regional connectivity.
- In past, there was a plan for BBIN MVA (Motor Vehicle Agreement).
  - But, Bhutanese Parliament decided not to endorse the plan over sustainability and environmental concerns. Therefore, In 2022, Bangladesh, Indian and Nepal moved ahead on Motor Vehicle Agreement without Bhutan. **BIN-MVA**.
    - ADB has supported the project as part of its South Asian Sub-Regional Economic Cooperation program.
    - World Bank has also announced its interest in supporting the infrastructure project.
- Though Bhutan is not participating in BBIN, its significance in improving regional connectivity can't be ignored. It is key to India's plan to push for subregional cooperation.

#### 5. Support at various international forum

- Bhutan has regularly supported India at various international forums.
- It is also the only country which has not joined China's OBOR Summit (it doesn't even have diplomatic ties with Nepal)

#### 6. New Areas of Partnership: It now encompasses Startups, Space and STEM education.

- Both sides recognize the progress made in the space sector including the launch of the first satellite jointly developed by India and Bhutan and inauguration of the satellite's ground earth station in Thimphu in 2023

### D) SOME KEY ISSUES IN INDIA-BHUTAN RELATIONS

#### 1. China's Growing economic and military influence in Bhutan poses a threat for India.

- » In October 2023, Tandi Dorji became Bhutan's first foreign minister to visit China and concluded 25th round of border negotiations. This visit underscores increasing signs of normalization of relations between the two countries.
- » India is currently observing the border negotiations carefully to ensure that the negotiations don't harm India's strategic interest.

#### 2. Growing and Unsustainable Trade Balance:

- » Trade deficit of Bhutan in its bilateral trade with India has been seen as a cause of concern. Thus, Bhutan has been seeking more access to Indian markets which could reduce the trade deficits.
- » Bhutan trade deficit has worsened with GST which makes export cheaper and imports from Bhutan more expensive, putting at peril Bhutan's industrial sector.

#### 3. Concerns related to Hydropower projects:

- » Bhutan has raised concerns that the terms associated with hydropower projects tend to favor India's interests. This has also led to negative public opinion regarding involvement of India in the hydro-projects in Bhutan.

#### 4. Other Issues

- » There are other issues like delay in project completions, finalization of tariffs and the impact of GST on these projects.
- » GST has also impacted India-Bhutan trade.
  1. For e.g. GST has brought Bhutan's Cardamom export to India to a halt.

#### E) WAY FORWARD AND CONCLUSION

- **Engaging with Political Dispensation on all sides of the spectrum**
  - The perception that India is close to PDP (People's democratic party) who ruled from 2013-18 and not very close to DPT (Bhutan Peace and Prosperity Party) who rules from 2008 - 2013 and came to power again in 2018, needs to change.
- **Keep a close eye on Bhutan-China border negotiation** and keep **Bhutan engaged so that India's interest are not hampered in border settlement**.
- **Intensify Economic Cooperation:** India needs to invest more in infrastructure development of Bhutan. This will help Bhutan revive its economy, become self reliant and create employment opportunities for its people. This will also protect Bhutan from the carrot of economic support by China.
- **Increased Connectivity:** Sub regional integration will be crucial for all the countries of the region. It will not only contribute to integration of South Asian market, but will also keep China out of the region.
- **Efficient and time-bound execution of various agreements and infrastructure projects** is another key for strong bilateral relations.
- **Conclusion**
  - » India-Bhutan ties are built on spiritual underpinning, and imperatives of geography, economy and connectivity. The key to strengthening India-Bhutan relationship is for India not to show any insecurity about this relationship, or in any way attempt to stifle differing voice, but to pursue this relationship with trust and complete faith.

### **3) BHUTAN-CHINA BORDER ISSUE**

- The main area of dispute between China and Bhutan are:

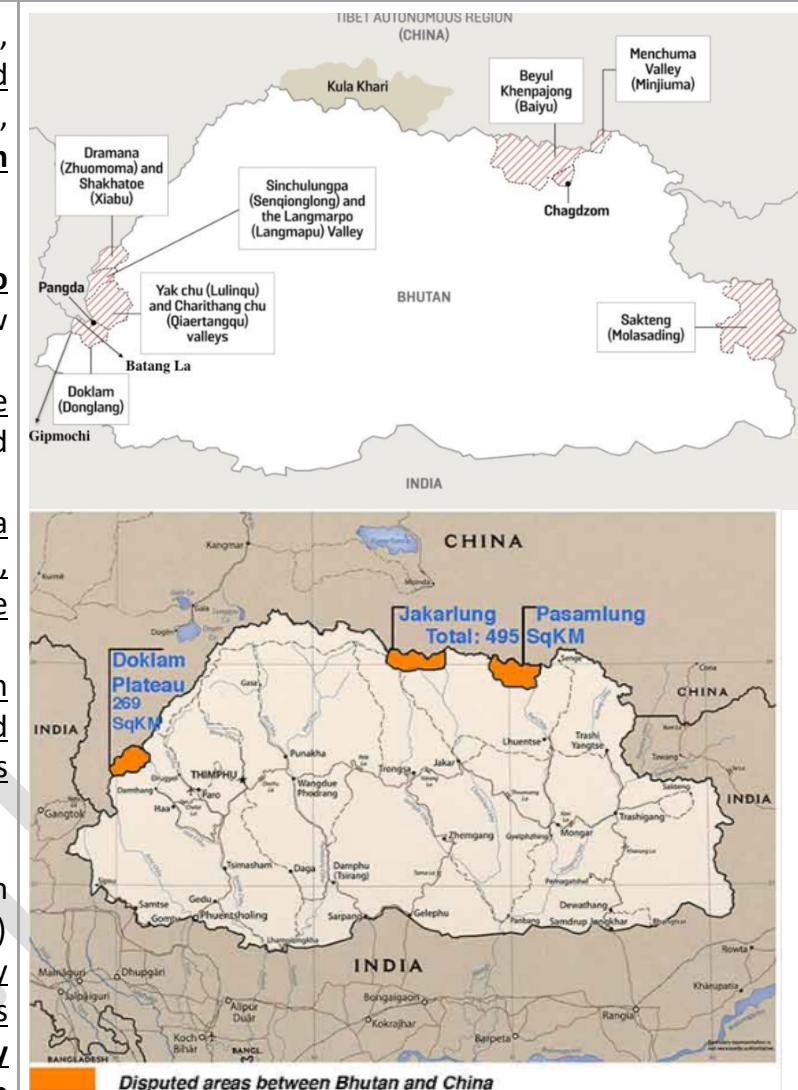
**Disputed region in West:** In the Western sector, China and Bhutan dispute are in Dramana and Shakhaote, Sinchulungpa and Langmarpo valley, Yak chu and Charithang valleys, and the Doklam region.

- These disputed regions are adjacent to China's strategic Chumbi valley - a narrow triangle between India and Bhutan.
  - **Doklam** is the only trijunction area of the sector where the borders of China, India and Bhutan meet.
  - Going by its current claims (Map-1) China intends to broaden and deepen the triangle, which will enable it to improve its offensive positioning against India.
  - Having control over Doklam offers China an in-depth presence in the valley, and strengthens its surveillance capabilities across India's Siliguri corridor.

**Jakarlung** and **Pasamlung** - the two northern areas with a total area of 495 sq km. (See Map-2)

- Geographically this sector is considerably larger than the Western sector and is culturally crucial to Bhutan. But it holds very little geopolitical and strategic importance for China and India.
  - As a result, China attempted to settle the dispute by unsuccessfully asking Bhutan to retain this region and cede the strategically crucial western sector. In the past Bhutan has rejected this package deal.

**In the east, the Sakteng (See Map-1) region stands disputed.** The assertion was made only in 2020 and presumably originates from Beijing's claim over Arunachal Pradesh. The region doesn't border China and hasn't been discussed in earlier negotiations.



- **Why is India concerned about China-Bhutan Border dispute?**
  - » If Doklam is ceded to China in the border dispute settlement, it would enable China to overlook the sensitive Siliguri Corridor that links mainland India to the north-eastern region.
  
- **Background of China-Bhutan bilateral relations:**
  - » Bhutan's relationship with China is determined by its long-standing reservations about opening up to the world and becoming embroiled in great power politics.
    - China's annexation of Tibet in the 1950s, and the subsequent seizure of eight Bhutanese enclaves exacerbated these concerns.
    - As a result, Bhutan had cutoff diplomatic relations with China and was hesitant to have diplomatic relations with the P5 countries.
    - It also embraced a special relation with India. China's perception of Bhutan being part of Tibet's five fingers continued to push Bhutan towards India.
  - » It was only with the beginning of bilateral talks in 1984 that China explicitly narrowed the disputed region to two sectors: In the north of Bhutan and in the West of Bhutan.
  
- **Why did China need to bring Bhutan on negotiating table?**
  - » For its status as an Asian power:
    - Bhutan is the only neighbouring country of China to have no diplomatic relations and 2nd out of 14 countries (other than India) to have unresolved border disputes. This challenges China's status as a rising power and Asian hegemon.
  - » Improving its offensive position vis-a-vis India.
  
- **Stick and Carrot strategy of China** to convince Bhutan to end the border dispute and establish diplomatic relations.
  - » Stick: China has continued to intimidate Bhutan by releasing new maps, encouraging border intrusions, weaponizing Tibetan herdsmen to drive away Bhutan grazers, and promoting settlements within Bhutanese territory. Further, in recent years, China has continued building new border villages in Bhutan's disputed North and Western sectors and has made new claims in Bhutan's Eastern sector.
    - In response, Bhutan has sped up its border dispute negotiations.
  - » Economic problems in Bhutan has also made Bhutan go close to China:
    - China's export to Bhutan have increased from 2 billion in 2020 to 15 billion in 2022.
    - Youth exodus triggered by structural issues and lack of opportunities has further necessitated the need for reforms.
    - For these reasons Bhutan see China has an inalienable partner for its path to recovery and reform.
  
- **In 2020, following the Galwan clashes - both Bhutan and China negotiated the three-step roadmap to demarcate borders on the table. 10th expert group meeting in 2021 and 11th, 12th and 13th in 2023 eventually culminated in 25th round of their border talks in Oct 2023.**
  - » IN 2021, Bhutan and China signed the 3-step Roadmap MoU.
    - It involves:
      - a. Agreeing to the border "on the table"
      - b. Visiting the sites on the ground

c. Formally demarcating the boundary

- » A **Joint Technical Team (JTT)** on the delimitation and demarcation of Bhutan China border was established in Aug 2023.
- » It can be noted that since 1984, Bhutan and China had held 24 rounds of talks to resolve the disputes until 2016. But the 25th round couldn't start due to Doklam standoff in 2017 and later due to Covid-19 pandemic.
- » The 25th round of talks held in Oct 2023 in China marked the end of 7 years of impasse. It was led by Bhutanese Foreign Minister Lyonpo Tandi Dorji and Vice Foreign Minister of China Sun Weidong. The talks also marked the first ever visit of a Bhutanese Foreign Minister to China.
- » **Key outcomes of the 25th round of border talks:**
  - The two sides signed a **Cooperation Agreement** detailing the function of the Joint Technical Team (JTT)
  - Both sides also expressed interest in ending the border dispute at the earliest and also exploring opportunities to establish diplomatic relations.

- **Analysis:**

- » **Bhutan realizes that it can no longer afford to ignore a swiftly changing world order** - where an assertive and economically mighty China plays a crucial role.
  - Bhutan is plagued by a number of challenges on economic front including dwindling foreign reserves, increasing trade deficit, weak private sector, looming debts etc. **China has hinted at prospects of cooperation and trade concessions for Bhutan with the establishment of diplomatic relations.**
- » At the same time, **Bhutan also needs to keep interest of its most trusted partner, India, in mind.**
  - Given **Bhutan's unique dependence on India**, there is little doubt that Bhutan will try to keep New Delhi on board in its efforts to normalize relations with China. One key redline will involve **keeping China away from southern Doklam's ridges** that overlook India's Siliguri corridor. **Infact, Bhutan has indicated that negotiations over the Doklam region would be a trilateral issue.** Similarly, in the East, it is unlikely that the concessions will include the Sektang sector - as it would open a new theatre of threat for India and also legitimize Chinas' claim over Arunachal Pradesh.
- » **India continues to watch the developments between China-Bhutan very closely:**
  - Closer ties between China and Bhutan (one of India's closest neighbours) is a cause of concern for India.
  - Despite the developments, **New Delhi hasn't made any public statements demonstrating its trust in this special relationship and understanding Bhutan's security and economic challenges.** India has understood Bhutan's reasoning in Thimphu's talks with China.

- India's interest will be best served by taking Bhutan on board and aligning strategies rather than by expecting acquiescence from a sovereign nation that will understandably pursue his own.
- Conclusion:
  - » India should approach the border negotiations between Bhutan and China with a greater understanding of Bhutan's reasoning, and with confidence that India's long-trusted neighbor will take both India's interests and its own consideration before any final agreement.



# CURRENT AFFAIRS PROGRAM

## PRE CUM MAINS 2024

### DEC 2023: BOOKLET-2

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## 1. GENERAL STUDIES – 2

### 1) INDIA SRI LANKA

#### A) SOME BASIC FACTS ABOUT SRI LANKA

Historically known as Ceylon, Sri Lanka is an island country located in South Asia. It lies in Indian Ocean, southwest of Bay of Bengal.

It is located between latitudes 5 degree 55' and 9-degree 51' North.

Gulf of Mannar and Palk Strait separate Sri Lanka from India.

**Maritime Borders:** Sri Lanka shares a maritime border with the Maldives in the south-west and India in the northwest.

Colombo, the largest city is also executive and judicial capital of Sri Lanka.

#### Important Ports of Sri Lanka:

1. **Port of Colombo:** The largest port of Sri Lanka. It is located at the mouth of river Kelani Ganga.
2. **Port of Hambantota:** It is also known as the Magapura Mahinda Rajapaksha port and is situated in the southern part of the SL. It is close to Asian and European marine trade routes, Suez Canal, and Malacca strait. It was constructed with the help of China's aid and has been given to China on a 99-year lease.
3. **Port of Galle:** Located on southwest of the country, it is the largest port of the region.
4. **Oluvil Port:** The port project was started in 2008 with the financial support of Denmark's foreign ministry. It is being developed in stages and 1st phase became operational in 2013.



1. **Port of Trincomalee:** It is located on the NE shores of SL and has the second largest natural harbour in the world. It is ten times bigger than the port of Colombo capable of accommodating ships of any size in its anchorage area.

#### B) POLITICAL HISTORY OF SRI LANKA

- **1948:** Independence proclaimed; D.S. Senanayake becomes the first Prime Minister.

- **1956:** Solomon Bhandarnaike was elected as the Prime Minister of Sri Lanka. He made **Sinhala the only official language**. More than **100 Sri Lankan Tamil people were killed** after the **Tamil members of parliament protested**.
- **1959:** Solomon Bhandarnaike was **shot by Talduwe Somarama**, a Buddhist monk. He succumbed to injuries the next day.
- **1960:** **Sirimavo Bandarnaike** becomes the **first women prime minister of the world**. She was sworn in on July 21, 1960, after her United national party won the elections.
- **1965:** **Opposition party wins** the election and **tries reverse the nationalization**.
- **1970:** **Sirimavo Bandarnaike reelected** and **brings back Sinhalese Nationalism**.
- **1977:** **LTTE was formed**
- **1983:** **'Black July' riots erupted** in Sri Lanka; about 400-3000 people were killed.
  - The **bilateral relations between India and Sri Lanka deteriorated** in **1980s** with rising Tamil militant separatism in Sri Lanka.
- **1987:** **Indo-Sri Lanka Accord**, which was intended to end the civil war between Sri Lankan Tamil nationalists and LTTE, signed.
  - It proposed a **political solution** to Sri Lanka's conflict by establishing a **provincial council system** and **devolution of power** for nine provinces in Sri Lanka. This is popularly known as the **Thirteenth Amendment (13A)** to the Constitution of Sri Lanka.
  - India also deployed **IPKF in Sri Lanka** intended to ensure peace (It is known as '**Operation Pawan**', which ultimately resulted in the assassination of PM Rajiv Gandhi)
- **1988:** Nationalist Janatha Vimukthi Peramuna (JVP) protest against the Sri Lanka-India agreement.
- **1990:** **Second Elam war breaks**. East province taken over by Sri Lankan Forces after heavy fighting. The LTTE continued to kill civilians in the Eastern Province.
- **1991:** LTTE suicide bombers kill Rajeev Gandhi in Tamil Nadu. He was instrumental in bringing the Indo-Sri Lanka accord.
- **1993:** An LTTE **suicide bomber kills Ranasinghe Premadasa**, the third President of Sri Lanka during a mayday rally.
- **1994:** President Kumaratunga again initiates peace talks with LTTE.
- **1995:** **The third Elam war breaks** out after a suicide squad attacked two naval vessels in Trincomalee killing 12 soldiers.
- **2000:** The EU criticizes both the Tamil Tigers and the Sri Lankan security forces concerning the human rights situation in Sri Lanka.
- **2003:** **The Sri Lankan government and LTTE holds peace talks and agree on a ceasefire**.
- **2005:** Rajapaksa elected for the first time.
- **2006:** The political killings, child soldiers, abductions, and clashes between the government and LTTE creates tension around the country. The Trincomalee massacre of students happened in 2006. **It was considered to be an act of state terror**. Vankalai massacre of four minority Sri Lankan Tamils. It was also considered to be an act of state terror.
- **2007:** Atleast 28 people which includes, 14 cadres of LTTE, die in clashes between the security forces and the Tamil Tigers in September.

- **2008:** Government blames LTTE after 12 civilians killed and 100 injured over a suicide bomb attack. **Government launches a massive offense ending the 2002 ceasefire agreement.**
- **May 2009:** **Velupillai Prabhakaran** was killed by Sri Lankan army. The war between the tigers and Sri Lankan military **reaches its bitter end** and the tigers decide to silence their guns in the interest of Tamil citizens.
- **2010:** **Mahinda Rajapaksa re-elected**. He promised to **restore an Independent National Human rights commission** along with other commissions.
- **2012:** **Rajapaksa government dismisses UN report** which states that Sri Lanka intimidated UN members investigating abuses at the end of civil war in 2009. The former Sri Lankan Army chief, Sarath Fonseka freed after 2 and a half years. Sri Lanka was in the same state when it came to ensuring justice to the victims of numerous Human Rights violations.
- **Jan 2013: Dismissal of Chief Justice**
  - Rajapaksa dismisses **Chief Justice Shirani Bandaranayake** after finding her guilty on three offences including financial irregularities.
- **Sep 2013:** **Tamil National Alliance (TNA) wins election at the Northern provincial council.**
- **2014:** President Mahinda Rajapaksa **doesn't allow the UN to investigate the war crime during the Tamil Tiger insurgency.**
- **2015:** Maithripala Sirisena **defeats Rajapaksa in Presidential elections**, pledging accountability over alleged atrocities during the civil war.
- **2017 - Jan:** Police clash with **protestors demonstrating against a plan to evict villagers to make way for a mostly Chinese port and industrial zone near the port city of Hamabantota.**
- **2018 - Oct:** Constitutional crisis as President Sirisena replaces Prime Minister **Ranil Wickremsinghe** with former President Mahinda Rajapaksa and suspends Parliament.
- **2019 Nov:** **Gotabaya Rajapaksa**, the younger brother of former president Mahinda Rajapaksa, wins the presidential election.
- **2020 Aug** - President Rajapaksa's SLPP party wins large majority in Parliamentary elections.
- **2022** - Protestors force President Gotabaya Rajapaksa out of office during an economic crisis.
- **2022-July:** Ranil Wickremsinghe elected President by MPs.
  - This was after the ex-president **Gotabaya Rajapaksa** fled the country after thousands of protestors stormed his presidential residences. The protestors had also called for **resignation of Mr Wickrem Singhe**, a close ally of Rajapaksa political family who was appointed Prime Minister in May 2022.

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## C) INDIA-SRI LANKA RELATIONS

### **Introduction**

- **India-Sri Lanka relations** are **more than 2,500 years old** and are built upon, geographical, historical, cultural, economic and religious factors. Bilateral relations have **traditionally been good.**

- **The year 2023** is particularly significant in India-Sri Lanka relations as it marks 75 years of diplomatic relations between the two countries and 200 years of the arrival of Tamil community in SL.
- **Both ethnic groups of SriLanka** (Sinhalese Buddhist and Tamils) have origins in India.
  - » Sinhalese Buddhist who constitutes 80% of the population claim to have come from Orissa in the 5th century BCE.
  - » Tamils are the other ethnic group who constitute 20% of the population.
- **Traditionally**, as Sri Lanka's close neighbor, India has had a huge influence in the Island Nation's political, economic, social and cultural consciousness and its world view.
- **But** the relations saw deterioration in 1980s.
  - » SL accused India of supporting the Tamil Separatists in the north of Sri Lanka.
  - » Ethnic Civil war created lakhs of refugees creating security concerns in India.
- **The Year 1987** saw the signing of India-Sri Lanka Peace Agreement.
  - SL amended the constitution to establish provincial councils, but it is not in practice till now.
  - India sent IPKF to see the implementation of the agreement. But LTTE didn't accept it leading to war. It led to death of 2,000 Indian soldiers and later the death of former PM Rajeev Gandhi.
- **Hands off Policy of India** in 1990s:
  - In 1990s India followed hands off policy which **gave space to extra-regional players**. This is seen as a strategic mistake on India's part by various international relations experts. It led to increased influence of China in Sri Lanka.

#### **Factors Which Bind India and Sri Lanka Together:**

1. **Geopolitical Significance of SriLanka for India**: Geographical location of Sri Lanka gives it a strategic place along the major sea lanes of communication from Europe to East Asia.
2. **Strong Political Cooperation**:
  - Sri Lankan Presidents, PMs, and foreign ministers have generally made New Delhi their first overseas destination, within days or weeks after taking charge.
    - For e.g. President Maithripala Sirisena visited India in Feb 2015 and May 2016.
    - Similarly, after getting elected for 2nd term in 2019, Sri Lanka was the first destination for PM Modi.
  - In July 2023, President Ranil Wickremesinghe visited India and took several steps towards strengthening of bilateral relations.
3. **Promoting Regional Cooperation**: Sri Lanka is both a member of SAARC and BIMSTEC and thus will play a crucial role in India's efforts to increase the regional cooperation in South Asia.

4. **Commercial Partnership** is very vibrant between the two countries and has witnessed considerable expansion in recent years. The coming into force of India-Sri Lanka FTA (ISFTA) in 2000 contributed to the bilateral trade.
  - India continues to remain the largest trade partner for SL.
  - India is also among the largest investor in SL.
  - After a five-year hiatus, in Nov 2023, India and Sri Lanka have relaunched talks on the Economic and Technology Cooperation Agreement. The 2 sides held 12th round of negotiation on the agreement in Colombo.
5. **Development Cooperation:** India's development portfolio is quite wide in Sri Lanka. It includes housing projects, education, health, agriculture, infrastructure etc.
6. **India's support during the financial crisis of Sri Lanka:**
  - India offered Sri Lanka assistance of \$4 billion through currency swaps, loan deferrals, loan facilities, and multiple line of emergency credit.
  - India also lobbied for Sri Lanka in the IMF and the Paris Club (despite not being a part of it). India became the first country to assure IMF of its debt restructuring to Sri Lanka.
7. **Cultural Aspects and People to People Contact:**
  - Other than Tamils, 1,000s of people of Indian origin comprising of Sindhis, Gujaratis, Memons, Parsis, Malayalis and Telugu speaking persons have settled in SL and are engaged in various business ventures. Each of these communities have their own groups which organize festivals and cultural events.
  - The Cultural Cooperation Agreement has been signed between both the countries. The Indian cultural centre in Colombo actively promotes awareness of Indian culture by offering classes in Indian music, dance, Yoga etc.
  - Education is another important area of cooperation between India and Sri Lanka. India offers scholarship slots annually to deserving Sri Lankan students.

#### **President Ranil Wickremesinghe's India visit (July 2023)**

Nearly a year after being sworn as the President of SL, Ranil Wickremesinghe visited India in July 2023. The visit was significant in the growing relations between the two countries.

- **Key Highlights:**
  - A joint statement on economic cooperation titled "Promoting Connectivity, Catalyzing Prosperity: India-Sri Lanka Economic Partnership Vision" was released after talks between PM Modi and President Wickremesinghe. It lays out vision in five areas: Maritime, Air, Energy, Trade and People to People initiatives.
    - » **New Investments in Maritime and Air Connectivity** will involve developing ports and airports in Sri Lanka, resuming ferry services, expanding flight networks to TN and SL's northern and eastern province.
    - The two sides have also agreed to do feasibility study on land bridge (consisting of railway line).

- » **A major surge in energy connectivity** will include renewable energy wind and solar plants in Sri Lanka. The two countries have also agreed to establish a power grid interconnection for bidirectional trade.
- **Trade, Economy and Finance:**
  - » Both sides agreed to boost private sector investments, recommence discussions on the Economic and Technology Cooperation Agreement, use the rupee as a currency for trade, and operationalize UPI (digital connectivity).
  - » They also agreed to explore the ways of enhancing tourism and cultural religious travel and educational collaboration.
- **Together, the idea was to promote 'civilization ties, geographical proximity, cultural connect, and age-old goodwill between the people of two countries'.**
- **Concerns:**
  - » None of the written documents released during the meet acknowledged previous commitments by Sri Lanka on honoring the 13th amendment for devolution of powers to the North and Eastern Provinces, and for resolving the long-pending issues over arrest of Indian fishermen.
- **Conclusion:**
  - » The recent visit is an attempt to build on the looming optimism. Both countries hope that connectivity will bring them together, build their trust, and further their interest.

#### **Key Pain points/Challenges in India Sri Lanka Relations:**

1. **Increasing Penetration of China in Sri Lanka**
  - China, as part of their string of pearl strategy is trying to encircle India by building strategic ports all along the Indian Ocean including in Pakistan (Gwadar), Bangladesh (Chittagong), Myanmar (Kyauk Phru) and Sri Lanka (Hambantota)
2. **Tamil Issues:**
  - Ethnic conflict between the Sinhala majority and Tamil Minority in SL has severely undermined the bilateral ties between the two countries in recent decades.
  - Repatriation of refugees is another bone of contention
  - Post war political and human rights issues; and India voting in UNHRC.
3. **Fishermen Issues and Kachathivu Island Issue**
  - Incidents of straying of Indian fishermen in SL waters cause regular tensions between the two countries.
4. **Domestic Politics of Sri Lanka:**
  - While the current SL government has indicated a strong desire to increase integration and connectivity with India, India is worried if this kind of commitment will continue with future governments or not. As Sri Lanka heads to presidential elections in 2024, India has

to be watchful about if the appetite for connectivity and integration will persist with the future government.

## Way Forward for India

- » **Economic Integration of SL with India:**
  - Closer economic integration between India and SL can result in technology transfer, skill transfer, and investment flow towards SL.
  - Establishment of a land bridge between TN and SL can lead to increased trade between South India and impoverished northern part of SL.
  - China's passivity and India's proactive assistance during SL's financial crisis has encouraged Sri Lanka to embrace a major geopolitical turnaround and calls to integrate with India are increasing in Colombo.
  - This integration will also be supported by positive sentiments about India among Sri Lankan population in general. India's future support in strengthening and development of areas such as agriculture, dairy sector etc can have a lot of positive impact on the lives of people and create positive sentiments about India.
- » **Prosperity through connectivity:** 'Positive transformation' in India Sri Lanka relations can be brought through increased connectivity.
  - During the visit of SL President Ranil Wickremsinghe in 2023 an agreement for exploring the possibility of land bridge (positively) having railway line was signed.
  - Another very significant outcome was the joint decision to 'carry out feasibility studies on establishing a petroleum pipeline (energy connectivity)'. This will ensure fuel sufficiency and thus energy security for Sri Lanka.
    - After Nepal and BD, Sri Lanka is the third neighbours with whom India is building 'energy connectivity', both in petroleum and power grid.
    - Other agreements related to maritime connectivity, energy connectivity and fintech connectivity were also discussed.
    - More work can also happen on maritime connectivity and air connectivity.
      - E.g. the recent restart of Kankesanthurai-Nagapattinam ferry service after almost 40 years.
    - All these connectivity initiatives are in sync with '**India's Neighborhood First**' policy and '**SAGAR**' Vision.
- » **India should consolidate its fragmented aid program:** Currently Indian aid is routed via multiple ministries and agencies. A single development bank will be much better.
- » **India should engage with all sides of the political spectrum in SL:** This would ensure that the process of cooperation, connectivity and integration between India and Sri Lanka will continue irrespective of the results of the 2024 Sri Lankan elections.
- » **On Ethnic Issue,** SL should ensure that aspirations of Tamils are fulfilled, and the process of rebuilding should ensure equality, justice and peace.
- » **Strengthening Security Cooperation:** SL needs to understand India's security concerns better.

## vi. Conclusion:

- "Security and development interests of the two countries are intertwined, and therefore "it is essential that we work together, keeping in mind each other's safety and sensitivities" PM Modi.

## 2) SOME ISSUES IN INDIA-SRILANKA RELATIONS (DETAILS)

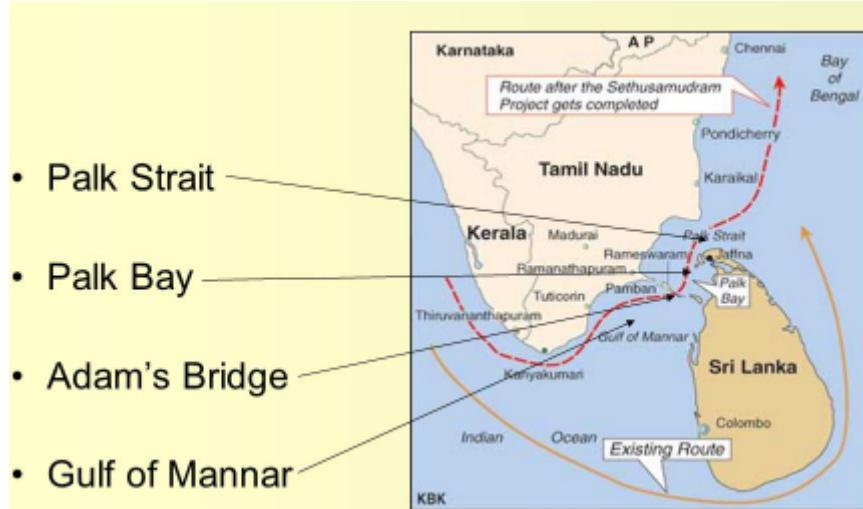
### A) CHINA

- **Background:**
  - In 2000s, China realized Geographic strategic importance of Sri Lanka which straddles the Indian Ocean and halfway between Gulf of Aden and Malacca Strait.
  - It understood the significance of SL to challenge both India and US naval forces in the Indian Ocean.
  - During the SL civil war, it provided arms and training to SL army. India was hoping that China's influence will reduce once the war was over. But the outcome was quite contrary. Currently, China has emerged as the biggest investor of Sri Lanka.
- **China's increasing Influence in SL and India's concerns:**
  - **Increasing Chinese Military Presence:** China's string of pearl strategy.
    - » Visit of Chinese Spy vessels (termed as 'research vessel by China') to Sri Lanka:
      - For e.g. in 2022, Chinese vessel the **Yuan Wang 5**, docked at **Hambantota port** in Sri Lanka. It was considered a ballistic missile and satellite tracking ship.
      - China reportedly has 7 such tracking ship, which can operate in the Pacific, Atlantic, and Indian Oceans. This ship-based monitoring adds to China's land based tracking system.
      - **Chinese continue to claim** that these are scientific missions. But the Indian suspicion of China using these missions for military purpose, including intelligence gathering is also substantial.
    - **China is also using Hambantota port** to refuel its warships and other ships that are present at any given point in time across western-eastern and southern ocean regions.
    - **Military Cooperation:** China has provided military assistance to Sri Lanka including training and equipment. This cooperation strengthens China's military presence in the Indian Ocean region and gives it greater influence over SL's military policies.
    - **Huge Chinese debt to Sri Lanka:**
      - » **China owns 52% of Sri Lanka's debt.** And thus, Sri Lanka is too dependent on China and may succumb to Chinese pressure and compromise India's security.
    - **Economic Relations**
      - » **Investments** China has invested in road infra, power plants, railways, EEZ, water supply (softening) etc.
      - » **Trade:**
        - China has emerged as the largest trade partner of SL
        - Sri Lanka and China are negotiating an FTA.
      - » SL is also participating in China's OBOR and under this China has built two ports - one in Colombo and another in Hambantota.
    - **Soft power:** China is using various soft power mechanisms, such as cultural exchange programs and scholarships, to increase its influence in Sri Lanka. This approach is subtle, but plays an important role in shaping public opinion.
  - **How has India tried to counter China's influence in SL?**
    - a. **Economic Measures:**

- India was proactive in supporting Sri Lanka during its financial crisis of 2022.
  - **Increased Investment:** India's investment in China has significantly improved. India is focusing on the development of ports, railways, roadways, housing infrastructure etc.
  - India is also planning to build Trincomalee port. The port is envisioned as an Indian counterweight to Chinese development at Hambantota port.
  - In 2015, India-Sri Lanka signed the civil nuclear agreement making India the first country to do so.
- b. **Increased focus on Connectivity:**
- The 2023 visit of President Wickremsinghe to India primarily revolved around connectivity. India has focused on various types of connectivity (exploring land bridge, beginning of ferry after 40 years, maritime and air connectivity, energy connectivity, digital connectivity etc.).
- c. **Political:**
- Recent bilateral visit between the two countries have increased.
- d. Since 2014, India has abstained from voting on UNHRC resolutions against SL.
- e. India is also collaborating with other regional powers like Japan and France to counter China's influence in SL and promote a rule-based order in the Indo-Pacific region.
- f. **Other aspects of relationship** as discussed in India-SL topic.
- **Conclusion:**
- » India remains suspicious of China's increasing presence in the Indian Ocean and its influence on SL, which is strategically placed halfway along key east-west international shipping routes.

## B) FISHERMEN ISSUE

- **Why in news?**
- » In Aug 2023, the chief minister of Tamil Nadu M.K. Stalin revived the debate over Kachathivu, by reiterating the demand for retrieval from Sri Lanka. (Aug 2023)
- **Example Questions**
- » What are the key factors behind Indian fishermen regularly trespassing into Sri Lankan waters? Suggest some measures to deal with the issue? [15 marks, 250 words]
- **Background**
- » The Palk Bay, a narrow strip of water separating the states of TN in India from Northern Provinces of Sri Lanka, has historically provided rich fishing grounds for both countries.
- » Historically, the shallow waters of Palk Bay and geographical contiguity between India and Sri Lanka facilitated the movement of ideas, goods and men. The bonds of ethnicity, language, and religion helped fisherman lead lives of harmonious coexistence for several centuries. Frequent migration, inter-marriages were very common.



- » During the height of civil war, SL had imposed ban on fishing because of fear of LTTE's Boat Bombs. Indian fishermen exploited the situation and crossed IMBL (international maritime boundary line). During this phase there was perfect camaraderie among Indian Tamil and Sri Lankan Fishermen as Sri Lankan Tamils who came to India as refugees were also being employed by Indian trawlers.
- » End of Civil War in SL in 2009:
  - The conflict has taken a new dimension since the end of Sri Lankan Civil war. The region has become highly contested site in the last 13 years.
  - Sri Lankan Tamils had lost ground to Indian fishermen.
  - Sri Lanka's complain of frequent trespassing of Indian fisherman in its waters.

- Main Issues (1. Kathchatheevu Island 2. Trespassing on IMBL 3. Economic and Environmental Issues)

» Kathchatheevu Island:

- About the Island: it is an uninhabited and barren 285 acre islet. It is located around 14 nautical miles from Rameshwaram.
- Ongoing disagreement over the territorial rights to the island of Kathchatheevu.



- Maritime Boundary Agreement of 1974: PM of India Shrimati Indira Gandhi and PM of SL Sirima R.D. Bandaraike, signed an agreement to demarcate the boundaries between the two

countries. A close personal relations between both Prime Ministers, Indira Gandhi and S. Bhandarnaike, facilitated the successful conclusion.

- **Opposition to agreement:** During the parliamentary debate, most of the opposition including DMK, AI DMK, Jan Sangh, Swatantra and Socialist Party, staged walkout in both houses.

» TN government and opposition parties had also criticized the transfer of Kathchatheevu and said that it didn't reflect the realities on ground.

» In the last 15 years, both Jayalaithaa and Karunaidhi had approached the Supreme Court on the matter.

- **What is the current stand of GoI?**

» In Dec 2022, the Union government, while referring to the two agreements, pointed out in its reply in the Rajya Sabha that Kathchatheevu "lies the Sri Lankan side of the India-Sri Lanka International Maritime Boundary Line". It also added that matter was subjudice in the SC.

- **Note:**

- The 1974 agreement had allowed Indian fisherman some traditional rights around Kathchatheevu island.

- St. Anthony's Church there holds an annual festival either in Feb or March drawing devotees from both sides of the Palk Bay, a tradition which has been going on.

- A supplemental pact in 1976 made it clear that fishing vessels and fishermen of the two countries "shall not engage" in fishing in the historic waters, territorial sea and EEZ of either of the countries.

» **Trespassing by Indian Fisherman :** Frequent poaching by Indian fisherman into Sri Lankan waters. This causes Indian fisherman from coastal TN and Puducherry getting frequently arrested by the SL navy for "poaching" or engaging in illegal fishing activity in Sri Lankan waters.

- Several rounds of bilateral negotiations between the two countries and talks between fishing community leaders from both sides have been held over the years, but a solution remains elusive.

» **Economic and Environmental damages due to use of mechanized deep water trawlers:**

- Deep water trawlers drag fishing nets through the seabed. The practice scoops out eggs, young fishes, and other marine organisms that eventually die and are thrown back into the sea.
  - This causes long term damage to both economy and environment.

#### - Reasons for these issues

- a. No well-defined boundary line between the two nations despite the 1974 agreement. It leads to fishermen trespassing into Sri Lankan waters in search of better catch.
- b. LTTE issue had raised vigilance.
  - To check intermittent flow of Tamil Refugees
  - To prevent flow of armed supplies to Tamil Militant groups.
- c. Historical Perspective

- Both Indian and Sri Lankan fisherman fishing in the Palk Bay area for centuries.

### **Other complaints against Indian Fishermen**

- Deep Sea trawling: TN is yet to agree to the chief demand of the northern Tamil Fishermen - to stop bottom trawling to restore trust between both the sides.
- Misuse of Kathchatheevu rights given to Indian fishermen.

#### - Impact

- » **Bilateral Relations:** Cases of arrest of Indian fishermen by Sri Lanka leads to worsening of relations between the two countries.
- » **Economic losses:** Unsustainable fishing from the region is depleting fishing resources of the region and impacting livelihood for fishermen on both sides.
- » **Palk Bay's Marine ecology** is also suffering impacting both environmental and economic sustainability.
- » **Increasing harassment of Indian fisherman :** Sri Lankan Navy has taken tough stand on the breaching of International Maritime Boundary and resorted to arresting , killing and damaging of boats.
- » **Tensions between TN and Central government in India:**
  - TN assembly has passed a resolution asking Indian government to take over Kathchatheevu island.

#### - Possible Steps that can be taken

- a. Developing fish farming extensively in Indian waters would prevent our fishermen from venturing into Sri Lankan waters for 'big catch'.
- b. India can also think of leasing fishing blocks, especially those identified as 'surplus' total available catch, from Sri Lanka.
  - One option could be to get back the island of Kathchatheevu on "lease in perpetuity"
- c. Strict and complete ban on mechanized trawlers - to preserve marine resources
  - It is banned in Sri Lanka, so ban by India would ensure equal rights for Sri Lankan Tamils
  - It would also reduce animosity between the fishermen of two countries.
- d. Educate Indian fishermen to keep on the Indian side on high sea : Use devices integrated with GPS to check weather on Indian waters or not.
- e. Greater cooperation between coast guards of the two countries.
- f. Permit licenses Indian fishermen to fish within designated area of Sri Lankan waters and vice versa.
- g. The two government could also consider the creation of Palk Bay Authority, comprising fishery experts, marine ecologists, fishermen's representatives, strategic specialists, and government officials. It should include officials from both governments.
  - The authority should determine ideal sustainable catch, type of fishing equipment that can be used, and the number of fishing dates for Indian and Sri Lankan fisherman.
  - Special provisions could be made to protect the interest of traditional fisherman.

#### - Conclusion:

- Fishermen issue has remained a bone of contention in the bilateral relations of the two countries for long now. The recent cordiality in relations between the two countries gives an opportunity of bringing back the issue of table and find a long-term sustainable solution to the problem.

### C) TAMIL ISSUE

#### - Why in news?

- Focusing on 13-A sans police powers 'practical': Ranil Wickremesinghe tells Parliament (Aug 2023)

#### - Important concerns from India's perspective:

- » Repatriation of refugees currently in India

#### » Post war political and human rights issues:

- » Key concerns of Tamils include military involvement in civil life in north and eastern province, occupancy of land by armed forces; women security;

#### ▪ Lasting political solution to address the grievances of Tamil people: 13th Amendment:

- Born out of Indo-Lanka accord of 1987 - 13th amendment has remained a long pending demand of Tamil National Alliance (TNA), the main party representing the island's Northern Tamils.
- The amendment envisages substantive devolution of political powers to the provinces.

#### - India stands for United SL and devolution of powers to provinces.

- PM Modi, in his press conference after meeting Mr. Wickremesinghe on 21st July 2023 aid: "We hope that the Government of Sri Lanka fulfill its commitment to implement 13th amendment and conduct provincial council elections"

#### - In Aug 2023, Sri Lankan President Ranil Wickremesinghe reiterated his offer to the Tamils of implementing 13th Amendment without police powers, while proposing a step-by-step approach to devolving powers to provinces.

- » Under the 13th Amendment, police powers have emerged as the most delicate issue in the transfer of authority to the Provincial Councils.

- » The Tamil National Alliance (TNA), the largest parliamentary grouping of Tamil legislators from the island's north and east, 'categorically rejected' it saying that the proposal is far from meaningful power devolution based on federal arrangement.

#### - India's voting at UNHRC:

- » Differences over former President's reluctance to address post-war political and human rights issues relating to the Tamil minority led to India voting against Sri Lanka twice (2012 and 2013) at the UN Human Rights Council and abstaining once.

- » But, since 2014, India has abstained from voting in resolution criticizing Sri Lanka.

- » In 2022, also India abstained from voting on a resolution on Sri Lanka at the UNHRC, while observing that Sri Lanka's progress in implementing commitments on the 13th Amendment, meaningful devolution, and early provincial elections remains "inadequate".

- The resolution was passed, and called upon the government of Sri Lanka to ensure prompt, thorough and impartial investigation and, if warranted, prosecution of all alleged crimes relating to human rights violation and serious violation of international humanitarian law.

- Earlier, in 2021 also India had abstained from voting a resolution against Sri Lanka.

#### D) RECENT START OF FERRY SERVICE (USEFUL FOR PRELIMS)

**Passenger Ferry Service between India and Sri Lanka** begins again after nearly 40 years (Oct 2023)

##### Background:

- » Maritime linkage between India and Sri Lanka isn't new. The Indo-Ceylon Express of Boat Mail ran between Chennai and Colombo via the Thoothukudi port from the early 1990s up until 1982.
- » However, the Civil war in Sri Lanka resulted in the halting of these services.

##### Re-beginning:

- An international, high-speed passenger ferry service between Nagapattinam on eastern coast of TN and Kankesanthurai in the northern province of SL, has resumed from 14th Oct 2023.
- The high - speed craft (HSC) Cheriyapani, embarked on its journey with 50 passengers and 12 crew members.

##### - Significance:

- » The initiative is aimed at bolstering bilateral ties, boosting tourism, and increasing people-to people contact. It will bring our countries, people and hearts closer.
  - PM Modi has called this a new chapter in diplomatic and economic ties between India and Sri Lanka.
  - Increased connectivity between the two nations whose people have travelled across the Palk bay for centuries.
  - The service will strengthen cultural ties by boosting religious tourism. From India, travelers can access significant religious sites in Colombo and southern parts of SL. Indian Pilgrim centers such as Nagapattinam, Nagore, Velankanni, Thirunallar, and temple towns such as Thanjavur, Madurai, and Tiruchi, are expected to see an influx of Lankan tourists.
  - It will also strengthen cultural ties between the two nations as several religious places could be visited through this service.

### 3) PARIS CLUB

##### - Why in news?

- » **Sri Lanka reaches agreement with India, Paris Club on debt treatment** (Nov 2023)

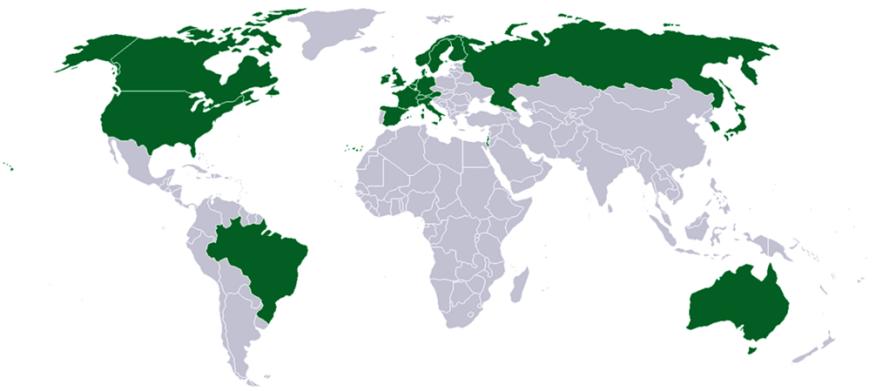
The Paris Club is a group of mostly western creditor countries that grew from a 1956 meeting in which Argentina agreed to meet its public creditors in Paris.

- It describes itself as a forum where official creditors meet

to solve payment difficulties faced by debtor countries.

- When debt countries undertake reforms to stabilize and restore their macroeconomic and financial situation, Paris Club Creditor provide an appropriate debt treatment.

Their objective is to find sustainable debt relief solutions for countries that are unable to repay their bilateral loans.



Map showing Paris Club countries highlighted in green. (Via Wikimedia Commons)

There are 22 members to this grouping and all of them are members of OECD

**Members are:** Canada, USA, Brazil, Ireland, UK, Spain, France, Italy, Switzerland, Germany, Belgium, Netherlands, Denmark, Austria, Norway, Sweden, Finland, Russia, Japan, South Korea, Israel, and Australia.

#### » **How many agreements have Paris Club been involved in?**

- Since its beginning, Paris Club has reached 470+ agreements with 102 different debtor countries. Since 1956, the debt treated in the framework of Paris Club Agreements amount to more than \$610 billion.

#### » **How has Paris Club been involved in debt agreements: Key Features of Paris Club Debt Agreements:**

- **Principle of Consensus and Solidarity:** Any agreement reached with debtor country will apply equally to all its Paris Club creditors.
- A debtor country that signs an agreement with its Paris Club Creditors, should not then accept from its non-Paris Club commercial and bilateral creditors such terms of treatment of its debt that are less favorable to the debtor than those agreed with the Paris Club.

#### » **The role and importance of Paris Club Creditors:**

- The Paris Club countries dominated bilateral lending in the last century, but their importance has receded over the last two decades or so. This is because of rise of China as the world's largest bilateral lender.

#### » **Sri Lanka agrees debt restructuring with Paris Club Creditors and India (Nov 2023)**

- Sri Lanka has reached an "agreement in principle" with India and the Paris Club group of creditors including Japan, on a debt treatment plan that will help the crisis hit island nation tap the next tranche of the IMF's nearly \$3 billion recovery package.
- **Background:**
  - Due to economic crisis, Sri Lanka defaulted on its nearly \$51 billion foreign debt. Therefore, restructuring of loan became necessary to begin its economic recovery plan.

- Major lenders formed OCC (Official Creditor Committee) in May 2023 in response to Colombo's request for debt treatment.
  - This OCC is co-chaired by India, Japan, and France, as chair of the Paris Club.
  - This committee held several discussions with Sri Lankan officials over the last few months, evaluating possible options in recasting Colombo's outstanding debt, such as altering the interest payments or the term of loans.
  - China, which is the largest creditor of Sri Lanka has decided to stay out of the platform but attended the meeting as observer.
  - **Japan and India**, the two other largest creditors for Sri Lanka have called for the need for creditor parity and transparency.
  
- » In Nov 2023, the OCC [Official Creditor Committee] and Sri Lanka agreed on the main parameters of a debt treatment consistent with those of the Extended Fund Facility arrangement between Sri Lanka and IMF.
  - The parameters of the agreement have not been finalized yet, but the Paris Club said that OCC is ready and looks forward to formalizing the agreement in the coming weeks in a MoU with Sri Lanka.
  - OCC has also noted that it expects that "other bilateral creditors" (a reference to China) should consent to sharing in a transparent manner, the information necessary for the OCC to evaluate comparability of treatment regarding their own bilateral agreement.
  - The OCC further asked Sri Lanka to continue to engage with its private creditors - who would hold the largest chunk of the island's foreign debt - and swiftly firm up "an agreement on terms at least as favorable as the terms offered by the OCC".
  - China has assured Sri Lanka of cooperation in the debt restructuring process and Sri Lanka has, in turn, assured other creditors of China's transparent participation, but the specifics of the possible debt treatment plan are awaited

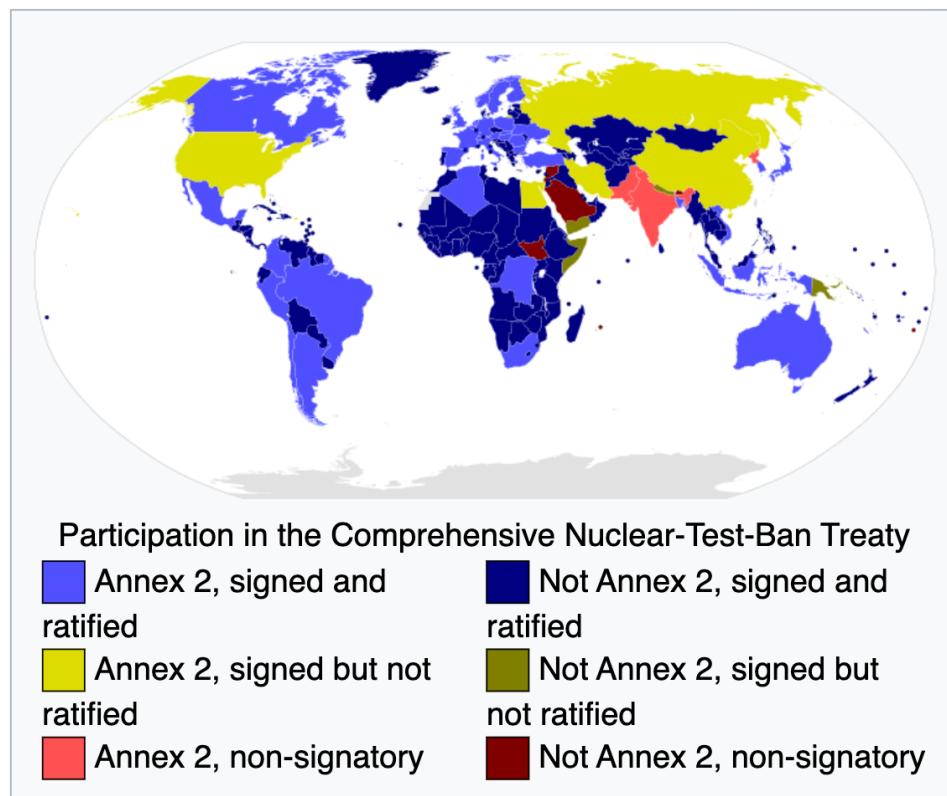
#### 4) COMPREHENSIVE NUCLEAR TEST BAN TREATY (CTBT)

- **Why in news?**
  - » **Russia** passes a law revoking Russian ratification of nuclear test ban treaty (Nov 2023)
  
- **Introduction**
  - » CTBT is a multilateral treaty by which states agree to ban all nuclear explosions in all environments, for military or civilian purposes.
    - **Need:** Between 1945 and 1996, over 2,000 nuclear tests were conducted – mainly by the US (over 1,000), Soviet Union (700) and France (200) – the treaty was brought to bring this to halt.
    - » The treaty was negotiated at the Conference on Disarmament in Geneva and adopted by the UNGA in 1996. But the treaty has not entered into force yet, due to the non-ratification of the 8 specific nations.
  
  - » **When would the treaty come in force?**
    - The treaty would enter into force 180 days after the 44 states listed in Annex-2 of the treaty ratify it. These annex-2 states are those states which participated in the CTBT's

negotiation between 1994 and 1996 and possessed nuclear power reactors or research reactors at that time.

- » As of Dec 2023, 9 annex-2 states have not ratified.
  - USA, China, Egypt, Iran and Israel have signed but not ratified.
    - Russia had signed and ratified but later withdrew ratification.
  - India, North Korea and Pakistan have not signed the treaty.
- » Total 184 countries have signed the treaty (17 (including Russia) without ratification):

## Comprehensive Nuclear-Test-Ban Treaty (CTBT)



### - Significance of CTBT

- » Prevents Nuclear Proliferation: CTBT is the last barrier on the way to develop nuclear weapons. It not only curbs the development of new weapons, but also prevents the improvement of existing designs. When in force, it will provide a legally binding prohibition on nuclear testing.
- » Prevents environmental damage that occurs due to nuclear testing.
- » It's non-discriminatory as under this treaty everyone has the same obligation -> never to conduct nuclear explosion.

### - Russia withdraws from the ratification of the treaty. (Nov 2023)

- » Russian President Vladimir Putin has signed a law revoking Russian ratification of the CTBT. Russia had ratified the agreement in 2000.

» **Why?**

- Russia says the aim is to restore parity with the US, which has signed but has never ratified the 1996 treaty, and that it will not resume testing unless Washington does.

- **Why has India not signed the treaty yet?**

- » **CTBT doesn't deal with India's stand of Complete disarmament** in a time bound manner. It is just restricting the new tests.

» **Discriminatory**

- For countries who **already have large stockpiles** of nuclear weapons, this is advantageous as it prevents others from getting it. For India, this pact will act as a hindrance in testing new technologies.

» **Technology difference between P-5 countries and India**

- P-5 countries no more need to go for testing to enhance their stockpiles as they have developed laboratory stimulated testing mechanism which will not require nuclear explosions.

- » **India's vulnerable neighborhood** makes it mandatory for India to keep the option of future tests open. China already has a huge stockpile and as per CTBT (and NPT) it will be able to retain its arsenal but prevent India from developing more. This will give China an upper hand.

- **Conclusion**

- » India's concerns are genuine and moreover the objectives of CTBT have been almost completely achieved (except in case of North Korea) by voluntary moratorium on tests by all the countries. India should keep striving for a more comprehensive agreement which calls for denuclearization of earth in phased manner rather than allowing some countries to remain with large arsenal and preventing others from getting the same.

## 5) VIENNA CONVENTION OF DIPLOMATIC RELATIONS (VCDR), 1961

### E) ABOUT THE CONVENTION

- **Introduction**

- » VCDR of 1961 is an international treaty that defines the framework for diplomatic relations between independent countries. It specified the privileges of a diplomatic mission that enable diplomats to perform their functions without fear of coercion or harassment by the host country.
- » It forms the legal basis of diplomatic immunity. Its articles are considered cornerstone of modern international relations.

- **History**

- » The first attempt to codify diplomatic immunity into diplomatic law occurred in Congress of Vienna in 1815.
- » The present treaty on the treatment of diplomats was the outcome of a draft by International Law Commission. The treaty was adopted on 18 April 1961, by the United Nations Conference

on Diplomatic Intercourse and Immunities held in Vienna, Austria and first implemented in April 1964.

- The same conference also adopted the Optional protocol concerning the acquisition of Nationality, the Optional Protocol Concerning the Compulsory settlement of Disputes, the Final Act and four resolutions annexed to the act.

- **Key Provisions of VCDR**

- **Persona Non Grata:** The host nation at any time and for any reason can declare a particular member of the diplomatic staff to be persona non grata. The sending state must recall this person within a reasonable period of time, or otherwise this person may lose their diplomatic immunity. (Article 9)
- **Inviolable Premise:** The premises of a diplomatic mission, such as an embassy, are inviolable and must not be entered by the host country except by permission of the head of the mission. Furthermore, the host country must protect the mission from intrusion or damage. The host country must never search the premises, nor seize its documents or property. (Article 22)
  - Article 30 extends this provision to the private residence of the diplomats.
- **Archives and document inviolable:** Article 24 establishes that the archives and documents of a diplomatic mission are inviolable. The receiving country shall not seize or open such documents.
- **Free Communication:** The host country must permit and protect free communication between the diplomats of the mission and their home country. A diplomatic bag must never be opened even on suspicion of abuse. A diplomatic courier must never be arrested or detained. (Article 27.)
- **Diplomatic Immunities:** Diplomats must not be liable to any form of arrest or detention. They are immune from civil or criminal prosecution, though the sending country may waive this right under Article 32. (Article 29)
  - Under Article 34, they are exempt from most taxes, and under Article 36 they are exempt from most customs duties.
  - **Actions not covered by diplomatic immunity:** Actions not covered by diplomatic immunity: professional activity outside diplomat's official functions. (Article 31.1c)
  - **Extension of protection to family members:** The family members of diplomats that are living in the host country enjoy most of the same protections as the diplomats themselves. (Article 37)

- **Optional Protocols**

- In the same year that the protocol was adopted, two amendment protocols were added. Countries may ratify the treaty without necessarily ratifying the optional protocol.
  1. **Concerning Acquisition of Nationality** : The head of the mission, the staff of the mission, and their families, shall not acquire the nationality of the receiving country.
  2. **Concerning compulsory settlement of dispute** : Dispute arising from the interpretation of this treaty may be bought before the ICJ.

- **Membership**

- As of Nov, 2023, it has been ratified by 193 countries.

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## F) INDIA-CANADA RIFT ON DIPLOMATIC ROW

- **India Sought Parity in number of diplomats:**
  - India asked Canada to downsize its diplomatic staff in India. India has 20 diplomats in Canada and sought a similar number of Canadian diplomat in India.
    - India's move followed the Canadian PM Justin Trudeau's remarks in Canadian Parliament in Sep 2023 who claimed a potential Indian link to the Killing of pro-Khalistan separatist leader Hardeep Singh Nijjar in Canada earlier this year. India has rejected this claim and have called it "absurd" and "motivated".
- In Oct 2023, Canada announced recalling of 41 diplomats and their families. It was done as the diplomats were in danger getting their immunity stripped on an arbitrary date.
  - Canadian foreign minister has said that the "unilateral revocation of the diplomatic privilege and immunity is contrary to international law" and is violation of the Vienna Convention on Diplomatic Relations.
  - **US and UK backed Canada**, stating that Diplomats are required to be on the ground to resolve differences. Notably, the two countries are also part of the **Five Eyes Intelligence-sharing alliance** with Canada, which also include Australia and New Zealand.
- **What did India say?**
  - Official statement of MEA has clarified that India hasn't violated any international legal principle. It has adhered to Article 11.1 of the VCDR based on two-pronged reasons.
    - i. Firstly, Canada has massive number of Diplomatic staff in India as compared to its counterpart
    - ii. Secondly, Canadian personnel have been continuously interfering in India's internal affairs.
  - Article 11 says that in the absence of specific agreement, as to the size of the mission, the receiving state may require that the size of a mission be kept within limits considered by it to be reasonable and normal, having regard to circumstances and conditions in the receiving state and to the needs of the particular mission
- **Has this demand for parity occurred in the past?**
  - Around 2017, Russia and USA also asked for each other's diplomats to be recalled over the principle of parity and reduced the presence of their missions.
- **Conclusion:**
  - It is thus clear that the recall of Canadian diplomats is in now way violation of the international law. Even in the scenario where recall seems to be unreasonable, it could still be justified as a valid countermeasure by India in response to security interference by Canadian diplomats and safety issues of Indian diplomats.

## 6) UNSC REFORMS

- **Why in news?**

- » With two major wars (Russia-Ukraine) and (Israel-Hamas) happening in last two years, UNSC's ability to ensure international peace and security is again being questioned (Nov 2023)

- **Example Questions**

- » What are the functions of United Nations Security Council? Why is there a consistent demand for reforms and expansion of UNSC? [15marks, 250 words]
- » Discuss the impediments India is facing in its pursuit of a permanent seat in UNSC. [10 marks, 150 words] [CSM 2015]

- **Important Quotes:**

- » "*The world has changed. Our institutions have not. We can't effectively address problems as they are if institutions don't reflect the world as it is.*": UN's Secretary General, Antonio Guterres.

- **Introduction**

- » The UNSC is one of the six principal organs of United Nations. It was formed immediately after World War - II with the prime responsibility of maintaining international peace and security.
  - It achieves this through investigating any dispute which may lead to international friction, regulating armament, peace keeping operations, international sanctions and authorization of military actions.
- » The Security Council has a special place among the UN organs as it is the only organ that has the powers to take binding decisions that member states have agreed to carry out (Article 25 of UN Charter).
- » Other crucial functions of UNSC include recommending admission of new members to UN and to recommend to the general assembly the appointment of secretary general and together with the assembly, elect the judges of the ICJ.

- **Membership**

- » The UNSC consists of **15 members**.
  - Of these **5 members are permanent with veto powers** (USA, UK, France, Russia and China) and **remaining 10 are non-permanent members** who are elected by UNGA (at least 2/3rd votes) on a regional basis to serve a **term of two years**. **Five non-permanent members** are elected every year.

- **Regional Groups from which non-permanent members come:**

- » African group - 54 - 3
- » Asia-Pacific group - 53 - 2
- » Eastern European - 23 - 1
- » Latin America and Caribbean - 33 - 2
- » Western European and other groups - 28 - 2

- **Elections: NP members chosen by regional groups - confirmed by UNGA.**

- » A member country needs to secure the votes of 2/3rd of the members present and voting at the General Assembly session (i.e. minimum 129 votes if all 193 member states participate).
- » **India** has so far been a non-permanent member of the UNSC **eight time**: 1950-51, 1967-68, 1972-73, 1977-78, 1984-85, 1991-92, 2011-12 and 2021-22.
- UNSC members are always present at UNHQ to meet at any time.
- **Presidency** held for a month by a member on rotational basis of English alphabet.
- **Why demands for reforms and Expansion at UNSC**
  - **Undemocratic**
    - Only a few countries are able to take many important decisions.
    - If we exclude China, the other 4 P-5 countries only contribute to 7% of the world's population.
  - **Anachronistic - changing global order.**
    - Since its inception, the global order has witnessed significant shift.
      - Number of countries have increased; we have shifted to a multipolar world; a population explosion (from 2.2 billion to nearly 8 billion)
      - Thus, current composition of UNSC represent the post WW-II realities and have not kept pace with the changing nature of the geopolitical scenario.
  - **Inequitable economic and geographical representation**
    - Economic powers like Japan, Germany, India and Brazil are not Part of P5.
    - UNSC's 75% work is focused on Africa, and still, they don't have any permanent membership.
  - **Regional Distribution of seats are also unfair.**
    - **Europe**, for instance, accounts for 5% of the world's population, but it still controls 33% of the seats in any given year.
    - Even for non-permanent seats, more than 50 Asia Pacific countries vie for 2 seats and around 30 west European and other groups have been allocated 2 seats.
  - **Too powerful**
  - **Weapons exporting countries at the helm.**
    - It hinders disarmament and somehow negatively impacts world peace and security.
  - **P-5 countries involved in a number of conflicts.**
    - e.g. US, Russia, China etc.
  - **Continuation of North-South Divide**
- **Demands for reforms on 5 key issues.**
  - » Categories of membership
  - » Veto power
  - » Regional representation
  - » Size of the enlarged council and its working methods
  - » Security council general assembly relationship

- **G-4** countries bidding for permanent membership of UNSC.
  - » **Germany** - among the largest contributors to UN, most well-functioning economy of Europe
  - » **Japan**
    - One of the largest contributors
    - Behaved impeccably in international forums since the UN got formed in 1945
  - » **Brazil** - 5th largest territory, most suitable to represent South American continent
  - » **India** - 2nd largest population
    - Largest average contributor to UN Peace Keeping force
- **Coffee Club /Uniting for Consensus**
  - » Italy, Spain, Argentina, Canada, Mexico, South Korea and Pakistan
  - » Opposed to G-4 becoming permanent members with a veto power
  - » Favors expansion of the non-permanent seats with regional representation.
- **Africa Group**
  - » Demands two permanent seats, because of historical injustices
  - » Council's agenda largely concentrated on the continent
- **L69 Group**
  - » It is a group of developing countries from Africa, Latin America and the Caribbean, Asia and Pacific (Small Island Developing States). They form a major bloc that is united by the common cause of achieving the lasting and comprehensive reform of the UNSC by expanding both permanent and non-permanent seats.
    - It currently has 32 members.
  - » The group derives its name from the draft document number "L.69" that the group had tabled in 2007-08, which led to the initiation of the Intergovernmental Negotiation (IGN) process.
  - » **Note:** India is a member of the grouping.
- **Reforms are difficult because of stringent provisions**
  - » **Bar on amending UN Charter has been kept very high:**
    - Reform requires the agreement of atleast two-third of UN member states (129/193) and that of all the P-5 members of UNSC enjoying the Veto right.
  - » **Inter-Governmental Negotiations (IGN) on Security Council Reform** has been going on since last 13 years. They have been working on various aspects of reform, including categories of membership, issues relating to the veto power and regional representation.
    - The IGN has been extremely difficult, contentious and complicated because of the **different groups, their views and different interests**. This has resulted into very little progress over the last 1 decade.
  - » Finally, the P-5 members inherently have been opposed to expansion of veto or permanent status. Those who already have power are always reluctant to share it.
    - For e.g., China has been blocking efforts to begin formal negotiations on UNSC expansion, saying that there is no need to rush through the reforms.

- **Why do India demand more permanent role at UNSC?/ India's Bid for UNSC:**
  - » Amongst all the aspirants who want to be permanent member of UNSC, India is the most vociferous one.
  - » India is **eminently suited for permanent UNSC membership by any objective criteria**, such as population, territorial size, GDP (3rd in terms of PPP), economic potential, Civilizational legacy, cultural diversity, political system (largest democracy) and past and ongoing contributions to UN Activities - especially to UN peacekeeping operations.
    - Largest average contributor to UNPKF
    - Elected 8 times in UNSC (1950-51, 1967-68, 1972-73, 1977-78, 1984-85, 1991-92, 2011-12, 2021-22)
  - » India is also a nuclear weapon state.
- **Advantages of permanent membership of UN**
  - » Better **protection of India's strategic interest** at UNSC
  - » Represent the interest of other developing countries.
  - » Contribute to world peace.
- **Challenges to India's UNSC membership:**
  - » **Difficulties of Inter-Governmental Negotiations** - Differences between various countries, regional rivalries etc.
  - » **Inherent opposition by P-5 countries** to expand the veto power
    - **China specially**, has always obstructed the idea of India's exclusion.
  - » **G-4** has also limited options for sole negotiations.
  - » **Resources allocated by India** at UN for diplomacy -> lack of enough number of staff; budgetary share of India is also not in top 20.
- Despite some of these challenges, GoI has accorded highest priority to its stand on getting a permanent seat in the expanded UNSC. To get international support needed, it has been actively raising issue in all important bilateral and multilateral forums. It has enhanced its engagement with the reform-oriented countries in the G-4; and with the L.69 Group - a cross regional group of countries from Asia, Africa and Latin America.
- **Conclusion:**
  - Reforms are also necessary to make the UNSC more legitimate, effective, and representative in character and also to correct historical injustices in South Asia, Africa and Latin America.



# CURRENT AFFAIRS PROGRAM

## PRE CUM MAINS 2024

### DEC 2023: BOOKLET-3

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## 1. GENERAL STUDIES – 2

### 1) SAARC

- **Why in news?**
  - The year 2023 marked the 9<sup>th</sup> year since the last SAARC Summit (Sep 2023)
- **Past Year Questions** (only relevant ones)
  - i. "Increasing cross-border terrorist attacks in India and growing interference in the internal affairs of several member-states by Pakistan are not conducive for the future of SAARC (South Asian Association for Regional Cooperation)" Explain with suitable examples. [Mains 2016] [12.5 marks, 200 words]
- **Example Questions**
  - i. "Revival of SAARC is in the interest of the whole of South Asia" Elaborate. [10 marks, 150 words]
  - ii. What are the key objectives of SAARC? Why has it failed to achieve those objectives? [12.5 marks, 200 words]
  - iii. SAARC has been a case of 'Retarded Regionalism'. Discuss key causes and consequences for this. [15 marks, 250 words]
  - iv. "Power asymmetry and lack of common strategic thinking, make South Asia an unusually fragile strategic environment where genuine cooperation is impossible" Critically Analyze [12.5 marks, 200 words]
  - v. "Despite having historical, cultural and social bonds, the South Asia remains one of the most polarized and divided regions of the world" Discuss the key reasons. [12.5 marks, 200 words]
- **Important Quotes**
  - "I dream of a day, while retaining our respective national identities, one can have breakfast in Amritsar, lunch in Lahore and dinner in Kabul. That is how my forefathers lived. That is how I want our grandchildren to live": Former PM Of India Dr. Manmohan Singh
- **Introduction**
  - SAARC is a major Pan-South-Asia economic and geopolitical organization of eight countries located in South Asia. It was found in 1985 with **seven South Asian countries** - Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka and Maldives. The membership grew to eight when Afghanistan joined in 2007. It also has 8 observer countries including China.
    - Pakistan has proposed inclusion of China as full members. Myanmar is also interested in full membership.
  - It's headquartered in **Kathmandu, Nepal**.
  - The SAARC countries together consist of only 3% of the world's land area but, 21% of the world's population. Moreover, 40% of the world's poor live in the region.



- The SAARC is aimed at achieving two set of goals:
  - i. First, the immediate and non-political aims such as promoting welfare of people; accelerating economic growth, social progress and cultural development; and strengthening collective self-reliance to contribute to mutual trust and understanding among member nations.
  - ii. Second, relates to the long term, political objective of creating a **durable, stable and peaceful regional order**, strengthening cooperation with other developing countries and cooperating with international and regional organizations.
- Potential of SAARC grouping/ Why SAARC is significant?
  - Promoting Regional Cooperation
    - South Asia is one of the world's **least integrated region** and SAARC was expected to play a significant role in increasing this integration. That is why the founding principle of the SAARC was that *together South Asia had a greater chance of fighting its shared ills.*
  - Increasing intra-regional trade and investment: With 1/5th of the world's population, South Asia has abysmally low intra-regional trade (around 5%). There is a lot of scope for increasing investment, tourism and services and commodity trade. For e.g. in ASEAN (intra regional trade is of 25%).
  - Increasing connectivity
    - Physical Connectivity -> Roads, Shipping lanes etc.
    - Increasing cultural cooperation
  - Work around India-Pakistan tension to increase cooperation in the region
  - SAARC is in sync with India's neighborhood first policy. Successful SAARC will go a long way in helping India achieve this policy goal. It is the only grouping where all 8 south Asian countries come together.
  - Dealing with common threats in the region
    - For e.g. **terrorism** can be dealt more effectively if cooperation in SAARC is effective.
  - Tackling the growing influence of China
    - As part of its global expansionism, China is chipping away at India's interest in South Asia.

- According to a study by Brookings India, most South Asian nations are now largely dependent on China for imports despite geographical proximity to India.
  - **Nepal** is moving closer to China for ideational and material reasons.
  - **Bangladesh** is being wooed by China by offering of tariff exemption to 97% of the BD products. Similarly, China has intensified its ties with **Sri Lanka** through massive investments.
  - A unified South Asian Platform remains India's most potent countermeasure in dealing with this Chinese challenge.
  - In an era of **deglobalization**, improved connectivity and trade in South Asia can serve as the "Goldilocks option".
- **Summits**
  - » The first SAARC Summit took place in **Dhaka in 1985**, and there have been 18 summits since then.
  - » However, the organization hasn't had a smooth sail, with many summits getting postponed for political reasons, either bilateral or internal.
    - **18th SAARC summit** was held in Kathmandu in November 2014
    - **19th summit** was supposed to be held in 2016 in Pakistan, but the summit was boycotted by India and other SAARC countries on grounds of increasing cross border terrorism from Pak. **Since then, the SAARC summit has not been held**.
- **What has SAARC achieved? / Has SAARC been a failure?**
  - » SAARC had chalked out areas of cooperation. It has played an important role in easing trade barriers between the member countries. It is also credited for laying down the ground work for improved political ties, and for fostering closer socio-economic cooperation among its member countries.
- However, the **mismatch between SAARC's ambitions and achievements have been profound**.
  - » Various agreements and institutional mechanisms established under SAARC, has not been adequately implemented. For e.g. SAFTA was signed in 1994 and came into effect in 2006, but it is yet to be implemented. Similarly the motor vehicle agreement couldn't be signed in 2014 summit.
  - » There has been no major economic or political benefit that has been realized by SAARC. Thus analysts have termed its performance as a case of '**Retarded Regionalism**'.
  - » The intra-regional trade remains a meagre 5%.
  - » The cooperation of social and economic sector has been minuscule.
  - » The region still faces security challenges like terrorism, illegal trafficking etc.
  - » India's problems with Pakistan on terrorism, territorial claims, and on its role in blocking SAARC initiatives on connectivity and trade are well known.
- **Limitation of the SAARC Process / Factors which led to SAARC not being able to achieve much of cooperation:** A number of factors including the motives of SAARC's formation, its structure, it mandate, working methods, and the relationship among member states have all been responsible for making SAARC a 'Zombie' organization:
  1. **SAARC was an UNWANTED Child**
    - » **Negativity** is associated with SAARC since its origin

- India was initially reluctant to be part of SAARC as the body started as an attempt to counter India by other south Asian countries.
- Pak was also reluctant as it wanted to give up on its South Asian Identity and get more integrated with the Islamic world of West Asia. Moreover, it was worried about SAARC becoming an India dominated group.

## 2. Structural Problems

- One principle followed by SAARC is that no contentious bilateral issues are discussed, which pretty much rules out all key subjects.
- Other principle which SAARC follows is that all decisions will be taken care by consensus, which given the Indo-Pak rivalry, exacerbated by the entry of Afghanistan, rendered any agreement a stupendously difficult exercise.

3. Power Asymmetry between India and other member countries in terms of Geography, Economy, Military Strength, and influence in global arena make the smaller countries apprehensive. When one of the constituents is too big and powerful compared to the rest, it will naturally affect the progress of the cooperation. The smaller countries perceive India as "Big Brother" and fear that it might use the SAARC to pursue hegemony in the region. Smaller countries have therefore been reluctant to implement various agreements under SAARC.

## 4. Lack of trust and bilateral tensions among member nations - especially between India and Pakistan

- The organization have not been able to isolate itself from the ill-effects of India-Pak tension. In particular, the lingering Kashmir dispute has become a significant obstacle in regional integration.
- According to scholars like C Raja Mohan and Rajeev Sikri, the SAARC process has succumbed to the rivalry b/w India & Pak. As long as India and Pak relations doesn't improve, nothing can be done on SAARC.
- Further, territorial and water disputes between member countries hinder the cooperation in South Asia.

## 5. A failure in the area of security cooperation

- For instance - while cross border terrorism emanating from Pakistan is a major concern for India, Pakistan has failed to address this concern. This has become the key reason for no progress on SAARC.

## 6. Lack of dispute resolution mechanism

- SAARC doesn't have any arrangement for resolving disputes or mediating conflict which hampers consensus building and thus slows down the decision-making process.

## 7. Other Inherent weaknesses of SAARC: Political stability in member countries.

## 8. Good Steps which could not be properly implemented

- South Asia Preferential Trade Agreement (SAPTA) was signed in the 7th summit at Dhaka in 1993, but it has not yet been adequately operationalized.
- Other proposal to establish South Asian Food Reserve and South Asian Development Fund have also has not been implemented.
- Similarly, declaration on enhancing political cooperation and promotion of mutual trust and understanding reiterated in each summit have registered little success.

9. SAARC faces shortage of resources, and countries have been reluctant to increase their contributions.

- **Has the SAARC Lost its utility?**

» No, it has tremendous utility.

- But it has been held hostage by Pakistan. Any significant progress under SAARC was stymied by it and they have continuously vitiated the atmosphere by bringing in the bilateral issues which is not allowed by SAARC.

- **Future of SAARC:** An organization can only be useful if member states share the view that it meets, or at least has the potential to meet, their respective interests.

» **Way forward**

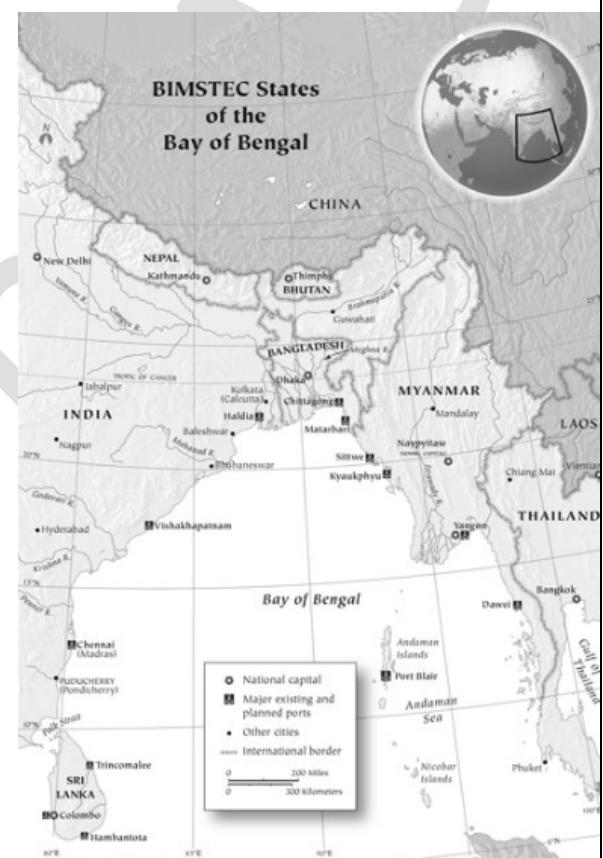
- **Deal with trust deficit:** Member countries need to put more attention towards developing trust towards each other which would set the basis for regional integration.
  - Along with official talks, track-2 diplomacy can be used for the purpose.
- **Take steps to re-initiate the process.**
  - This would take political will from all the countries as well as steps by Pakistan to control the terrorism emanating from its soil. .
- **Revive the process of South Asian Economic Integration:** Deeper regional economic integration will create greater interdependence with India acquiring the central role, which, in turn, would serve India's strategic interest.
- **Increased Connectivity:** Connectivity is prerequisite for the prosperity of the region.
  - Construction of the proposed BBIN corridor will be landmark step towards this.
  - Similarly, construction and development of ports will benefit SAARC as it benefitted EU in past.
- And if nothing works, India should look at enhancing regional cooperation by considering SAARC (minus Pakistan) as an option.
- **Deal with domestic challenges** which hinders cooperation in South Asia.
  - Divisive domestic politics with anti-Pak rhetoric and recurrent 'Bangladeshi migrant' rhetoric influence foreign policy in an undesirable manner. It dents India's soft power of being a liberal and secular democracy, which gives moral legitimacy to India's leadership in the region.

- **Conclusion**

- » Considering the limitations faced by SAARC for now, it is very natural for India to gravitate towards BIMSTEC, which acts as a bridge between South Asia and South East Asia. But in the process, the efforts put towards regional integration under SAARC should not be ignored. Crucial regional problems like terrorism, drug trafficking etc. have their origin in Pakistan and therefore a regional cooperation effort should include Pakistan.
- » **BIMSTEC cannot replace SAARC** for reasons such as lack of a common identity and history among all BIMSTEC members. Moreover, BIMSTEC's focus is on the Bay of Bengal region, thus making it an inappropriate forum to engage all South Asian nations.
- » India should view SAARC as a unit which has common future, and as a force-multiplier for India's ambition on the global stage.

## 2) BIMSTEC

- **Why in news?**
  - » S Jaishankar attends BIMSTEC Foreign Ministers meet (July 2023)
  
- **Example Questions**
  - » Discuss the significance of BIMSTEC in fostering regional cooperation and addressing common challenges in South Asia and southeast Asia. Suggest potential areas of improvement and measures needed to enhance the role of BIMSTEC in the evolving geopolitical landscape of the region. [15 marks, 250 words]
  - » "BIMSTEC can be a game changer for growth and development of North-East India" Elaborate. [10 marks, 150 words]
  - » Do you think BIMSTEC provides more potential for regional integration, including physical connectivity and economic cooperation when compared to SAARC? Give reasons [10 marks, 150 words]
  
- **Important Quotes**
  - "For India, it (BIMSTEC) is a natural platform to fulfill our key foreign policy priorities of 'Neighborhood First' and 'Act East'": PM Modi
  
- **Intro**
  - » BIMSTEC is a regional organization of 7 member states (Bangladesh, India, Sri Lanka, Thailand, Nepal, Bhutan and Myanmar) from South Asia and Southeast Asia that lie in littoral and adjacent areas of Bay of Bengal.
  - » **Basic details** (Important for Prelims)
    - It came into being on June 6, 1997 (as BISTEC - Bangladesh-India-Sri Lanka - Thailand Economic Cooperation) through the Bangkok declaration. It was later rechristened as BIMSTEC.
    - It is headquartered in Dhaka.
    - It is a unique link between South-Asia and South-East Asia. From the very beginning, it has been considered a powerful mechanism to promote opportunities for trade, investment and tourism between these two regions. Societies within BIMSTEC are pluralistic; our languages are rich and diverse, and we have a shared cultural heritage
  
- **The Objective** of the alliance is to harness accelerated growth through mutual cooperation in different areas of common interest by mitigating onslaught of globalization and by utilizing regional resources and geographical advantages.



- It is based on **two basic principles**.
  - i. To respect the principle of **sovereign equality, territorial integrity, political independence, non-interference in internal affairs, peaceful-coexistence and mutual benefits**.
  - ii. **Constitute an addition to and not be a substitute** for bilateral, regional or multilateral cooperation involving member states.
  
- **Key Areas of Cooperation**
  - Unlike many other regional groupings, **BIMSTEC is a sector driven cooperative organization**.
    - » It has identified **7 sectors** (earlier there were 14 sectors, but in the **fifth summit meeting** it was rationalized to 7 sectors).
      - Of these 7 areas, **Security and energy** is led by India. It includes under it the erstwhile independent sectors of '**Counterterrorism and Trans-National Crime**', '**Disaster Management**', and '**Energy**'.
      - **Other Areas** are - **Trade, Investment and Development** (Bangladesh); **Environment and Climate Change** (Bhutan), **Agriculture and Food Security** (Myanmar), **People to People Contact** (Nepal), **Science Technology and Innovation** (Sri Lanka) and **Connectivity** (Thailand)
  
- **BIMTEC's growth was hindered in the beginning because of:**
  - Lack of **political will and collective effort**.
  - South Asia's **focus on SAARC**
  - But, **with the decline of SAARC, BIMSTEC has emerged as a very important grouping for regional connectivity in the region**.
  
- **Significance of BIMSTEC for India**
  - **Regional Cooperation** (alternative to SAARC)
    - In the **absence of smooth functioning of SAARC**, the **groupings like BIMSTEC can take forward regional cooperation further**. Therefore, the **main motivation in reinvigorating BIMSTEC is not to counter Pakistan but to enhance regional cooperation**.
    - This regional cooperation can help us better deal with **common problems like terrorism, disasters, poverty etc.**
  - **Regional Connectivity - Also with Southeast Asia**
    - It acts as a **bridge between South and South East Asia** and represents a **reinforcement of relations among these countries**.
    - It acts as a platform for **inter-regional cooperation between SAARC and ASEAN countries**.
  - **Sync with India's foreign Policy**
    - It supports India's **Neighborhood first** and **Act East** policy.
  - **Developing North-East:**
    - BIMSTEC projects are crucial for **development of north-east India**. They will provide **better connectivity, increased economic opportunities, more jobs and thus will decrease the alienation of the region**.
    - Moreover, plans of **Mountain Economy** etc. will also help North-East India.
  - There are **economic similarities** between BIMSTEC countries
    - All 7 countries are **developing, highly growing economies**

- They have sustained average annual growth rates between 3.5% to 7.5% in recent years (exclude the COVID-19 year).
- **Countering China in the region**
  - BIMSTEC provides India an opportunity to push constructive agenda and counter China's investments in a collective way.

- **BIMSTEC has more potential than SAARC**

- In the past, India had spent more political capital and efforts to make SAARC work, than on BIMSTEC.
- However, now we have come to realize that BIMSTEC provides more potential for regional integration, including physical connectivity and economic cooperation than SAARC which is dominated by India and Pakistan and thus naturally hamstrung by tensions between the two countries.
- BIMSTEC has potential to be more successful as:
  - » **Better Cooperation and Trust:** Unlike SAARC, there is an attitude of cooperation, enthusiasm as:
    - There is no Pakistan to veto India's suggestions.
    - Member countries have generally cordial relationships, something patently missing among the SAARC countries.
  - » **Two influential regional players - no fear of domination by India**
    - Unlike SAARC BIMSTEC includes two major regional players - **India and Thailand.** This adds to the comfort of smaller neighbours by reducing the fear of dominance by one big power.
  - » **BIMSTEC countries have strategic interest in its growth:**
    - **Bangladesh** views BIMSTEC as a platform to position itself as more than just a small state on bay of Bengal.
    - **Sri Lanka** sees it as an opportunity to connect with Southeast Asia and serve as the subcontinent's hub for the wider Indo-Pacific region.
    - **Nepal and Bhutan** aim to connect with the Bay of Bengal region and escape their landlocked geographic positions.
    - **Myanmar and Thailand** want to connect more deeply with India to access its huge market.
    - **India** finds BIMSTEC as a tool for:
      - Increasing connectivity within south and southeast Asia. It is a natural platform to fulfil our key foreign policy priorities of 'Neighborhood First' and 'Act East'.
      - Pushing a constructive agenda to counter China's investment.
  - » **An opportunity to connect South Asia and ASEAN**
    - The BIMSTEC Is in sync with India's Act East policy and Thailand's Look West Policy. It also helps countries such as BD, Nepal and Bhutan to develop connectivity with ASEAN countries.
  - » **BIMSTEC provide more trade opportunities.**
    - The region include fastest growing economies in the world.

- Trade among the BIMSTEC countries have reached 6% in just a decade while it had hovered around 5% among SAARC countries since its inception.
  - » **Sector driven cooperation** allows better focus and less diversion.
  - » **More Chances of Expansion:** Sri Lanka has suggested inviting Indonesia, Malaysia and Singapore -> if this is done it would further lead to enhancement of the role that BIMSTEC can play.
  - » **Other members are also wary of China** and prefer India's benign characteristics.
- Therefore, it can be said that Bay of Bengal can emerge as vehicle of regional cooperation.
- India, which chafed at Pakistan's reluctance to allow progress under the SAARC framework, now has the opportunity to demonstrate that it can do a lot better in the Bay of Bengal.
- The initiative could range from coastal shipping, terrorism and from the development of underwater resources in Bay of Bengal to protecting the marine environment.
- **Limitations/Difficulties faced by BIMSTEC:** In spite of a lot of potential, some concerns still remain in BIMSTEC
    - **BIMSTEC doesn't have a lot of concrete achievement** in more than 25 years of BIMSTEC history.
      - A major failure relates to the continuing inability to produce a comprehensive FTA - 19 years after signing of the framework agreement in 2004.
    - There is a **too much flexibility in the conduct of its process.**
      - Summits have been infrequent.
      - A charter was finalized only recently - during 5th Summit in March 2022
    - **Only limited progress has been made in terms of connectivity:**
    - Lack of financial resources with the secretariat has hindered the performance of the group.
      - For greater regional connectivity, more financial resources are needed.
      - The movement towards development of the BIMSTEC Development Fund is minimal.
      - No Progress on Blue Economy has been made in the grouping.
      - Business chambers and corporate leaders are yet to be engaged fully with the activities of BIMSTEC.
    - Deterioration of relations between **Bangladesh and Myanmar** due to Rohingya issue is also hindering the progress in BIMSTEC.
    - Earlier, **lack of leadership was a major concern.** But since 2016, India has taken a number of initiatives to promote the grouping.
  - **5th BIMSTEC Summit**
    - » The 5th BIMSTEC summit was hosted by Democratic Socialist Republic of Sri Lanka in and from Colombo in hybrid mode on 30th March 2022.
      - Theme "**BIMSTEC - Towards a Resilient Region, Prosperous Economies, Healthy People**".
    - » **Key outcomes:**
      - BIMSTEC Leaders signed the **BIMSTEC Charter** and witnessed the signing of the **BIMSTEC Convention on Mutual Legal Assistance in Criminal Matters**, the MoU on the

Establishment of the BIMSTEC Technology Transfer Facility, and the MoU on Mutual Cooperation between Diplomatic Academies/ Training Institutions of BIMSTEC Member States.

- The summit saw considerable progress being achieved in the BIMSTEC connectivity agenda with the adoption of the '**Master Plan for Transport Connectivity**'.
- The summit also adopted the BIMSTEC Masterplan on Transport Connectivity, and the Rationalized Areas of Cooperation under BIMSTEC.
  - The 14 areas of cooperation under BIMSTEC have been rationalized to 7 areas of cooperation.
- » **The Chairmanship of BIMSTEC was handed over to Thailand from Sri Lanka at the Summit.**

- **1st ever Foreign Ministers' meeting of the Bay of Bengal Initiative for Multi-sectoral Technical and Economic Cooperation (BIMSTEC)**

- Held in Bangkok, Thailand in July 2023
- India was represented by our foreign minister Dr. S Jaishankar.
- The meet focused on strengthening resilience and coordination among BIMSTEC members, reflecting the challenges that we all confront today.

- **Key Progress made by BIMSTEC:**

- **Adoption of a BIMSTEC charter** in 5th Summit in 2022. This gives the grouping a legal status.
- **Rationalization of priority area** from 14 to 7
- **Pledging of funds** to the operational budget to ensure actionable policy measures can be undertaken.
- **Signing of memorandum** on technology transfer, diplomatic training, and a master plan on connectivity - all of which are of important for grouping's future as aspirational countries in a region that has already become the gravitational centre of global geopolitics.

- **Way forward:** The developments so far under BIMSTEC have been encouraging. But to maintain the momentum and to strengthen BIMSTEC as a sustainable platform, following steps should be considered:

- Keep BIMSTEC away from politics that bedeviled SAARC.
  - India must not fall in the trap of putting geopolitics over economic, reducing BIMSTEC into just another geopolitical weapon for isolating Pakistan.
  - India should lead BIMSTEC with much broader, inclusive vision driven by economic merits of cooperation.
- We also need to hold the future summits in a timely manner.
- Member states also need to commit significant resources to strengthen the organization.
  - India which is already the largest contributor to BIMSTEC needs to further increase its contribution.
- **Timely Delivery of Projects:** Complete the infra projects -> Kaladan Multi-modal Project, IMT trilateral highway in a timely manner.
  - **Improved Connectivity** (Physical, digital and people-to-people) should be the mantra for increased cooperation within BIMSTEC. With connectivity comes integration, cooperation and development.
- **Ensure Tangible outcomes** which will motivate countries to concentrate on BIMSTEC

- Finalize the FTA which is being discussed to further increase the economic cooperation in the region.
- Counter the impression that BIMSTEC is an India-dominated bloc, a problem that we have faced for long in SAARC.
- **Use People-to-People Engagement** in deepening relations between BIMSTEC countries. This can be done through:
  - Academic/ Education Diplomacy
  - Tourism Diplomacy
  - Festival Diplomacy
  - Health and Medical Diplomacy
  - Publication Diplomacy

- **Conclusion**

- The potential of BIMSTEC needs to be utilized to address the needs and requirements of the region, especially in the area of economic development. Given the fairly amicable relations between the member states of BIMSTEC, increasing its performance and its effectiveness is an achievable goal as long as countries exhibit enough political will and mutual respect.

### 3) WORLD BANK GROUP

- **Example Questions**

- a. What are the main functions of the World Bank Group? Explain the role of five different organizations which constitute the World Bank Group? [150 words, 10 marks]
- b. Discuss the organizations structure of World Bank. Why has India been clamouring for reforms? [250 words, 15 marks]

- **Introduction**

- WBG is a family of five international organizations that make leveraged loans to developing countries and work towards sustainable solutions to reduce poverty and build shared prosperity in developing countries.
- It is the largest developmental bank in the world and is also an observer at the United Nations Development Group (UNDG).
- It is one of the Bretton Woods organization.
- **History:**
  - It was founded in 1944 at the United Nations Monetary and Financial Conference or the Bretton Woods Conference, which was convened to establish a new, post-World War II international economic system.
  - It officially became operational in 1946.
  - **IMF and WB are called Bretton woods twins** as they were formed as a result of Bretton Woods Agreement.
- HQ: Washington D.C.

- **Goals/ Mission**

- Ending extreme poverty and building shared prosperity
- The five organizations which form part of WBG are: IBRD, IDA, IFC, MIGA, and ICSID.
  - a. **International Bank for Reconstruction and Development (IBRD)**
    - Provides debts financing on the basis of sovereign guarantees.
  - b. **International Development Association (IDA)**
    - Provides concessional financing (interest free loans or grants), usually with sovereign guarantees;
      - ('Soft loan Window' -> as it gives concessional loans)
      - It is one of the largest source of credit for the world's poorest countries.
  - c. **International Finance Cooperation (IFC)**
    - Provides various forms of financing without sovereign guarantees, primarily to the private sector
  - d. **Multilateral Investment Guarantee Agency (MIGA)**
    - Provides insurance against certain types of risk, including political risk, primarily to the private sector.
      - It thus encourages private sector to invest in foreign developing countries.
  - e. **International Centre for settlement of Investment Disputes (ICSID)**
    - It helps private investors and foreign countries to work out differences when they don't agree.
    - Many Bilateral Investment Treaties also provide ICSID mechanism for dispute resolution.
    - Note:
      - India is not a member of ICSID and considers the convention biased in favor of developed countries.
      - For e.g. the Chairman of ICSID is the Chairman of World Bank. The chairman appoints the arbitrators too
- **Membership:**
  - To become a member of the Bank, under the **IBRD Articles of Agreement**, a country must join the International Monetary Fund (IMF). Presently, IBRD has 189 members.
    - Note: Currently, all member of IMF are also members of IBRD.
  - Membership of **IDA, IFC and MIGA** are conditional on membership in IBRD.
    - # Members: IDA (173); IFC (185); MIGA (182); ICSID (185);
- **World Bank:** The term "world bank" generally refers to just the IBRD and IDA, whereas the term WBG refers to all five institutions collectively.
  - **IBRD and IDA focuses on developing countries** in areas such as human development, infrastructure, environment protection, large industrial construction project, and governance.
  - They provide **loans at preferential rates to member countries**, as well as grants to the poorest countries.
- **Decisions Making Process:**
  - The bank runs like a **giant cooperative**, where its members are shareholders and is operated for the benefit of those using its service. The **number of shares of each country** is based on roughly the size of its economy.

- The US, Japan, and China are the largest shareholders. (Sep 2021)
  - i. United States - 16.53%
  - ii. Japan - 7.79%
  - iii. China - 4.49%
  - iv. Germany - 4.49%
  - v. United Kingdom - 4.31%
  - vi. France - 4.31%
  - vii. India - 3.71%
  - viii. Italy - 3.17%
  - ix. Canada - 2.97%
  - x. Russia - 2.74%
- **A Board of Governors** represents the Bank's government shareholders. They are the ultimate policy makers in the WB.
- **24 Executive directors** deal with the daily functions of the bank including approving loans and guarantees, new policies, the administrative budget, country assistance strategy and borrowing and financial decisions.
  - » 5 Executive directors are from the five largest donors (US, Japan, Germany, UK and France)
  - » Remaining 19 executive directors represent the other member countries.
- **Need of Reforms:**
  - a. **Dominated by a few developed countries:**
  - b. **Doesn't represent the current economic picture of the world.**
  - c. Imposes "free Market" economic policy on developing countries as a condition for loans.
  - d. **Need for Capital Increase**
  - e. **Need of transparency** -> to ensure integrity, credibility and impartiality of the organization (e.g. recent data manipulation controversy)
- **Suggestion by G20 expert panel on strengthening Multilateral Development Banks (MDBs), such as WB, ADB (Oct 2023)**
  - Shift from financing individual projects to prioritizing programs with sectoral focus and long-term transformation plan, as identified by National Government.
    - MDBs should focus on helping national governments create and operationalize their respective country platforms for the highest priority sustainable development goals (SDGs)
  - **MDBs** need to ramp up financing to \$390 billion by 2030 and private sector can play an important role here by reversing the current trend of "disappointingly low" private financial flows to EMDEs.
    - MDBs need to embrace partnership with private sector.
- **World Bank Group and India**
  - India is the largest client of the WBG.
  - India is member of 4/5 organs of WBG.
- **Reports:**
  - Global Economic Prospect

- Logistic Performance Index (last in 2018)
- Ease of Doing Business Index
  - Stopped due to data manipulation controversy.
- Human Capital Index

## 4) INTERNATIONAL MONETARY FUND (IMF)

- **Introduction**
  - » **Beginning**
    - The IMF also known as the Fund, was conceived at a UN conference in Bretton Woods, New Hampshire, United States, in July 1944. It formally came into existence in 1945, the IMF is governed by and accountable to 189 countries that make up its near-global membership.
      - **Note:** IMF and World Bank are two Bretton woods organizations.
    - **Headquarter:** Washington DC
- The **primary goal** of the IMF was to bring about International Economic Coordination to prevent competing currency devaluation by countries trying to promote their own exports.
  - » Eventually, **IMF evolved to be a lender of last resort** to governments of countries that had to deal with severe currency crisis.
- The **Organization's Objectives stated in the Articles of Agreement are:**
  - To promote international Economic Cooperation, International Trade, Employment and Exchange rate stability, including by making financial resources available to member countries to meet balance of payment needs.
- **How IMF promotes global Economic Stability**
  - » The IMF helps countries to implement sound and appropriate policies through its key functions of surveillance, technical assistance, and lending.
    - » **Surveillance**
      - IMF's mandate is to oversee the international monetary system and monitor the economic and financial policies of its 189 member countries. This surveillance takes place at the global level and in individual countries and regions.
      - **Consulting with member countries**
        - IMF monitors members' economies through regular - usually annual - consultation with each member country.
      - **Closely monitors global and regional trends**
        - Periodic reports : **The World Economic Outlook**, its regional overviews, **the Fiscal Monitor**, and the **Global Financial Stability Report**, analyze global and regional macroeconomic and financial developments.
    - » **Technical Assistance:** IMF provides advice and training on a range of issues within its mandate, including fiscal, monetary and exchange rate policies, regulation and supervision of financial systems; statistics systems; and legal framework.
    - » **Lending**

- Financial assistance to a member country which is experiencing financial difficulty. It can also support crisis prevention.
- A core responsibility of IMF is to provide loans to member countries experiencing actual or potential balance of payments problems.

## - IMF Bailouts

- Why in news?
  - In March 2023, IMF confirmed \$3 billion bailout plan for Sri Lanka's struggling economy (March 2023)
    - IMF officials are also negotiating with Pakistan for \$1.1 billion bailout plan as the country faces a severe economic crisis.
- Why do nations seek IMF bailout?
  - To deal with major macro-economic risks:
    - For e.g. in case of both Sri Lanka and Pakistan, both countries have witnessed domestic price rise rapidly and steep depreciation in their currency.
- How does the IMF help countries?
  - It lends money, often in the form of special drawing rights (SDRs), to troubled economies that seek the lender's assistance.
  - IMF carries out its lending to troubled economies through a number of lending programs such as Extended Credit Facility; the flexible credit facility; the standby agreement etc.
- Criticisms of IMF Bailouts
  - IMF usually imposes conditions on countries before it lends any money to them. For e.g. a country may have to implement certain structural reforms as a condition to receive IMF loans. The IMF's conditional lending has been controversial as many believe that these reforms are too tough on the public. Sometimes IMF is also accused of influencing international politics.
- Supporters argue that without structural reforms bailout will not be successful.

## - Where the IMF Gets its Money

- Most resources for IMF loans are provided by member countries, primarily through their payment of quotas.
- **Borrowings** provides a temporary supplement to quota resources and has played a critical role in enabling the fund to meet member's need for financial support during the global economic crisis.
- Concessional lending and debt relief for low income countries are financed through separate contribution based trust funds.

## - Governance and Organization

- The IMF is accountable to the government of its member countries.
  - At the top of its organization structure is the **Board of Governors**, which consists of one governor and one alternate governor from each member country.
    - The Board of governor meets once each year at the IMF-World Bank Annual Meetings. Twenty-four of the governors sit on the **International Monetary and Financial Committee (IMFC)** and normally meet twice each year.

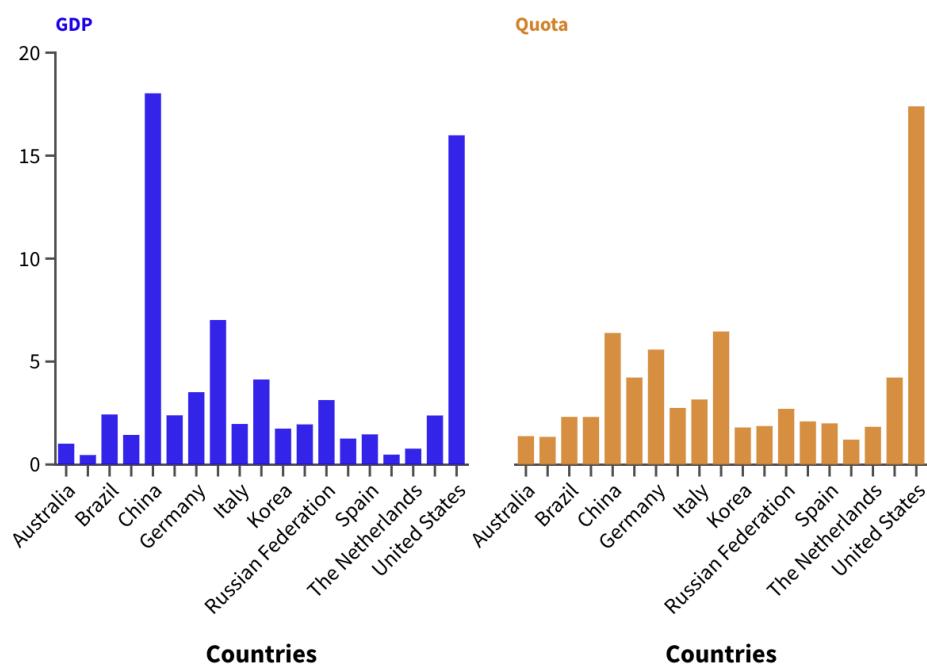
- The day-to-day work of IMF is overseen by its 24-member **Executive Board**, which represents the entire membership; this work is guided by the IMFC and supported by the IMF staff. From 2016, all members of the board are elected.
- **The Managing Director** is the head of the IMF staff and Chairman of the Executive Board and is assisted by four Deputy Managing Directors.

#### - **IMF Quotas**

- Quota subscriptions are a central component of the IMF's financial resources. Each member country of IMF is assigned a quota, based broadly on its relative position in the world economy.
  - A member country's quota determines its
    - Maximum financial commitment to the IMF
    - its voting power
      - Each IMF member's votes are comprised of basic votes plus one additional vote for each SDR 100,000 of quota.
        - The 2008 reforms fixed the number of basic votes at 5.502% of total votes.
    - iii. **Access to Finance:** The amount of financing a member can obtain from the IMF (its access limit) is based on its quota
- The current Quota formula is a weighted average of GDP (weight 50%), openness (30 percent), economic variability (15%), and international reserves (5 percent).
  - GDP is measured as a blend of GDP - based on market exchange rates (weight of 60%) and PPP exchange rates (40 percent).

### Countries with IMF quotas (over 1%)

The 2023 meeting of World Bank & IMF in Morocco were expected to initiate a process whereby IMF quotas, which decide voting heft of countries, would be restructured.



- Quotas are denominated in Special Drawing Rights (SDRs), the IMF's unit of account.

- » India's quota is 2.76% and China's is 6.41%, while the U.S.'s quota is 17.46 % (translates to a vote share of 16.52%) giving it a unique veto power over crucial decisions at the IMF, many of which require a supermajority of 85%.
  - The largest member of IMF is the United States (current Quota, March 2017 : SDR 82.99 billion (US\$113 billion)
  - The smallest member is Tuvalu (Current quota, SDR 2.5 million (about US\$3.4 million).
- **How Quota Review works**
  - » The IMF's *Board of Governors conducts general quota reviews* at regular intervals (usually every five years) Any changes in quotas must be approved by 85 percent majority of total voting power, and a member's quota cannot be changed without its consent.
    - There are two main issues addressed in a general quota review:
      1. the size of an overall increase
      2. the distribution of the increase among the members.
- **Why periodic reviews are done?**
  - » **Maintaining adequacy of resource:**
    - In terms of member's balance of payment financing needs
    - IMF's ability to help meet those needs.
  - » **Reflect changes in the global economic status**
- **Ad hoc increases** outside general reviews do not occur often, but the increases in quotas for 54 member countries approved under the 2008 reforms are a recent example.
- **The 2010 Review and it's coming into effect in Jan 2016**
  - » The **2010 Quota and Governance reform** were approved by the IMF's Board of Governors in Dec 2010 and built on an earlier set of reforms that were approved by the Governors in April 2008.
  - » This was the **14th General Review of Quotas**
    - Reform package came into force in Jan 2016
  - » **Key outcomes of the 2010 reform**
    - Quota Reforms -> Doubling of Quota to SDR 477 billion; Shifting of quota to under-represented member countries and EMDCs.
      - This has made China the 3rd largest shareholder in IMF and (India, Brazil and Russia) have also come among the largest shareholders.
    - **Governance Reform**
      - All elected IMF's Executive Board (Board Reform Amendment)
  - » **Implications**
    - Increase the financial strength of the IMF.
    - Fund will better meet and represent the needs of its members in a rapidly changing global environment.
    - It is a major step towards better reflecting in the institution's governance structure and increasing role of dynamic emerging market and developing countries.
    - This will reinforce the credibility, effectiveness, and legitimacy of the IMF.
- **IMF Quota and Governance: Need for reforms**
  - **Need for Reform**

- Given the unequal voting power mechanism, IMF doesn't always serve the interests of poor and developing countries, hence require two sets of reforms:

### 1. Need for Quota Reforms

- To give more say to developing nations in the activities of the multi-lateral organizations.
- To reflect the changes in economic realities, especially with regard to increasing prowess of the developing nations.
- To increase the financial capability of IMF.

### 2. Need for governance Reform.

- To make it more representative

- Some IMF members have become frustrated with the pace of governance reform, as the balance of economics and geopolitical power has shifted, becoming more dispersed across the world, particularly with the emergence of China and India.

#### - Key changes agreed to in 2019 Agreement.

- » The 15th Quota Review is currently underway.
- » IMF has agreed to maintain its funding at \$1 trillion but has postponed changes to its voting structure.
  - This deal is a compromise with the U.S., the fund's largest shareholder, which has resisted changes to the organization's voting structure as well as increase in its permanent resource base.
  - The IMF quotas will now be reviewed before the end of 2023.

#### A) SDR (UNDERSTAND FOR PRELIMS)

- The SDR is an international reserve asset, created by IMF in 1969. It operates as a supplement to the existing money reserves of member countries.
- Why was SDR needed? Under Bretton Woods, the international supply of two key reserve assets - gold and US dollar - proved inadequate for supporting the expansion of world trade and financial development that was taking place. Therefore, international community decided to create a new international reserve under the auspices of IMF.
- The IMF uses SDRs for internal accounting purposes.
- The value of SDR is calculated from a weighted basket of major currencies, including the U.S. dollar, the euro, Japanese Yen, Chinese Yuan and British Pound.
  - The makeup of SDR is re-evaluated five years. The current makeup of the SDR is represented by the following table:

Currency	Weights Determined in the 2015 Review	Fixed Number of Units of Currency for a 5-Year Period Starting Oct. 1, 2016
U.S. Dollar	41.73	0.58252
Euro	30.93	0.38671
Chinese Yuan	10.92	1.0174
Japanese Yen	8.33	11.900
Pound Sterling	8.09	0.085946

- **Which currencies can be included in SDR baskets?**

- Currencies of "members or monetary unions whose exports had the largest value over a five-year period and have been determined by the IMF to be freely usable."
- The **SDR interest rate (SDRi)** provides the basis for calculating the interest rate charged to member countries when they borrow from the IMF and paid to members for their remunerated creditors position in the IMF.
- The IMF member countries are entitled to get a loan from IMF's SDR Account. This loan amount is upto 200% of the member's quota with the IMF. It is also known as **Paper Gold**.
  - In this arrangement IMF doesn't lend directly. It is the member countries, who are in a strong position, lend their SDR holdings to member countries who are in problems for balance of payment.



# CURRENT AFFAIRS PROGRAM

## PRE CUM MAINS 2024

### DEC 2023: BOOKLET-4

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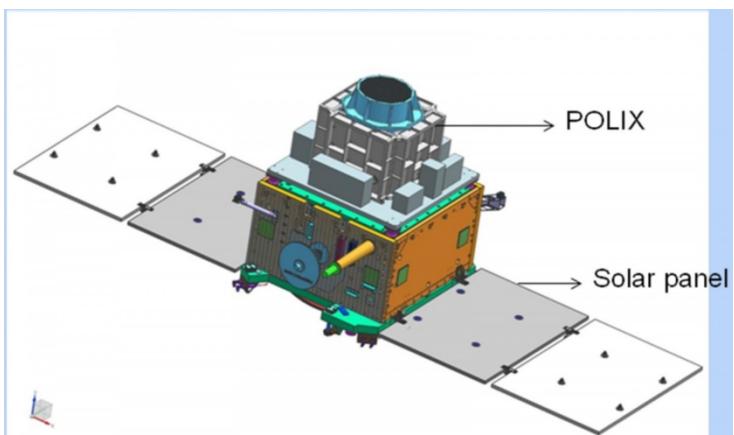
## 1. GENERAL STUDIES – 3: S&T UPDATES

### 1) SPACE: CHANDRAYAAN-3 PROPULSION MODULE RETRACES STEPS BACK TO EARTH'S ORBIT (DEC 2023)

- **What happened?**
  - Scientists have brought the propulsion module (PM) of Chandrayaan 3 mission back into earth orbit.
  - This was not part of original mission plan. It utilized the logistics advantage of near perfect mission, especially the availability of more than 100 Kg of fuel.
- **How was this achieved?**
  - ISRO performed maneuver to raise the orbit of the PM around the moon (from 150 km to 5,112 kms)
  - Second maneuver targeted an earth orbit of 1.8 lakh X 3.8 lakh km.
- **Significance:**
  - This experiment prepares ISRO for future missions, especially the ambitious Lunar Sample Return Mission.
  - Through this ISRO has been able to understand what is involved in the “planning and execution of trajectory and maneuvers to return from Moon to Earth”

### 2) SPACE: XPOSAT

- **Why in news?**
  - India (ISRO) set to launch its first X-Ray Polarimeter Satellite (Nov 2023)
- **More Details**
  - XPoSat will be a specialized science mission that will study the polarization of X-Rays in space.
    - The mechanization of polarization of radiation gives away the nature of its source, including the strength and distribution of the magnetic field and the nature of radiation around it.
  - XPoSAT will carry two scientific payloads in a low earth orbit.



- The **Primary Payload (POLIX) (Polarimeter Instrument of X-Rays)** will measure the polarimetry parameters (degree and angle of polarization) in medium X-ray range of 8-30 KeV photons of astronomical origin.
- The **XSPEC (X-Ray Spectroscopy and Timing)** payload will give spectroscopic information in the energy range of 0.8 – 15 keV.
  - The **POLIX** payload is developed by the Raman Research Institute (RRI), Bangalore, with support from ISRO centres.
  - The **XSPEC** payload is developed by the UR Rao Satellite Centre (URSC), ISRO.
- **Need:** The emission mechanisms from various astronomical sources such as blackhole, neutron stars, active galactic nuclei, pulsar wind nebulae etc. originates from complex physical processes and are challenging to understand.
- **The Polarimetry measurement adds two more dimension to our understanding**, the degree of polarization and the angle of polarization and thus is an excellent diagnostic tool to understand the emission processes from astronomical sources.
- **International Trend in Space-Based X-Ray Polarimetry**
  - Internationally, space-based x-ray polarimetry is gaining importance.
    - The **Imaging X-Ray Polarimetry Explorer (IXPE)** mission, launched on Dec 09, 2021, represents NASA's inaugural space-based endeavor, focused on scrutinizing X-Ray Polarization across various celestial bodies.
    - **Note:** XPoSAT energy range of 8-30 keV for polarization measurement is complimentary to IXPE energy range of 2-8 KeV. Therefore, XPoSAT and IXPE spacecrafts will collectively probe different emission mechanisms and physics for bright x-Ray sources. Their coordinated observation will provide a wide window in the energy range of 2-30 KeV for polarimetric observations for bright X-Ray sources.

### 3) SPACE: PSYCHE MISSION

- **Example Questions:**
  - Launched on 13<sup>th</sup> October 2023, Psyche Mission has been much in news since then. What are the key goals of the mission? What potential benefit does it hold for human race? [10 marks, 150 words]
- **About Psyche Asteroid:**
  - Psyche is one of the asteroids in the asteroid belt. What makes the asteroid unique is that it appears to be the exposed nickel-iron core of an early planet, one of the building blocks of our solar system.
- **About Psyche Mission:**

- The *Psyche Mission* is a NASA space mission launched on 13<sup>th</sup> Oct 2023 to explore origin of planetary cores by orbiting and studying the metallic asteroid Psyche in 2029. The mission consists of Psyche Aircraft.

▫ **Significance:**

- **Understanding the Core of a Planet:** Deep within rocky terrestrial planets – including Earth – scientists infer the presence of metallic cores. But these remain unreachably far below the planets' rocky mantles and crusts. Psyche offers a unique window into the violent history of collisions and acceleration that created terrestrial planets.
- **Science Goals include:**
  - Understand a previously unexplored building block of planet formation: Iron cores.
  - Look inside terrestrial planets, including Earth, by directly examining the interior of a different body, which otherwise couldn't be seen.
  - Explore a new type of world made of metal (and not of rock and ice)
- **Science Objectives:**
  - Understanding Psyche – Whether it is a core, or if it is an unmelted material, relative ages of psyche's surface etc.
- **Deep Space Optical Communication (DSOC):** The Psyche mission is also testing a sophisticated new laser communication technology that encodes data in photons at near-infrared wavelength (rather than radio waves) to communicate between a probe in deep space and Earth.

▫ **Conclusion:**

- Overall, the Psyche mission will not only explore the Psyche Asteroid, but it will also unlock a deeper understanding of earth and our solar system

#### 4) SPACE: DEEP SPACE OPTICAL COMMUNICATION

- **Why in news?**
  - » NASA's Deep Space Optical Communication Demo sends, receives first data (Nov 2023)
- **Example Questions:**
  - » Discuss the significance of NASA's Deep Space Optical Communication (DSOC) experiment for future space exploration. [10 marks, 150 words]
- **Need of Deep Space Optical Communication:**
  - » **Low bandwidth of radio frequency communications:** Future space missions are going to require higher bandwidth of communication as they will need to transmit higher volumes of science data, images, videos etc.

- » **Higher frequencies (shorter wavelengths)** which can carry more data suffer from the problems of getting blocked by atmosphere, and higher scattering when it is contacted with any interference.
- NASA's Psyche Spacecraft is on its way to Psyche asteroid and will reach there by 2029. But in between it is involved in experiments related to Deep Space Optical Communication (DSOC).
- Primary Objective of DSOC is to give tools and technology to future NASA initiatives to communicate at much higher bandwidth.
- Demo:
  - » DSOC has achieved 'first light' sending data via laser to and from far beyond the Moon for the first time.
  - » NASA's DSOC experiment **has beamed a near-infrared laser encoded with test data from nearly 16 million kms away** – about 40 times further than the Moon is from Earth – to the Hale Telescope at Caltech's Palomar Observatory in San Diego County, California. This is the **farthest ever demonstration** of optical communication.
- Key features:
  - » It is pioneering the use of **near-infrared laser signal for communication with spacecraft**.
  - » **Its bandwidth is more than 10 times higher** than the state of art radio-telecommunication system of comparable size and power. This enables higher resolution images, larger volumes of science data, and streaming of videos.
- Advantages: Higher Bandwidth, faster data transmission, improved image resolution, reduced power consumption, potential for streaming video and real-time communication
- How were the limitations of high frequency communication overcome?
  - » **Extremely precise pointing**: To achieve this, the transceiver aboard the spacecraft needs to be isolated from the craft's vibration.
  - » **Compensating for movements of spacecraft and Earth**: The targeting has to adjust for this continuous movement.
  - » **Extracting information from weak signal**: Since the signal will travel several million kms, the received signal will be very weak. New Signal processing tools have to be utilized to extract precise information from the communication.
- Psyche spacecraft is the first to carry a DSOC transceiver and will be testing high bandwidth optical communications to Earth during the first two years of the spacecraft's journey to the main asteroid belt.
- Achieving the first light is **one of many critical DSOC milestones in the coming months, paving the way toward higher-data-rate communication**.
- Has Space based optical communication happened in past?

- » In 2013, NASA's Lunar Laser Communications Demonstration tested record breaking uplink and downlink rates between Earth and the Moon using similar technology.
  - » **But DSOC** is taking optical communication to Deep Space, paving the way for high-bandwidth communication far beyond the Moon and over 1,000 times farther than any optical communication test to date.
- **Significance:**
- » The DSOC holds the key for future space missions. As humans travel deep into space, they would want fast way of sending and receiving large amount of data from earth.
  - » It would pave the way for high data rate communications capable of sending scientific information, high-definition imagery, and streaming video in support of humanity's next giant leap: Sending humans to Mars.
- **Conclusion:**
- » While some challenges remain, the DSOC's potential for faster, richer space communication illuminates the path forward for future deep space missions.
- **Useful Video:** <https://youtu.be/VsKgYmQS-Kw?si=4HhQDlcTEyH8Xqfw>

## 5) BLACK HOLES

- **Why in news?**
  - » Ferocious black holes reveal 'time dilation' in early universe (July 2023: Source: The Hindu)
  - » Spotting black holes (Sep 2023: Source – The Hindu)
- **What is a Black Hole?**
  - » A Black hole is a place in space where gravity pulls so much that even light can't get out. This strong gravity is because matter has been squeezed into a tiny space. This can happen when a star is dying.
  - » Since, no light is emitted from them, they are invisible.
  - » They are generally detected by telescopes by analyzing the behavior of stars that are very close to this black hole.
  - » **How large is a black hole?**
    - A black hole can be as small as an atom (but having the mass of a mountain) and they can be very large as well.
    - Stellar is a kind of blackhole whose mass is around 20 times the mass of sun. There are many many stellar blackholes in our Milky Way Galaxy.
    - "Supermassive" are the largest black holes. These black holes have masses that are more than 1 million suns together. Every large galaxy contains a supermassive blackhole at its

center. The Supermassive blackhole at the center of the **Milky Way galaxy** is called **Sagitarrius**. It has a mass of 4 million suns and would fit inside a very large ball that could hold a few million earths.

**Quasars:** Quasars are a subclass of active galactic nuclei (AGNs), extremely luminous galactic cores where gas and dust falling into a supermassive black hole emit electromagnetic radiation across the entire electromagnetic spectrum. They are among the brightest objects in the Universe.

**Note:** All Quasars are AGN, but not all AGN are Quasar



» The boundary of black hole is called **event horizon** which acts as one way towards the black hole and allows nothing to get out of it.

#### - **Singularities and Blackhole**

» In 1915 Karl Schwarzschild noticed that Einstein's then new-general theory of relativity predicted the existence of strange objects known as "singularities". They were places where his new equation describing gravity seemed to go haywire. Inside them there was a bizarre place where time stopped, and space became infinite. Over the years evidence have piled up explaining that singularities do exist in our universe as black holes.

#### - **Spotting black holes: How do we identify blackholes?**

» A blackhole is identified by the gravitational force it exerts on nearby stars.

- If the unseen companion happens to be a black hole, then because of its high gravity it will start pulling matter off the surface of the visible star. This matter start falling towards the blackhole in a characteristic spiral path. In the process it also emits X-Rays which can be detected from earth.
- From the observed orbit of visible star one can determine the lowest possible mass of the black hole.

#### - **Recent Updates about Blackholes**

##### **A) SCIENTISTS HAVE DISCOVERED OLDEST BLACK HOLE YET (NOV 2023)**

- A study published in Nov 2023 have confirmed that supermassive blackholes existed at the dawn of the universe. NASA's JWST and Chandra X-Ray Observatory have teamed up to confirm this observation.

- Given the age of the Universe is 13.7 billion years old, the age of this black hole is 13.2 billion years. Further, this blackhole is whopper – 10 times bigger than the black hole in our milky way galaxy. It is believed to weigh from 10% to 100% the mass of all the stars in its galaxy.
- **How was it formed?**
  - » The researchers believed that the black hole was formed from colossal clouds of gas that collapsed in a galaxy next door to one with stars. The two galaxies merged, and the black hole was formed.
- **Role of Chandra X-Ray Observatory:** The fact that Chandra X-Ray detected it confirms without doubt that it is a black hole. With X-rays you discover the gas that is being gravitationally pulled into the black hole, sped up and it starts glowing int the X-Ray.
- This one is considered quasar since it is actively growing, and the gas is blindingly bright.

## B) FEROIOUS BLACKHOLES REVEAL TIME DILATION IN EARLY UNIVERSE (JULY 2023)

- Scientists have used observation of a ferocious class of black holes called quasars to demonstrate “time dilation” in the early Universe, showing how time then passed only about a fifth as quickly as it does today. The observation stretches back to about 12.3 billion years ago, when the universe was roughly  $1/10^{\text{th}}$  of its present age.
- **Quasars were used as a “clock”** in the study to measure time in the deep past. The researchers used observations involving the brightness of 190 quasars across the universe dating to about 1.5 billion years after the Big Bang even that gave rise to the Cosmos. **They compared the brightness of these quasars at various wavelengths to that of quasars existing today**, finding that certain fluctuations that occur in a particular amount of time today did five times more slowly in the most ancient quasars.

## 6) NEUTRINO PARTICLES

- **Introduction**
  - » Neutrinos are one of the fundamental particles which make up the Universe. It is a fermion. They are similar to electrons but without any charge.
  - » Neutrinos are affected by weak subatomic force of much shorter range than electromagnetism and are therefore able to pass through great distances in matter without being affected by it.
    - Neutrinos interact very weakly with most of the things - trillions of them pass through every human body every second without anyone noticing.
  - » **A neutrino spin** always points in the opposite direction of its motion, and until a few years ago, neutrinos were believed to be massless. It is now generally believed that the phenomenon of neutrino oscillations requires neutrinos to have tiny mass.
  - » **Three types of neutrinos are known**, there are strong evidence that no additional neutrinos exist, unless their properties are unexpectedly very different from the known types.

- » Each type or flavor of neutrino is related to a charged particle (which gives the corresponding neutrino its name). Hence, the "electron neutrino" is associated with the electron, and two other neutrinos are associated with heavier version of electrons called muon and the tau.
- » The table below list the known types of neutrinos (and their electrically charged partners)

Neutrino	$n_e$	$n_m$	$n_t$
Charged Partners	Electron (e)	Muon (m)	Tau (t)

- **How are neutrinos formed?**
  - » Neutrinos are produced copiously in nuclear reactions in the Sun, stars, and elsewhere.
  - » Majority of neutrinos in the vicinity of earth are from the nuclear reactions in the Sun.
  - » They are formed on earth when unstable atoms decay, which happens in the planet's core and nuclear reactors.
- **Active Research Areas**
  - » Large neutrino detectors
    - Measure the neutrino masses and determine the precise values for the magnitude and rates of oscillations between neutrino flavors.
- **Motivation for research**
  - » Neutrino's low mass and neutral charge mean that they interact weakly with other particles and fields. This feature of weak interaction interests' scientists because it means neutrinos can be used to probe environments that other radiation (such as light or radio wave cannot penetrate)
    - Thus, Neutrinos can be used to probe the Universe, areas beyond our Solar system and phenomenon like Supernova.
  - » They can also enhance the understanding of basic physical laws as it provides a tool to study the structure of nucleons (protons and neutrons)

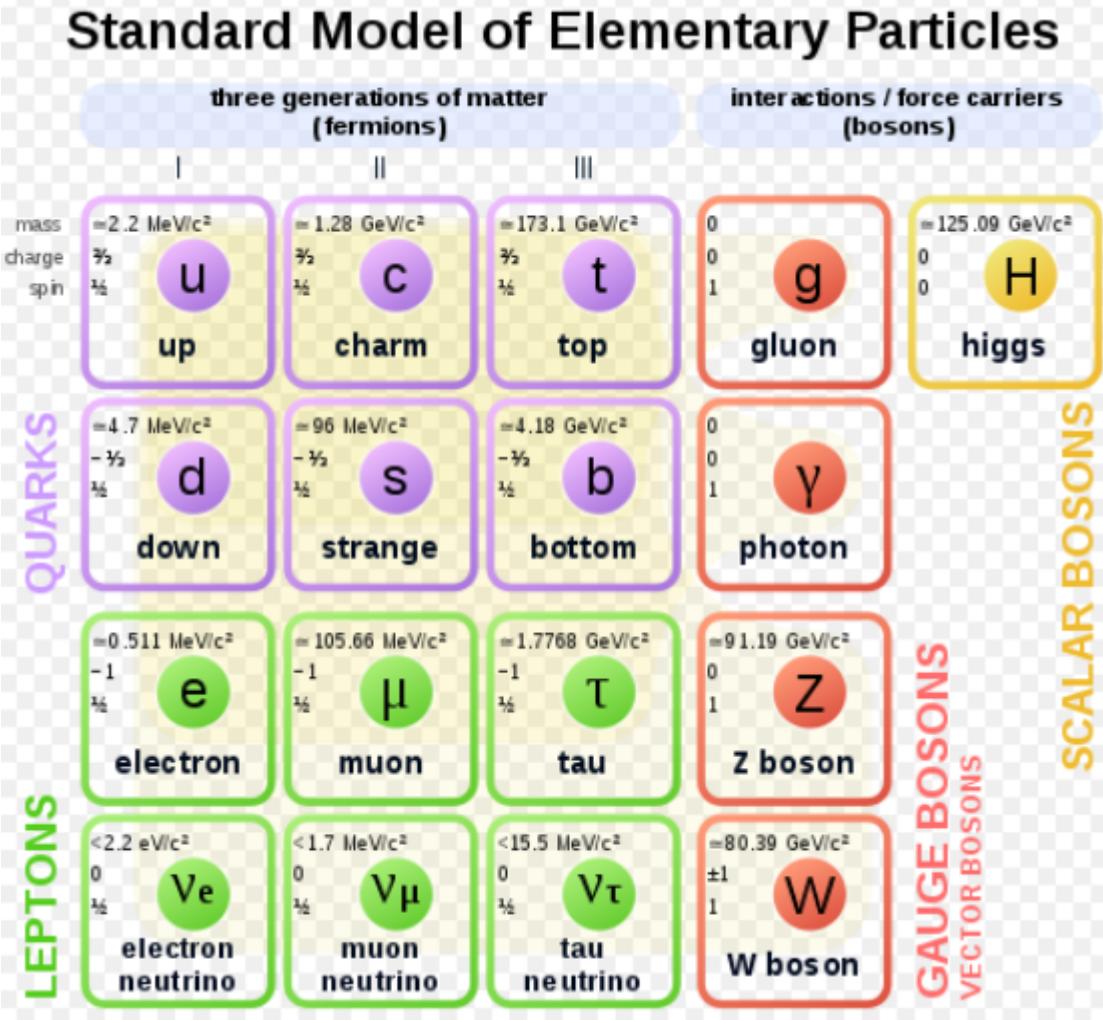
#### A) INDIAN NEUTRINO OBSERVATORY (INO) PROJECT IN THENI, TN

- It is a Rs 1600 Crore Science Project conceived nearly 20 years ago and can put India on the world map in the field of Neutrino Physics. It will house a massive iron detector which will be placed more than a Kilo meter below the surface of the earth. With a weight of nearly 50,000 tonnes, it will be the largest particle detector in the world.
  - » The project is led by TIFR and has more than 25 top research institutions in the country as collaborators.
- Setting up of this opportunity would mean revival of a lost opportunity for India because in 1965 pioneering Indian Scientists at the Kolar Gold Field (KGF) observatory were among the first in the world to discover the traces of atmospheric neutrinos. With the closure of KGF mines in 1990s, experimental research on neutrinos came to an end in India.
- The project will be jointly supported by the Department of Atomic Energy and The Department of Science and Technology.

- Issue Associated with INO: Environment Clearance (Matter pending in the SC)
- Useful Video:
  - » [India based Neutrino Observatory A Mega Science Project](#)



## B) NOTE: STANDARD MODEL OF PARTICLE PHYSICS



### C) IN A FIRST, SCIENTISTS SEE NEUTRINO EMITTED BY THE MILKY WAY (JUNE 2023)

- For the first time, scientists have seen neutrinos originating from the central disk of the Milky Way. It was achieved with the help of IceCube Experiment. They detected high-energy neutrinos in pristine ice deep below Antarctica's surface, then traced their source back to locations in the Milky Way - the first time these particles have been observed arising from our galaxy.
- About IceCube Experiment:
  - » For the past 10 years, an array of small light sensors drilled into Antarctic ice has been detecting neutrinos as they zip through our planet. IceCube is an actual cube of these sensors, a km long on each side, that was sunk 1.5 and 2.5 km deep in the ice. In this translucent medium, the sensors pick up tiny flashes of so-called Cherenkov radiation that forms when a vanishingly rare neutrino hits the ice and creates a shower of secondary particles.
- Significance:
  - » The experiment established the galaxy as a neutrino source.
  - » Milky Way neutrinos may help scientists understand the origin of high-energy particles known as cosmic rays, which kick off the formation of neutrinos.

## 7) HEALTH: FLU

### A) INFLUENZA A VIRUS

There are four types of Influenza viruses: A, B, C, and D. Influenza A and B viruses cause seasonal epidemics of diseases.

Influenza A viruses are the only influenza viruses known to cause flu pandemics (i.e. global epidemics of flu diseases)

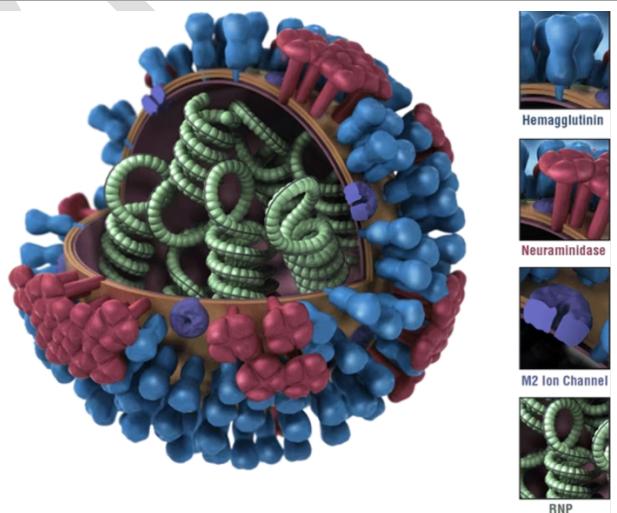
Influenza A virus is the only species of the genus *Alphainfluenzavirus*. It is an RNA virus.

Influenza A viruses are divided into subtypes based on two proteins on the surface of the virus: hemagglutinin (H) and neuraminidase (N).

- There are 18 hemagglutinin subtypes (H1 - H18) and 11 different neuraminidase subtypes (N1 - N11)

More than 130 influenza A subtype combinations have been identified in nature, primarily from birds, there are potentially many more influenza A subtypes combinations given the propensity of virus "reassortment".

Reassortment is a process by which influenza viruses swap gene segments. It can occur when two influenza viruses



infect a host at the same time and swap genetic information.

- The influenza A virus subtypes that have been confirmed in humans, ordered by the number of known human pandemic deaths, are:
  - » **H1N1** caused Spanish Flu in 1918 and the 2009 swine flu pandemic.
    - A variant of H1N1 was responsible for the Spanish Flu pandemic that killed some 50 million to 100 million people worldwide in 1918 and 1919.
  - » **H2N2** caused "Asian Flu" in the late 1950s.
  - » **H3N2** caused "Hongkong Flu" in the late 1960s.

## B) SWINE FLU

- **Swine Flu** is a respiratory disease caused by **influenza A viruses** that infects respiratory tract of pigs and result in barking cough, decreased appetite, nasal secretion, and restless behavior; the virus **can be transmitted to human**.
- **The first case of influenza A H1N1** was reported in Mexico in **April 2009**. Since then this infection has affected almost all the countries of the world.
  - » **The Virus**
    - Investigators decided to name it **H1N1** flu since it was mainly found infecting people and **exhibits two main surface antigens, H1 (hemagglutinin type 1) and N1 (neuraminidase type 1)**. The eight RNA strands from novel H1N1 flu have one strand derived from human flu strains, two from avian (bird) strains, and 5 from swine strains.
    - Most common virus causing swine flu is H1N1 but the flu virus can sometimes also come from other subtypes such as **H1N2, H3N1, and H3N2**. Since 2017, H3N2 is becoming a dominant strain.
  - » **Cross Species infections** (swine to humans, humans to swine) etc. have **mostly remained local and haven't caused national or worldwide infections** in either pig or humans.
  - » **Transmission to humans:**
    - Most common way for humans to catch swine flu is through contact with an infected pig (not through properly cooked pork)
    - Swine flu is transmitted from person to person by inhalation or ingestion of droplets containing virus from people sneezing or coughing.
  - » **Symptoms**
    - **Similar to most influenza infections:** - fever, cough, nasal secretion, fatigue and headache.
  - » **Prevention and cure**
    - **Vaccination** is the best way to prevent or reduce the chances of becoming infected with influenza virus
    - **Two antiviral agents, zanamivir (Relenza) and oseltamivir (Tamiflu)**, have been reported to help prevent or reduce the effects of swine flu if taken within 48 hours of the onset of symptoms.

## C) AVIAN INFLUENZA: BIRD FLU

- **Intro**
  - Bird flu (Avian Influenza) is caused by influenza A viruses.
    - Only viruses of the H5 and H7 subtypes are known to cause the highly pathogenic form of the bird diseases.
      - Most avian influenza virus don't infect humans; however, some such as A(H5N1) and A(H7N9), have caused serious infections in people.
    - Recently, China reported that H10N3 has also infected humans.
  - **There are several subtypes of Avian Influenza**
    - **AH5N1** is the most common virus causing bird flu, or avian influenza. It is largely restricted to birds, and often fatal (**high pathogenicity**) to them. It can sometimes cross over to other animals, as well as human.
      - According to WHO, the H5N1 was first discovered in humans in 1997 and has killed almost 60% of those infected. Though, it is not known to transmit easily among humans, the risk remains.
    - **A-H7N9**: It was reported in China in 2013. An outbreak of H7N9 strain killed around 300 people in 2016 and 2017.
  - **Risk Factors for human infections**
    - The primary risk factor for human infection appears to be direct or indirect exposure to infected live or dead poultry or contaminated environments, such as live bird markets.
  - **Impacts**
    - Outbreaks of AI in poultry may raise global public health concerns due to their effect on poultry population, their potential to cause serious disease in people and their pandemic potential.
    - Can impact local and global economies and international trade.
  - **Note**
    - There is no evidence to suggest that the virus can be transmitted to humans through properly prepared poultry or eggs.

## D) NISHAD

- The **National Institute of High Security Animal Diseases (NISHAD)** of ICAR is a premiere institute of India for research on exotic and emerging pathogens in animals.
  - It came into existence on 8th Aug 2014 as an independent institute under ICAR, from its original status as High Security Animal Disease Laboratory (HADSL), a regional station of Indian Veterinary Research Institute (IVRI).
- **Recent updates:**
  - 'Inactivated low pathogenic avian influenza (H9N2) vaccine for chickens', developed by scientists of ICAR-NISHAD, Bhopal was transferred to various private companies. (Dec 2022)

## E) THE EUROPEAN UNION IS EXPERIENCING THE LARGEST BIRD FLU OUTBREAK IN EUROPE: REPORT BY EUROPEAN FOOD SAFETY AUTHORITY (EFSA) (2022 AND 2023)

More than 50 million birds culled between Oct 2021 to Sep 2022

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#### **F) FIRST CASE OF AVIAN FLU FOUND IN ANTARCTIC REGION (OCT 2023 )**

- Avian flu has been detected for the first time in Antarctic region and has raised concerns for birds and mammals which feed on these bids.
- **Which type?**
  - Highly Pathogenic Avian Influenza (HPAI) was detected in brown skua (a predatory seabird) populations on Bird Island, South Georgia, making it the first known case in the Antarctic region.
- The ongoing pandemic of HPAI H5N1 was first reported in 2022 in northern hemisphere. In July 2022, outbreaks were reported in northern hemisphere's wildlife, especially seabirds.
- Later in 2022 and 2023, HPAI H5N1 spread rapidly in south America and eventually to Antarctic and sub-Antarctic region.
- **Risk Assessment:**
  - Sea-Gulls and Skuas are the most threatened avian group. They are followed by bird's prey such as hawks and carcasses, terns and shorebirds.
  - Among marine mammals, fur seals and sea lions are reportedly most vulnerable, followed by southern elephant seals and dolphins.



# CURRENT AFFAIRS PROGRAM

## PRE CUM MAINS 2024

### DEC 2023: BOOKLET-5

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## 1. GENERAL STUDIES – 3: S&T UPDATES

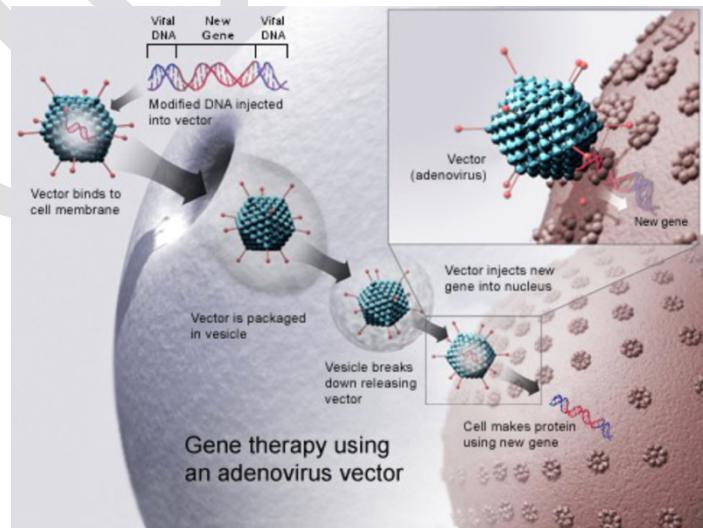
### 1) GENE THERAPY

#### - Example Questions

- » Gene therapy is gaining popularity in developed countries to treat various types of rare genetic disorders. Describe briefly what gene therapy is and what advantages it has over other treatments? How are National Guidelines for Gene Therapy Product development and Clinical Trials, 2019 going to contribute to the gene therapy development in the country. [250 words, 15 marks]

#### - Introduction

- **Gene therapy** refers to the process of introduction, removal or change in the content of an individual's genetic material with the goal of treating the disease and a possibility of achieving long term cure.
  - For e.g. UK recently approved **Casgevy**, a gene therapy production which genetically replaces the defective genes which are responsible for causing sickle cell anaemia.
  - **Gene Therapy Products (GTPs)** include the mechanisms to deliver nucleic acid components by various means for therapeutic benefit to patients. They include entities that are used for things like gene augmentation, gene editing, gene silencing, synthetic or chimeric gene augmentation etc.



#### - Advantages of promoting gene therapy

- **Permanent result may be a possibility:** Once the faulty genetics are replaced by the correct genes, the positive impact may be long lasting, sometimes permanent too.
- **Gene therapy is the only option** for the treatment of several genetic diseases.
- **High burden of rare genetic diseases in India:** Around 7% of India's population suffers from rare genetic diseases. Gene therapy can prove to be a turning point in treatment of such genetic diseases.
- **Worldwide market for the gene therapy products** is expected to go to \$250 billion by 2025.

- **Steps taken by India:**
  - » **National Guidelines for Gene Therapy Product Development and Clinical Trials – Released by ICMR in Dec 2019**
    - Aims to ensure that gene therapies are introduced in India and clinical trials for gene therapy can be performed in an ethical, scientific and safe manner.
    - Provides for general principles for developing gene therapy products (GTPs) for any human ailment.
    - Provides a framework for all areas of GTP production including pre-clinical testing, clinical administration, human clinical trials, as well as long term follow ups.
    - They apply to all stakeholders involved in the field of gene therapy including researchers, clinicians, oversight/regulatory committees, industry, patient support groups and any other involved in GTP development or their application in humans and their derivatives.
    - The guidelines will serve as a roadmap for those in the field trying to develop gene and cell therapies and will thus contribute to accelerating the development of advanced therapeutic options
  - » ICMR has also proposed setting up of task force to promote gene technology research in the country.
- **Concerns/Limitations/ Challenges associated with Gene Therapy:**
  - » **Technical Challenges:**
    - Unwanted immune response; gene therapy targeting wrong cells; the delivery viruses may mutate and become harmful.
  - » **Affordability issues:**
    - Gene therapy products are very expensive (for e.g. gene therapy for sickle cell anaemia recently approved in UK costs approx. \$2 million)
    - **Absence of local manufacturing capacity** leads to most GTPs needing to go to another country for processing which also increases the cost.
  - » **Ethical Challenges**
    - For e.g. creation of GM babies using germline gene editing by a Chinese scientist attracted global criticism and fueled debate on ethical concerns regarding applications of gene therapy technologies.
    - **Playing God** debate.
- **Way Forward:**
  - » **Policy Interventions** are needed to improve infrastructure of biotechnology research in the country.
  - » **Promoting PPP** in the gene therapy sector can increase the amount of required investments.

- » **Capacity building of healthcare professionals** to deliver gene therapy products once developed.
- » **International Collaboration** for tech-transfer, knowledge sharing etc.
- » **Awareness Generation:** Here community engagement will be crucial to promote screening for genetic disease.
- » **Continue to explore and promote alternatives**, such stem cell transplant wherever possible to develop complementary alternatives.

- **Conclusion:**

- » Gene therapy acts as a beacon of hope for crores of patients in India suffering from rare genetic diseases. Therefore, it is important that through various policy intervention and international collaboration more R&D in the field is promoted and gene therapy products which are not only of very high quality but also affordable.

## 2) SICKLE CELL ANAEMIA

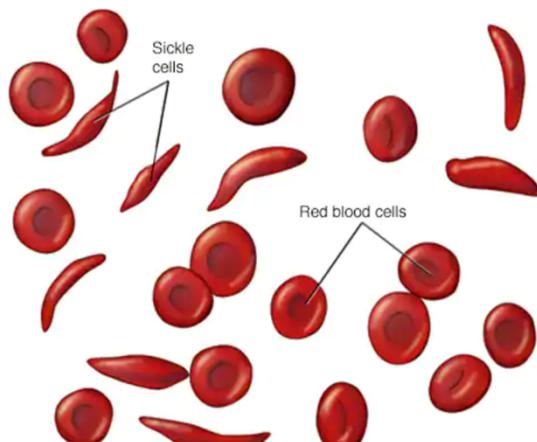
- **Why in news?**

- » The first therapy based on gene editing technology Crispr-Cas9 for Sickle cell disease and thalassemia has been approved in UK (Nov 2023)

### About Sickle Cell Anaemia:

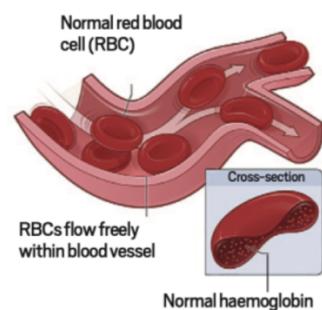
It is one of a group of inherited disorders known as Sickle Cell Diseases. It affects shape of the red blood cells which carry oxygen to all parts of the body.

RBCs are usually round and flexible so that they move easily through the blood vessels. But, in sickle cell Anaemia, some of the RBCs are shaped like sickle and also become rigid and sticky. This slows or blocks blood flow.

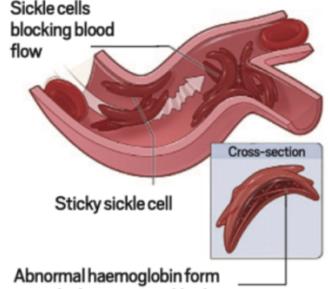


### IMPACT ON RED BLOOD CELLS

#### Normal red blood cells



#### Abnormal, sickled, RBC (sickle cells)



US National Institutes of Health (NIH)

**Note:** Both Sickle Cell Anaemia and thalassemia are caused by errors in the gene for haemoglobin, a protein in the red blood cells that carry oxygen to organs and tissues.

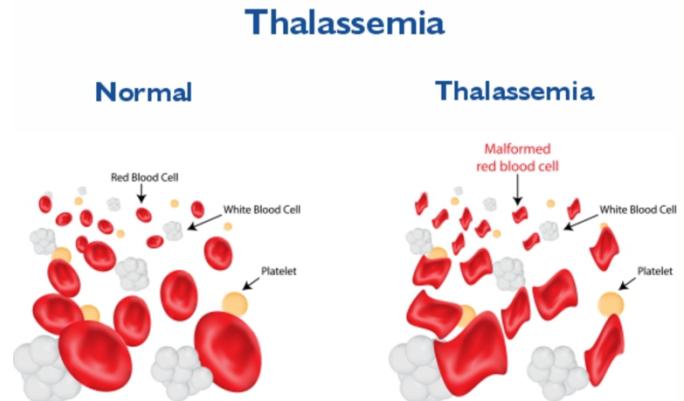
**Symptoms:** Anaemia -> fatigue; Episodes of extreme pain called pain crises; Swelling of hands and feet; delayed growth and puberty; Vision problems etc.

- **Treatment:**
  - No cure (except bone marrow transplant)
  - UK has recently approved a gene therapy for the treatment of sickle cell anaemia.
- **The UK Drug Regulator, in a landmark breakthrough, in Nov 2023 approved a gene therapy for the cure of sickle cell disease and thalassemia.**
  - This therapy is called **Casgevy**. It is the first licensed therapy in the world based on gene editing technology CRISPR-CAS9. This therapy edits the faulty gene that leads to these blood disorder, potentially curing person for life.
- **How does the therapy work?**
  - The therapy uses the patient's own blood stem cells, which are precisely edited using Crispr-Cas9. A gene called BCL11A, which is crucial for switching from foetal to adult is targeted in the therapy.
  - Foetal haemoglobin, which is naturally present in everyone at birth, doesn't carry the same abnormalities as adult haemoglobin. The therapy uses the body's own mechanisms to start producing more of this foetal haemoglobin, alleviating the symptoms of the two conditions.
- **How is the therapy prepared and given:**
  - **Casgevy** is one time treatment for which the doctor has to first collect blood stem cells from the bone marrow using a process called apheresis - used to filter out the blood for different components. The cells are then sent to the manufacturing site where it takes about six months for them to be edited and tested.
  - **Then the edited cells are then transplanted.** Before this doctor gives a conditioning medicine for a few days to clear the bone marrow of other cells that will be replaced by modified cells.
  - **The patient has to stay in hospital for at least one month** so that the edited cells take up the residence in bone marrow and start making RBCs with normal haemoglobin.
- **Side effects** from the treatment are similar to those associated with autologous stem cell transplants, including nausea, fatigue, fever and increased risk of infection.
- **Key challenges of the treatment:**
  - » **Very Costly:** it is estimated that the therapy will cause around \$2 million per patient, which is in line with other gene therapies.
  - » **Absence of local manufacturing technology:** This means that the harvested blood stem cells have to be sent across countries.
  - » **Preventing the misuse of CRISPR-CAS9:**

- **Situation in India:**
  - An estimated 30,000 - 40,000 children in India are born with this disorder every year. Thus, India has one of the highest burdens of sickle cell anaemia in the world.
- **Steps taken by India:**
  - In Budget 2023-24, a Mission to Eliminate Sickle Cell Anaemia by 2047 was announced. It entails awareness creation, universal screening of 7 crore people in the age group of 0-40 years in affected tribal areas, and counselling through collaborative efforts.
- **Way Forward:**
  - **Identify people suffering from Sickle Cell Anaemia:** Awareness creation; universal screening of people in the age group of 0-40 years in affected tribal areas; counselling through collaborative efforts.
  - **Replicate the success of this therapy in India while keeping the cost affordable.**
  - **Create an environment for development** of various gene therapy productions using CRISPR CAS9
    - More funds to various research institutions
    - Improving infrastructure of research labs etc.
  - **Strengthen regulatory framework** of Gene Therapy Products (GTP) in India to prevent its misuse.
- **Conclusion:**
  - Gene Therapy can play a very important role in achieving India's mission of eliminating Sickle Cell Anaemia by 2047.

## A) THALASSEMIA

- Thalassemia is an inherited blood disorder in which the body makes an abnormal form of hemoglobin.
- If both of your parents are carriers of thalassemia, you have a greater chance of inheriting a more serious form of disease.
- The disorder results in excessive destruction of RBCs, which leads to anemia.
- **Treatment Option**
  - » Blood Transfusion
  - » Bone Marrow transplantation
  - » Medication and supplements
  - » Possible surgery to remove spleen or gallbladder.
- **Situation in India**



- » India is the thalassemia capital of the world with 40 million carriers (highest in the world) and over 1,00,000 patients (Majors) under blood transfusion every month. It is the most common genetic blood disorder that is prevalent in India.
  - » People suffering from the disease are unknowingly transferring on this genetic disorder to their children.
    - Around 10,000 births of Thalassemia major are taking place every year.
  - » Most of the thalassemia treatment takes place in private sector with out-of-pocket expenses.
  - » The 2021 policy and associated benefits haven't been operationalized yet.
- **World Thalassemia Day**
- It is observed on May 8 every year to commemorate Thalassemia victims and to encourage those who struggle to live with the disease.
    - The day was created by Thalassemia International Federation (TIF) in 1994.
  - **Theme for 2023:** "Strengthening Education to Bridge the Thalassemia Care gap"

### 3) RARE DISEASES

- **Introduction**
  - » A rare disease is a health condition of low prevalence that affects a small number of people compared with other prevalent diseases in general population.
    - They generally include genetic diseases, rare cancers, infectious tropical diseases, degenerative diseases etc.
  - » The most common rare diseases recorded in India are Haemophilia, Thalassemia, sickle cell anaemia, primary immuno-deficiency in children, auto-immune diseases, Lysosomal storage disorders such as Pompe disease, Hirschsprung disease, Gacher's disease, Cystic fibrosis etc. These diseases may be impacting around 70 million people from India, 50% of which are children.
- **Why special focus is needed for Rare diseases / Need of a separate policy on Rare Diseases**
  - » **High cost of treatment** or no treatment > not affordable for most of the citizens -> health insurance generally excludes rare diseases.
    - Available are primarily expensive because pharma companies are not interested in R&D as the number of patients for each disease is very less (Orphan Drugs)
    - As per WHO, only 5% of the identified rare diseases have treatment.
  - » **Difficult to diagnose.**
  - » **Early screening generally doesn't happen** because of lack of awareness among primary care physicians, lack of adequate screening and diagnostic facilities etc. There are very few medical professionals who can deal with these diseases
  - » Currently there is inadequate insurance cover and treating practitioners are lacking management practices.
- **National Policy for Rare Diseases, 2021**
  - » MoH&FW came up with the policy in March 2021.

- It aims to lower the high cost of treatment for rare diseases with increased focus on indigenous research with the help of a **National Consortium** to be set up by Department of Health Research, MoH&FW as convenor.
  - It envisages creation of a national hospital based registry of rare diseases so that adequate data is available for definition of rare diseases and for R&D.
  - It focuses on early screening and prevention through primary and secondary healthcare infrastructure such as H&W Centres and District Early Intervention Centres (DEICs) and through counselling of high risk parents.
    - Screening will also be supported by NIDAN Kendras set up by the DBT.
  - The policy aims to strengthen tertiary health care facilities for prevention and treatment of rare diseases through designating 8 health facilities as **Centre of Excellence** and these CoEs will also be provided one-time financial support of upto Rs 5 crores for upgradation of diagnostic facilities.
  - **Provision for financial support:** The policy was amended in May 2022. It now provides a financial assistance of upto Rs 50 lakh for treatment of rare diseases of all categories.
    - » In the original policy, a financial support of upto Rs 20 Lakhs was provided under the Umbrella Scheme of Rashtriya Arogya Nidhi for treatment of those rare diseases that require a one time treatment (disease listed under Group 1 in the rare diseases policy)
  - The policy also envisages a crowd funding mechanism in which corporates and individuals will be encouraged to extend financial support through a robust IT platform for treatment of rare diseases.
    - » Funds so collected will be utilized by CoEs for treatment of all three categories of rare diseases as first charge and then the balance financial research could also be used for research.
- **Performance of the policy (Critical Analysis) (Jan 2023)**
- » LS MP Varun Gandhi have written to Union Health Minister and have said that more than 4,000 identified patients of rare diseases - mostly children - are yet to receive the Rs 50 lakh financial assistance for treatment guaranteed by the Union Government under the National Policy for Rare diseases, 2021.
    - More than 10 children who were awaiting treatment have already lost their lives.
  - » The 10 CoEs constituted under the policy are yet to seek financial assistance (crowdfunding) for patients with rare diseases.
- **Key Issues:**
- » Implementation challenges.
  - » Cost Effectiveness of interventions for rare disease vis a vis other health priorities
  - » the sharing of expenditure between central and state governments.
  - » **Other issues** (about gene therapy - already discussed)

## 4) ANTI-MICROBIAL RESISTANCE

- **Why in news?**
  - » **Genes fuel antibiotic resistance in Yemen Cholera Epidemic (Sep 2023)**
    - The Cholera outbreak in Yemen, which began in 2016, is the largest in modern history and anti-biotic resistance has become widespread among *V. cholerae* bacteria since 2018.
    - A study has found the presence of a new plasmid - a small, circular DNA molecule - in *V. cholerae* from late 2018 to the bacterial strain behind the epidemic. This plasmid introduced genes encoding resistance to multiple clinically used antibiotics, including macrolides (such as azithromycin).
- **Example Questions:**
  - » Antimicrobial resistance is a multi-driven problem and only a multi-pronged approach can be helpful in tackling the scourge. Elaborate [10 marks, 150 words]
- **Introduction:**
  - » Antibiotic resistance occurs when an antibiotic has lost its ability to effectively control or kill bacterial growth; in other words, the bacteria becomes "resistant" and continue to multiply in the presence of therapeutic levels of antibiotic.
- **Why do bacteria become resistant to antibiotic?**
  - » **Natural Phenomena: Evolution** - Selective pressure for the survival of resistant strains of bacteria.
  - » **Human Action:** Current higher levels of antibiotic resistant bacteria are attributed to the overuse and abuse of antibiotics.
- **How do bacteria become resistant?**
  - » Some bacteria are naturally resistant to certain type of antibiotics.
  - » However, bacteria may also become resistant in two ways :
    - By Genetic Mutation
    - By acquiring resistance from another bacterium.
- **Why India is vulnerable to Anti-biotic resistance?**
  - » **India is the largest consumer of anti-microbials globally** and the use of **last resort anti-microbials like cephalosporins is soaring.**
    - **Easy availability and overuse** of anti-biotics is the most important factor: Over the Counter Availability; Irrational Use; over-prescription by doctors
      - For e.g. Children often receive multiple courses of antibiotic every year since the viral infections are recurrent. This makes them more vulnerable to anti-microbial resistance.
  - » **Poor Health Sector** -> improper treatment -> Development of anti-biotic resistance
    - Further, exposure to subtherapeutic levels of anti-microbials or non-adherence to prescribed medications has also been cited as a driver of AMR
    - E.g.: in case of TB

- » Increasing and completely unregulated use of antibiotic in Agriculture, live stocks and Poultry sector.
  - Amount of antibiotics used in the farm animal and food industry is three to four times more than those used by humans.
  - For instance, Colistin is extensively used in veterinary practices as a growth promoter. This leads to generation of colistin-resistant bacteria in poultry and fresh water fish.
- » **Poor Sanitation conditions** -> More diseases -> More use of medicines -> More AMR development
- » Unchecked discharge of effluents by the pharmaceutical industries -> high concentration of pharmaceutical substances are found in surface and ground water systems near production facilities -> anti-biotics cause development of anti-microbial resistance in environment.

- **Impact of increasing anti-microbial resistance**

- » **Damage to Public Health:**
  - In 2019, drug-resistant superbugs killed about 1.27 million people globally - a toll more than HIV/AIDs or malaria - and according to the UN estimates, the number could reach 10 million by 2050.
  - Demands complicated treatment pattern, with longer stay in hospitals -> increase in cost of treatment.
  - Stronger antibiotics which are used after the first line of drugs fail generally have toxic side effects
  - Resistance also emerging for second line of drugs (e.g. XDR-TB emerging)
  - Without functional anti-microbials to treat bacterial and fungal infections, even the most common surgical procedures, as well as cancer chemotherapy, will become fraught with the risk of untreatable infections.
  - All this is compounded by the fact that no new class of anti-biotics have made it to the market in the last three decades, largely on account of inadequate incentives for their development and production.
- » **Economic damages** due to AMR can be equivalent to what 2008-09 economic shocks resulted into: UN Report
- » **Environmental Damages**
  - Extensive amount of anti-biotics lead to development of AMR in some micro-organisms. It impacts the microbial biodiversity and thus the environmental balance needed.

- **Steps that government has taken and Steps that we further need to take**

- **National Policy for Containment of Antimicrobial Resistance, 2011**
- Guidelines for appropriate antibiotic usage which have revised Schedule H drugs to make over-the-counter availability of certain antibiotics nearly impossible
- Programs such as Red Line Campaign
- Sanitation campaigns such as Swatch Bharat Mission etc.
- National Surveillance system for AMR (April 2017)
- **National Action Plan on Antimicrobial Resistance (April 2017):** Focused on enhancing awareness, strengthening surveillance, improving rational use, promoting research and supporting neighboring countries.

- **What more could be done**

- **Strengthen healthcare services** -> early detection; high quality medicines, complete treatment.
- **Strengthening infection prevention and control in health care facilities and farm**
- **Proper Implementation** of National AMR resistance action plan should get high priority, towards tackling drug resistance.
  - » Efficient utilization -> Following WHO's '**Access, Watch and Reserve**' strategy.
  - » Strict implementation of various drugs control regulation and increasing the fine for over the counter sale of drugs.
  - » Import and Export policies of food and feed should strictly regulate the anti-biotic use.
- **Proper regulation of livestock sector** to reduce the use of anti-biotics there.
  - » Improve biosecurity and ensure that harmful pathogenic organisms are not present at the farm.
  - » Promote vaccination over drugs
  - » **Developing and Using Alternatives**
    - **Botanical products with anti-microbial properties:** Extracts from turmeric, ginger, pepper and garlic are effective anti-microbial and can be added to the feed to control bacteria.
    - Use of **Probiotics and Prebiotics**
    - Using Seaweed extracts for improvement of immunity and additional physiological performance among aquaculture animals.
    - **Using enzymes** instead of antibiotics as growth enhancers. For e.g. enzymes like proteases, amylases, cellulase, esterase, lipase etc. are intended to enhance the availability of nutrients and help nutrient absorption in the digestive system.
    - **Phage therapy** (i.e. using Bacteriophages in aquaculture)
    - **Irradiation of food crops**
  - » DAHD should develop standard treatment guidelines to reduce misuse of anti-biotics.
  - » Bring a law to regulate manufacturing and sale of poultry feed laced with anti-biotics.
- **Regulating pharmaceutical industry effluents** -> strengthening BWM rules and improving its strict implementation.
- **Tackling AMR in Environment**
  - » Come up with a technical guidance to contain AMR from waste and environment.
  - » Shift to safer manufacturing practices for pharma to ensure reduced wastage and discharge in environment.
- **More Research** in the field of Anti-biotic resistance and coming up with safe mechanism to treat these AMR diseases
  - » **A multi-sectoral \$1 billion AMR Action Fund** was launched in 2020 to support the development of new anti-biotics. Similar steps to allocate more resources for AMR research would be required.
- **International Collaboration** should increase.
  - » All UN member states should phase out the use of anti-microbial on the WHO's highest priority list as growth promotion agents.
  - » Trade of anti-biotics must be regularized for therapeutic purpose only with strict legalized medical prescription and supervision.
- **Increased focus on awareness** generation among common people against the need of excessive use of anti-biotics.
- **Develop new varieties of anti-biotics:**

- » Since developing new anti-biotics is expensive and requires a few years at least, a developing country like India needs to jump start in-house development of new anti-biotics through PPP. Government agencies like ICMR and CSIR, along with DBT, DST can also work with global partners like Global Antibiotic Research Development Partnership (GARDP) etc.

- **Conclusion**

- » The world can't contain anti-microbial resistance unless stakeholders from all sectors such as human and animal health, environment, crops, food and drug come forward to act. **One-Health action** is must to slow down AMR chronic.

## 5) NUCLEAR ENERGY

- **PYQ:** With growing energy needs should India keep on extending its nuclear energy program? Discuss the facts and fears associated with nuclear energy
- **Introduction:**
  - » Energy security means consistent availability of sufficient energy in various forms at affordable prices. When a country moves ahead on the path of development, it is necessary to utilize every energy resource available in the country.
  - » Currently, nuclear energy makes up about 3% of India's energy sources
- **Advantages of Nuclear Energy:**
  - Least carbon footprint** (lesser than renewable energy)
    - The threat of climate change and environmental pollution are likely to constraint the use of fossil fuels
  - Cost of nuclear power**
    - The cost of nuclear power plants is pretty competitive to other fossil versions
  - Quantity of waste generated** is also very less
  - Potential of self sufficiency**
    - India has huge reserves of thorium which if properly utilized will reduce the dependency of India on foreign country
  - Depleting fossil fuels and import dependency:** India is currently drawing around 63% of its total energy from thermal sources. A significant part of this is imported.
  - Limitations of Renewable Energy**
    - Renewable energy are subject to vagaries of weather; they are land intensive; dependence on import technology; energy storage handicaps;

- Renewable energy is inevitable and nuclear option should be retained as insurance.

## » Limitations

- a) Safety concerns in light of recent disasters
- b) Nuclear waste disposal is a big concern
  - India still doesn't have a credible waste disposal policy.
- c) Potential of developing nuclear weapons
- d) Security concerns
  - Nuclear power plants can be favorite targets for terrorist organizations. If this happens it may cause irreversible damage to people living in the region and the ecosystem.
- e) India is dependent on other countries both for raw material and technology
  - Our future potentially depends on third stage of nuclear program.
- f) Ecological concerns
  - Nuclear plants are generally set near the coast as it requires a lot of water.
  - It is going to put pressure on coastline as India's western coastline is home to fragile ecology of western Ghats.
- g) Long gestation period
  - Till now only more than 20 plants are operational. There are long gestation periods which increases the cost of plants significantly.
- h) More safeguards -> more costly
  - Post Fukushima disaster, the cost of per unit energy has gone up. This has led to concerns regarding the cost viability of nuclear power plants.

## » Way Forward

- **Adopt National Policies that advance the deployment of nuclear reactor technologies:** As we know that India's total energy demand is expected to cross 800 GW by 2032, it is very important to utilize all possible options available and nuclear energy is one of the most important of those options.
- We need to develop a fledging domestic nuclear industry which will reduce our dependence as well as help us in reducing the gestation period of the plants.

- In light of the limitation's association with nuclear energy, stress should be laid on **cautious development, safety precautions in operation and disposal of wastes**. But development of nuclear energy can't be stonewalled in the light of such concerns.
- Establish a harmonized international regulatory system coordinated by the IAEA.
- Encourage multinational Cooperation on permanent disposal of spent fuel



# CURRENT AFFAIRS PROGRAM

## PRE CUM MAINS 2024

### DEC 2023: BOOKLET-6

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## 1. GENERAL STUDIES – 3: S&T UPDATES

### 1) COMPUTER AND IT: WEB BROWSERS – HOW DO THEY WORK

#### Why in news?

- » How do web browser work? (Dec 2023: Source - TH)

#### Definition:

- » A web browser is software that allows you to find and view websites on the Internet. They translate code into the dynamic webpage that forms the backbone of our online experience.

#### Different Browsers over the years:

- » In 1990, the English Computer Scientist Tim Berners-Lee introduced the concept of World Wide Web and with it came the first web browser, also known as WorldWideWeb.
- » The next watershed moment was Mosaic browser in 1993. It was developed by US National Centre for Supercomputing Application. It introduced the concept of displaying images alongside text. It revolutionized our interaction with the web and made internet visually engaging.
- » In 1994 came the Netscape Navigator and it became the most popular browser of its time. It brought features like bookmarks and user-friendly URL bar. It simplified the navigation and made the web more accessible.
- » Late 1990s saw the period of the 'Browser Wars'. Microsoft's Internet Explorer (IE) and Netscape Navigator were the primarily contenders. This competition led to a lot of innovation in various browsers. But, by 2,000 IE emerged as undisputed leader mostly on the back of the success of Windows operating system which generally shipped with IE as default browser which most of the people used. But this monopoly also led to stagnation and lack of innovation.
- » In 2004-05, this monopoly was broken with the arrival of Mozilla's Firefox. Firefox was developed by a community of volunteers and was based on open-source principles. It introduced groundbreaking features like tabbed browsing, and pop-up blocking. It also allowed users to extend their personal browsers with add-ons.
- » In 2008, Google launched Chrome, which swiftly gained in popularity for its speed and minimalist design. It also revitalized the browser market and encouraged innovation across the board.
- » Today, the most popular browsers are Google Chrome, Firefox, Microsoft's Edge and Apple's Safari.

#### How do Browsers work?

Modern web browsers have multiple core components, each of which is a complex technology in itself.

#### A) REQUEST AND RESPONSE

- When you enter a website's address (in the form of Uniform Resource Locator (URL)) into your browser's address bar (or when you click a link), you set in motion a sequence of digital communication. The browser sends a request to a server, asking for the contents of the specific web browser you're interested in. This request travels through a network of servers, like

dispatching a letter through a series of post offices. Upon reaching the server, the request is received and processed.

- The server then formulates a response containing the information (or data) required to construct the web pages. This response embarks on its journey back to your browser, carrying the digital blueprint for the page you requested.

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## B) DECONSTRUCTING THE RESPONSE

- The response from the server is an amalgam of various files. Typically, these files have information encoded in three languages: HTML, CSS, and JavaScript. Each set of information plays a pivotal role in shaping the final presentation of the web page.
- **HTML (Hyper Text Markup Language)** provides the architectural blueprint of webpage. It defines structure of the webpage, outline elements like headings, paragraphs, images, and links. HTML is the foundation on which browser construct a visual layout.
- **CSS (Cascading Style Sheets)** imparts style and aesthetics to the HTML structure by controlling attributes like color schemes, fonts, spacing, and positioning. CSS ensures that webpages come with its unique identity.
- **JavaScript** is a dynamic engine, making webpages interactive and responsive. It allows interactive elements like pop-ups, forms, animations, and Realtime updates, creating an engaging user experience.

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## C) RENDERING

- With HTML, CSS and JavaScript in hand, a browser begins the process of rendering. This involves deciphering the HTML to understand the structural arrangement, applying CSS for stylistic finesse, and executive JS to infuse interactivity.
- The process is remarkably swift, assembling the final webpage and presenting it to user in a cohesive and visually appealing manner in much less than a second, depending on the amount of data.
- **Rendering engines** are in themselves a key piece of technology that enables screens to display graphics.

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## D) MANAGING DATA

- Browsers serve as adept custodians for your digital footprint, so they also implement instruments like **cookies** and **cache** to enhance your online experience.
- **Cookies** are small snippets of data stored on your computer by websites you visit. They retain information such as login status, site preference, and shopping cart content. This allows you to navigate seamlessly, without having to re-login to a site when you close and reopen it in a short span of time.
- **Cache** is a repository of frequently accessed files. When you revisit a webpage, the browser checks its cache to see if it already has a copy of the required files. If so, it retrieves them from the cache itself rather than re-downloading them from the server.

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## E) SECURITY

- Web browsers use an array of security measures to protect your data as they fly between your computer to various servers, via the internet, and even when they're stored on your computer. They

do this by using **encryption protocols**, such as **HTTPS**, to create secure tunnels for data exchange shielding the information from prying eyes.

- Browsers also use warning systems to alert you about potentially malicious websites, preventing inadvertent exposure to threats.

#### Future of Internet Browsers:

- As technology hurtles forward, web browsers evolve in tandem. They are embracing new technologies like **Web Assembly**, a format that enables near-native performance within the browser environment.
- Support for VR and AR experience is also on the horizon, promising immersive online interactions.
- Privacy features are being bolstered, providing users a greater control over their digital footprint.

#### Conclusion:

- **Web browsers** are the unsung heroes of our digital endeavors, translating code into the dynamic web pages that form the backbone of our online experiences.

## 2) HEALTH: GENERIC MEDICINES

- **Why in news recently?**
  - » On Aug, 2023, the National Medical Council (NMC) directed all doctors to prescribe only generic names and not brand names which led to protest. Following the Indian Medical Association's protest, the NMC has withdrawn the order on 'generic prescribing' since Aug 23, 2023.
    - **Why the protest?**
      - Doctors trust certain brands
      - The control over which brands to take will go to chemist shops.
- **Example Questions**
  - » "Generic medicines can play a key role in making India's health sector affordable". Discuss. [15 marks, 200 words]
- **What is a generic drug?**
  - » Generic drug is a low cost version of pharmaceutical drug that is equivalent to a brand-name product in dosage, strength, route of administration, quality, performance and intended use.
  - » They usually enter market after patent protection of the original drug expires.
- **Note:** Broadly Medicines can be of three types:
  - » **Branded:** These are still on patent
  - » **Branded Generic:** Off-Patent and Generic, but nonetheless produced by a reputed company, with a brand.
  - » **Generic:** Off-Patent, and unbranded.
- **Government's attempt in promoting generic drugs**
  - » National Medical Council (NMC) has directed all doctors to prescribe generic names and not branded names.

- » But this order was withdrawn after protest from Indian Medical Association.
- » Making it mandatory for all chemists to display generic medicines prominently
- » **Pradhan Mantri Bhartiya Janaushadhi Pariyojna (PMBJP)** was launched by Department of Pharmaceuticals, Ministry of Chemical and Fertilizers, Government of India as a direct market intervention scheme in 2008.
  - » As of Jan 2023, **9,000 Jan Aushadhi Kendras** are functional across the country.
    - The government has set up a target to increase the number of Jan Aushadhi Kendras to 10,000 by March 2024.
      - It offers 1759 medicines, and 280 surgical devices covering all major therapeutic groups.

#### - **Advantages**

1. **Affordable healthcare:** Generic medicines are cheaper as it doesn't include manufacturer's marketing cost, cost spent on prescribing doctors etc.
2. **Breaks the doctor-pharma nexus:** The existing nexus leads to prescription of only the brand of companies which gives some kick-backs to doctors.
  - » **Reduce unnecessary prescription:** This is resorted to by doctor if pharma companies are paying them
3. **Promotes domestic pharma companies** as India is a world leader in generic drug manufacturing.
4. **Difficult for quacks to function** as non-qualified people may find it difficult to know generic names

#### - **Limitations**

1. **Quality concerns**
  - » Concerns about lack of uniformity in the quality of generic versions.
  - » Studies have shown that many generic versions don't work.
  - » Doctors trust and prefer well-established brands.
2. **Erode doctor-patient relationship**
  - » As by prescribing generic drugs, doctor refuse to take responsibility for clinical outcomes.
3. **Low profit margins for retailers**
  - » Retails pharmacists, in turn, have little incentive in stocking and selling low price generic medicines since they have lower profit margins.
4. **Shortage**
  - » Though, there are more than 9,000 Jan Aushadhi Kendras, the reach of traditional medical stores is very high and they primarily deal in non-generic versions.
5. **Difficult for common person to understand**, especially the multiple salt names in a FDC.
6. **May discourage big pharma companies to launch their new medicines in India**

#### - **Way forward**

- » **Improved Quality** through improved regulation of pharma sector.
  - Human Resource issues like shortage of drug quality inspectors has to be tackled in a fast track manner.
- » **Increasing Production and Availability:** Increasing the penetration of Jan Aushadhi Kendras.
- » **Allow pharmacist to substitute for alternative:** Laws for enabling substitution of generic and branded equivalents by pharmacists need to be introduced.
- » **Prohibit Branding for out of patent drugs**

- » **Increased awareness** on generics needed among consumers, pharmacists
- » **Short names for generic FDCs** (officially approved trade names) will also ensure that doctors don't write out the generic names of their multiple constituents.
- » **Improving government health facilities** would contribute to more coverage of government hospitals in overall health coverage and government hospitals can promote generic better.

- **Conclusion**

- » Overall, generic prescribing is a good move in the right direction and will have several positive ramifications for healthcare in India. However, like everything, successful implementation would require a series of enabling steps at different levels from production to prescription and from Quantity to Quality.

#### A) PRELIMS SCHEMES: PRADHAN MANTRI JAN AUSHADHI YOJANA (PMJAY)

- **Intro:**
  - » **Pradhan Mantri Bhartiya Janaushadhi Pariyojna (PMBJP)** was launched by Department of Pharmaceuticals, Ministry of Chemical and Fertilizers, Government of India as a direct market intervention scheme in 2008.
- It aims to make quality generic medicines available to all at affordable prices through Jan Aushadhi Stores (JAS) opened in each district of the states.
  - » First Jan Aushadhi Store (JAS) was opened at Amritsar Civil Hospital in 2008.
- Other key focus of the scheme is to create awareness and demand for generic medicine
- **Incentives given:**
  - » The scheme provides an excellent opportunity of self-employment with suitable and regular earnings.
  - » An incentive of Rs 5,00,000 is provided to the Jan Aushadhi Kendras as financial assistance and one time additional incentive of Rs 1 lakh (as reimbursement for IT and infra expenditure) is provided to Jan Aushadhi Kendra opened in North-Eastern India, Himalayan state, island territories, and backward areas identified by NITI Aayog as aspirational districts or if opened by women entrepreneurship, Ex-Serviceman, Divyangs, SCs and STs.
- As of Jan 2023, 9,000 Jan Aushadhi Kendras are functional across the country.
  - » The government has set up a target to increase the number of Jan Aushadhi Kendras to 10,000 by March 2024.
    - It offers 1759 medicines, and 280 surgical devices covering all major therapeutic groups.

#### 3) HEALTH: NEGLECTED TROPICAL DISEASES (NTD)

- **WHO Definition:**
  - » NTDs are a diverse group of 20 conditions that are mainly prevalent in tropical areas, where they mostly affect impoverished communities and disproportionately affect women and Children.
    - The epidemiology of NTDs is complex and often related to environmental conditions.

- They are caused by variety of pathogens - viruses, bacteria, protozoa, and parasitic worms (helminths).
- Which are the diseases included in NTDs:
  - » Buruli Ulcer, Chagas Disease, Dengue & Chikungunya, dracunculiasis (Guinea-worm disease), echinococcosis, foodborne trematodiases, human African trypanosomiasis (sleeping sickness), leishmaniasis, leprosy (Hansen's disease), lymphatic filariasis, mycetoma, chromoblastomycosis and other deep mycoses, onchocerciasis (river blindness), podoconiosis, rabies, scabies, and other ectoparasitoses, schistosomiasis, soil-transmitted helminthiases, snakebite envenoming, taeniasis/cysticercosis, trachoma, and yaws and other endemic treponematoses.
- Note:
  - » 'Noma' is the latest addition to WHO's list of neglected tropical diseases (Dec 2023)
- These diseases are contrasted with the "big three" infectious diseases (HIV/AIDS, tuberculosis, and malaria), which generally receive greater treatment and research funding.
- Jan 30: World NTD Day
  - » In May 2021, the delegates at the 74th World Health Assembly unanimously adopted a proposal to declare Jan 30 as 'World NTD Day'.
- WHO's new roadmap for 2021-2030 calls for three strategic shifts to end NTDs:
  - » From measuring process to measuring impact.
  - » From disease-specific planning and programming to collaborative work across sectors.
  - » From externally driven agendas reliant to programmes that are country-owned and country-financed

#### A) NOMA DISEASE

It is a severe gangrenous disease of the mouth and face. It primarily affects young children (between the ages of 2 years to 6 years) in regions of extreme poverty.

It starts as an inflammation of gums, which, if not treated early, spreads quickly to destroy facial tissues and bones.

**Cause:** Evidence indicate that NOMA is caused by bacteria found in the mouth. There are multiple risk factors associated with the disease. It includes malnutrition, weakened immune system, infections, and extreme poverty. If the child is malnourished and has recently been sick with an infectious disease, such as measles or chickenpox, they are at more risk for developing noma.

It is not contagious but tends to strike when the body's immune system is weak.



NOMA is sometimes called the 'Face of Poverty' as it is a social marker of extreme poverty and malnutrition.

**Significance** of Including NOMA in the NTD's list:

- Amplify global awareness.

**Impact:** It can be fatal and may also cause severe disfigurement for survivors.

**Treatment:** It involves antibiotics, advice and support on practices to improve oral hygiene with disinfectant mouth wash and nutritional supplements. In case of early diagnosis, proper wound healing without long-term consequences may take place. In severe cases, surgery may be necessary.

**Cases** are mostly found in sub-Saharan Africa. Some cases are also reported from Americas and Asia.

**Accurate estimation** of the number of noma cases is challenging due to rapid progression of the disease and the associated stigma.

- Catalyze research, stimulate funding and boost efforts to control the disease through multisectoral and multi-pronged approaches.

## 4) HEALTH: HIV

### - Why in news?

- » Hopes dashed as last HIV vaccine trial in Africa for his decade ends in failure (Dec 2023: Source - DTE)
- » The WHO has released new scientific and normative guidance for human immunodeficiency virus (HIV) at the 12th International AIDS Society Conference on HIV Science on July 23, 2023.

### - Practice Question:

- » Highlight the current state of HIV/AIDs in India. Critically evaluate the effectiveness of National AIDS Control Program in addressing the challenges of HIV/Aids in the country. Give recommendations for strengthening the program's response in the context of India. [15 marks, 250 words]

### - Introduction:

#### » About virus:

- » HIV are two species of Lentivirus (genus) of Retroviridae family. The virus first emerged in 1920 in Kinshasa (then Leopoldville), Belgian Congo.
- » The Human Immunodeficiency **Virus (HIV)** targets the immune system and weakens people's surveillance and defence systems against infections and some types of cancers.
  - » As the virus destroys and impairs the function of the immune cells, infected individuals gradually become immunodeficient. Immune function is typically measured by CD4 cell count.
  - » The most advanced form of HIV infection is acquired immunodeficiency syndrome (AIDS), which can take from 2 to 15 years to develop depending on individual. It is defined by developments of certain cancers, infections, or other severe chemical manifestations.

- **Note:** CD4 cells are a type of white blood cells that play a major role in protecting your body from infection. They send a signal to activate your body's immune response when they detect "intruders" like the viruses or bacteria.

- **Transmission**

- » Exchange of a variety of body fluids - blood, breast milk, semen and vaginal secretion
- » **Note:** Individual can't be infected through ordinary day to day contact such as kissing, hugging, shaking hands, sharing food or water etc.

- **Behaviours or conditions which can put individual on risk:**

- » Unprotected sex (including anal)
- » Having other STDs like syphilis, herpes, chlamydia etc.
- » Use of contaminated needles, syringes etc. while injecting medicines or drugs.
- » Unsafe blood transfusion and medical procedures
- » Infected mother to unborn child.

- **Diagnosis**

- » **Three types of tests:**

- **Antibody test:** By detecting presence or absence of antibodies to HIV in blood; **most commonly used test.**
  - When someone is infected with HIV, the immune system produce proteins called anti-bodies, and they are directed against the unique proteins of HIV. Though, these antibodies are not able to eliminate the virus, but they serve as a marker to show that someone is infected with HIV.
- **RNA (viral load) test (RT-PCR)**
- **A Combination test**
  - It detects both antibodies and viral protein called p24 (antibody-antigen test, or HIV Ab-Ag test).
    - P24 forms part of the core of the virus (an antigen of the virus).

- **Prevention**

- » **Avoid risk behaviours** (i.e. use condoms, test and counsel for HIV and STIs, Voluntary medical male circumcision, using only sterile injecting instruments)
- » **Antiretroviral (ART) use for prevention.**
  - **ART as Prevention** - If an HIV positive person adheres to an effective ART regimen, the risk of transmitting the virus to their uninfected sexual partner can be reduced by 96%.
  - **Pre-exposure prophylaxis (PrEP) for HIV negative partner:** Oral PrEP of HIV is the daily use of ARV drugs by HIV uninfected people to block the acquisition of HIV.
  - **Post Exposure prophylaxis for HIV (PEP):** PEP is the use of ARV drugs within 72 hours of exposure to HIV in order to prevent infection. PEP includes counselling, first aid care, HIV testing, and administering of a 28-day course of ARV drugs with follow up care.
- » **Drug releasing Vaginal Ring Cap:** To prevent HIV-AIDS in Women
  - The ring is made of flexible silicon matrix polymer. The woman inserts it into the vagina, where it, over the course of a month, **releases the antiretroviral drug dapivirine**. It has to be changed after 28 days.

- **Treatment**
  - » HIV can be suppressed by combination ART consisting of 3 or more ARV drugs. ART doesn't cure HIV infection but controls viral replication within a person's body and allows an individual's immune system to strengthen and regain the capacity to fight off infection. With ART, people living with HIV can live healthy and productive lives.
- **Stem Cell Therapy to treat HIV** have shown success:
  - » In 2022, a US patient was reported cured of HIV after stem cell transplant. By July 2023, six persons had been cured by this method.
  - » In the first five cases, the treatment teams specifically looked for donors with CCR5 delta 32 mutation. It is associated with lower risk of HIV.
    - People who inherit CCR5 delta 32 mutation from both parents don't have the receptors which are used by HIV virus to enter the cells. Those who inherit the mutation from one of the parents have fewer receptors and are less likely to get infection.
    - Only 1% of the people on earth carry 2 copies of CCR5-delta 32 mutation.
  - » **Why can't stem cell transplant become routine treatment for HIV?**
    - Finding matching donor for all 40 million patients would be impossible.
    - The CCR5 delta 32 mutation occurs mostly in Caucasians whereas most of the cases are in the African continent.
    - Further, stem cell transplant is a complex process and comes with its own risks.
- **SDG Goal 3.3:** To achieve the end of AIDS by 2030 i.e. zero new infection by 2030.
- **Global Situation of HIV:**
  - » **Successes Achieved in HIV Response:**
    - As per UNAIDS, in 2022, 39 million people globally were living with HIV, of whom 29.8 million were accessing ART.
      - Coverage of ART has become 4 times of the number in 2010.
    - **New Cases:** Around 1.3 million people got newly infected with HIV in 2022 - which is 59% lower from the peak in 1995.
    - It is possible to end AIDS by 2030: UNAIDS
- **WHO response**
  - » WHO is cosponsor of the United Nation Program on Aids (UNAIDS). Within UNAIDS, WHO leads activities on HIV treatment and care, HIV and tuberculosis co-infection, and jointly coordinate with UNICEF the work on the elimination of mother to child transmission of HIV.
- **Vaccination Efforts:**
  - » **Hopes Dashed as last HIV vaccine trial in Africa for this decade ends in failure** (Dec 2023)
    - The study, known as PrEPVacc, was led by African researchers with support from European Scientists.
      - They were testing two different vaccine regimes on about 1500 volunteers in Uganda, Tanzania, and South Africa.

- After, multiple other high-profile trials failed in the past, PrEPVacc researchers were quite optimistic and had described the latest study as the final trial of the decade.
- **HIV situation in India**
  - » More than 2 million people in India live with HIV.
    - HIV Epidemic has an overall decreasing trend in the country with estimated annual new HIV infections declining by 37% between 2010 and 2019.
  - » **Success in controlling AIDS**
    - 2015 HIV estimates results reaffirm the country's success story in responding to HIV/AIDS epidemic. India has **successfully achieved 6th Millennium Development Goal (MDG6)** of halting and reversing the HIV epidemic.
  - » **Emergence of three north Eastern States as new HIV Hotspots:** **Mizoram** (1.19%), Nagaland (0.82%), Meghalaya (0.73%), Tripura (0.56%) and Manipur (0.47%)
    - Reasons: Injecting Drug Users and Unsafe Sexual Practices.
- **Steps taken by government of India in recent times to Reduce HIV transmission**
  - **National Aids Control Program** was launched in 1992 and its four phases have been completed so far. It is a central sector scheme.
    - » It has been extended for five years (1st April 2021 to 31st March 2026)
    - » It is a comprehensive program for prevention and control of HIV/AIDS in India.
    - » Under this, ART Centres run by National AIDS Control Office (NACO) provide lifetime free medicines, diagnostic kits and other essentials for those in need.
  - **National Aids Control Organization (NACO)**, under MoH&FW, provides leadership to HIV/AIDS program.
  - **HIV & AIDS Prevention and Control Act 2017** provides a legal framework for protecting the rights of HIV positive people.
  - Implementation of 90:90:90 strategy adopted by UNAIDS
  - **Other steps** include - Multimedia campaigns; Red ribbon clubs in colleges; training and sensitization program for SHGs; etc;
- **Challenges in successful implementation of HIV prevention Programs**
  1. **Lack of Capital**
    - Funding that India and other developing countries had been getting from developed countries for HIV control has come down
    - Health budget is way below the requirement of 4% (NHP targets 2.5%)
  2. **Stigma Associated and lack of awareness**
    - It creates a big problem as HIV positive people don't come out for treatment and further accidentally contribute in promotion of the infection
  3. **Shortage of Medicine**
    - There have been complaints about shortage of medicine stockpile related to HIV/AIDS.
  4. **Increasing drug abuse**
    - Increasing drug abuse in various parts of the country can become a factor for increasing spread of HIV.

## 5. Lack of sex education at school level

- It prevents early education of children regarding prevention of sexually transmitted diseases.

### - Way Forward for India to deal with HIV

- » **More Resources/Funding:** More funds allocation for health sector, specially HIV/AIDS.
  - Affordable and accessible health care facilities.
  - Better drug procurement policy to get the adequate quantity in affordable price.
    - Here Tamil Nadu Model which goes for mass procurement from manufacturers can be a way forward
- » **Sex education** in schools would ensure that adolescents and young adults are aware of all the precautions to be taken
  - Reducing stigma and discrimination will lead to early detection and control.
- » **Fight drug addiction:** Focus on injectable drug users is needed to preventing any alarming rise of HIV in this group
- » **Increases focus on target groups:**
  - Improved focused on vulnerable groups
    - Sex workers
    - Transgenders
    - Truck Drivers
      - NACO study shows that 2.5% of truck drivers in India are suffering from HIV
      - They are also bridge population as they play a key role in transmission
  - Special focus on high prevalent states.
- » **Integrated Approach for a more comprehensive treatment:** HIV/AIDs patient should also be provided mental health support, legal support etc, other than being given free services under NAIDS.

## 5) HEALTH: NON-SUGAR SWEETNERS (NSS)

### - What are non-Sugar Sweeteners?

- » Non-Sugar Sweeteners (NSS) or Non-Nutritive Sweeteners (NNS) are substances used in place of sweeteners that have sugar (sucrose) or sugar alcohols. They have negligible or zero calories because, unlike sugar, they don't get broken down by the body into products that provide energy or calories.
- » They are used as table top sweeteners as well as in food items marked as 'Sugar Free', 'Diet' etc.
- » They are of primary **two types - i) Artificial, ii) Natural**
  - **Artificial:** These NSS are prepared in laboratories. Examples include Aspartame, Saccharine, Acesulfame-potassium, Sucratose, Neotame (derived from aspartame), Advantame (derived from aspartame) etc.
  - **Natural:** These are extracted from plants (e.g. Stavia, Thaumatin, Monk Fruit etc.)
- » All the six artificial NSS and 3 natural NSS are approved by the US Food and Drug Administration. India's FSSAI has also approved all of them (except Advantame, and Mon Fruit).

### - Why are they used?

- » **TO reduce consumption of sugar** (which has led to global rise in diabetes and obesity).

- **Market:**
  - » As per a report by global market consultancy The Business Research Company the market for these NSS was worth **\$20 billion in 2022** and it is expected to reach about **\$30 billion by 2027**.
- **Criticisms:**
  - i. Little Evidence to substantiate the benefits of NSS in controlling diabetes and obesity.
  - ii. Growing body of research says that these NSS may lead to cardiovascular diseases, cancers, and type-2 diabetes.
    - For e.g. WHO in its July 2023 guidelines have classified Aspartame as "possibly carcinogenic to humans".
- **Way Forward:**
  - » **Experimental Studies:** More detailed experimental studies should be conducted to bring more clarity on the health impact of NSS.
  - » **FSSAI** should update its standards based on these artificial sweeteners.
  - » **Citizens** should also avoid artificial products unless it's very necessary. We need to go for a more natural way of life which is not only healthy but also more sustainable.

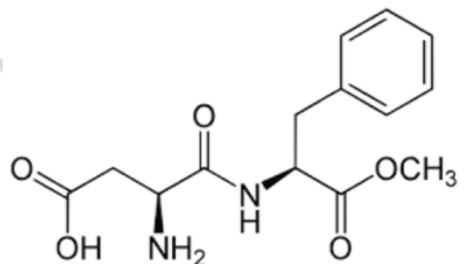
#### A) PRELIMS FACTS: ASPARTAME

Aspartame is an artificial sweetener which was invented in 1965 and has been in use in USA since early 1980s.

It is a compound of carbon, hydrogen, nitrogen, and oxygen with chemical formula **C<sub>14</sub>H<sub>18</sub>N<sub>2</sub>O<sub>5</sub>**.

It is among the most popular sugar substitute used in the world.

**Several Studies have highlighted problems associated with Aspartame:**



- The **WHO** analyzed some 1,300 studies, and cited the following three, to declare aspartame "possibly carcinogenic to humans" -  
 > European Journal of Nutrition, 2016; Cancer Epidemiology, 2022; Cancer Epidemiology, Biomarkers & Prevention, 2022;

- **WHO has placed aspartame in Group 2B.** This group consist of those substances which are possibly carcinogenic.
- **Details about various Groups:**
  - » **Group-1: Carcinogenic:** These substances have shown sufficient evidence in humans and animals to be treated as carcinogenic. It includes tobacco smoking, alcohol consumption, Solar Radiation, ionizing radiation.
  - » **Group-2A: Probably Carcinogenic:** Limited evidence in humans but sufficient evidence in animals. It includes insecticide DDT, Red Meat, Night Shift Work, Emission from high temperature frying etc.
  - » **Group-2B: Possibly Carcinogenic:** Limited evidence in humans or sufficient evidence in animals. It includes aspartame, gasoline engine exhaust, heavy metal lead;
  - » **Group-3: Not classified as carcinogen:** Inadequate evidence in humans an in animals. It includes coffee, Mercury, Paracetamol, crude oil etc.

## B) CONCEPTUAL CLARITY: UNDERSTANDING HOW DIABETES MAY BE CAUSED BY NSS

- **How Sugar causes diabetes:**
  - » Under normal circumstances, glucose in the blood signals pancreas to make insulin, which then enters the blood. Insulin, in turn, helps sugar enter the body's cells so it can be used for energy.
  - » **When a person consumes high levels of sugars**, the pancreas pumps out more insulin to get blood sugar into cells. If this continues, the carefully orchestrated process goes haywire. The body's cell stops responding to all that insulin and become insulin resistant even if pancreas keep making more insulin to try to get the cells to respond. Eventually the pancreas gives up and stops releasing insulin, and blood sugar continues to spike, leading to diabetes.
- **How Non-Sugar Sweeteners may cause diabetes?**
  - » Pancreases react similarly to sugar and NSS as it can't differentiate between the two. As a result, they release insulin, increasing their levels in the blood. Subsequently cells become resistant to insulin and pancreas become overworked and stop producing insulin.

## 6) BIOTECHNOLOGY: GM INSECTS: NEW GUIDELINES

- **Practice Questions:**
  - » Discuss various applications of Genetically Engineered (GE) insects. Evaluate the various risks associated with the introduction of such insects and suggest measures to ensure sustainable and safe usage of GE insects [15 marks, 250 words]
- **A genetically modified (GM) insect** refers to insects whose DNA has been engineered through various genetic engineering tools like CRISPR CAS9.
- Various GE insects are available globally today. The **development and application of GE insects** offers applications in various fields:
  - » **Improving Human Health:**
    - » **Vector Management** in human and livestock health: GE mosquitoes for e.g. can be designed to carry genes that limit their ability to transmit diseases such as dengue, malaria etc.
    - » **Reduction in use of chemicals** -> Maintenance and improvement of both human health and environmental health.
  - » **Food Security:**
    - » **Management of crop insect pests:** Insects can be genetically engineered to carry traits that reduce the population of agricultural pests.
      - For e.g. introducing sterile males can help control pest population.
    - » **Increased food production:** **Protein production** for healthcare purposes; **honey production** etc.
      - Engineering honeybees to make better-quality and/or quantities of honey can contribute to reduced imports and may facilitate exports.
    - » **Improvement in beneficial insects** like pollinators, predators, parasitoids etc.

- » **Economic Application:**
  - » Other than improved agri production, improvements in productive insects (e.g. silkworm, lac insect) etc can promote economic growth.
    - E.g. GE silkworms can produce finer and/or cheaper silk, affecting prices and boosting sales.
- » **Fighting pollution and ensuring environmental sustainability:**
  - » Reduction in use of chemical will contribute to reduced pollution and environmental sustainability. Similarly, improved pollinators can contribute to biodiversity production.
  - » Some GE insects can be used as bio-indicators to monitor pollution or detect some specific substance in environment.
- **Some Concerns:**
  - » **Ecological Risk:** Once introduced in the environment, it's very difficult to contain these insects. And if some future problem emerges, it would be difficult to control.
  - » **Unforeseen health implications** when these GM insects interact with humans.
  - » **Bioweapons:** GE insects may be used to produce bioweapons.
  - » **Regulatory challenges:** Government guidelines like Guidelines for Genetically Engineered insects; National Guidelines for Gene Therapy Product Development and Clinical Trials' have similar ambiguity.
  - » **Ethical concerns:** GE insects raise a question – “If human being should act as God” and make changes in the living organisms around it.
- **Way Forward:**
  - » **Updating policies and guidelines** to remove any ambiguity and defining clear purpose and goals of GE insects.
  - » **Increased R&D and better Regulatory Oversight:** Increasing the capacity of DBT and other associated institutions to promote for R&D in the development and evaluation of GE insects.
  - » **Effective Monitoring and Evaluation:** A robust monitoring and post-release evaluation mechanisms will be needed to track the impact of GE insects on health, biodiversity, and the ecosystem.
  - » **International Collaboration** through bodies like FAO on understanding the impact of GE insects and sharing the best practices and technology.
  - » **Stakeholder Engagement:** Participation of all the stakeholders including citizens, scientists, farmers, doctors etc in understanding the need of GE insects, their development and associated risks can give diverse perspective to decision making.
- **Conclusion:**

GE insects have the potential to solve a number of problems associated with health, food security and environment. But the expansion of their usage should be synchronized with comprehensive risk assessment, robust regulatory framework and inclusive stakeholder engagement

#### A) GUIDELINES FOR GENETICALLY ENGINEERED (GE) INSECTS: RELEASED BY DBT IN APRIL 2023

- The guidelines provide procedural roadmaps for those interested in creating GE insects.
  - » It intends to help Indian researchers navigate regulatory requirements.
  - » The guidelines are harmonized to guidance from WHO on GE mosquitoes.
- But **experts have identified some issues with the guidelines:**
  - » **Uncertainty of Purpose:** The guidelines don't specify the purpose for which GE insects may be approved in India. It only provides regulatory procedures for R&D on insects with some beneficial applications.
  - » **Uncertainty for Researchers:** The guidelines are applicable only to research and not to confined trials or deployment.
    - Government authorities will also have to closely follow the deployment of these insects. Once deployed, the GE insects can't be recalled, and unlike GM foods, they are not amenable to individual consumer choice.
  - » **Uncertainty of Ambit:** The guidelines offer SOPs for GE mosquitoes, crop pests, and beneficial insects – but what 'beneficial' means, in the context is GE insect is not clear.



# CURRENT AFFAIRS PROGRAM

## PRE CUM MAINS 2024

### DEC 2023: BOOKLET-7

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## 1. GENERAL STUDIES – 3: S&T UPDATES

### 1) ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

#### » Intro

- Artificial Intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs which can complete tasks that typically require human intelligence.
  - » With the **explosion of available data and expansion of computing capacity**, the world is witnessing rapid advancements in AI, ML, and deep learning.
- Machine learning is a science that involves **development of self-learning algorithms**. Machine learning uses statistics (mostly inferential statistics) to develop self-learning algorithm. It is a type of artificial intelligence.
  - » **Note:** All Machine Learning is AI, but not all AI is machine learning
  - » For e.g., symbolic logic (rules engines, expert systems, and knowledge graphs) as well as evolutionary algorithms and Bayesian statistics could all be described as AI, and none of them are machine learning.
  - » In Machine Learning the computer program should learn from experience "i.e., given data" such that the overall performance on doing a certain task increase.
    - i. Input data
    - ii. Model Training
    - iii. Output

#### - Applications of Artificial Intelligence and Machine Learning

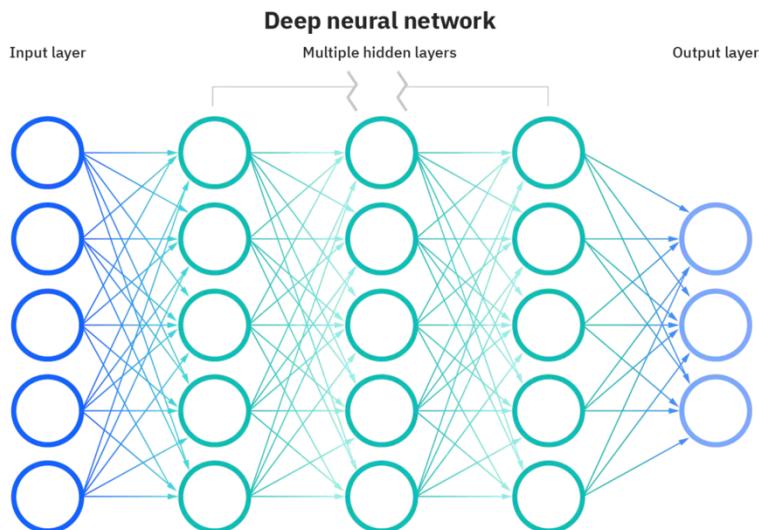
- Advertisements, Online shopping suggestions etc.
- Spam filtering
- Search engines
- Fighting Black Money (e.g., Project Insight of India)
- Space Exploration (e.g., identifying exoplanets from pictures)
- Health Sector (e.g., identifying cancerous lumps, development of new medicines/molecules etc, early detection and prevention of diseases).
  - E.g., a Bengaluru based startup has developed a non-invasive, AI-enabled technology to screen for early signs of breast cancer.
  - For COVID-19, AI enabled chatbot was used by MyGov for ensuring communications.
- Developing new materials (E.g. Google Deepmind predicted the structures of 2 million new materials)
- Education (e.g., Personalized learning through adaptive tools; customizing professional development courses etc.)
- Agriculture: AI enabled solutions for water-management, crop insurance, and pest control are also being developed. Technologies like image recognition, drones, and automated intelligent monitoring of irrigation systems can help farmers kill weeds more effectively, harvest better crops, and ensure higher yields.

- ICRISAT has developed an **AI-power sowing app**, which utilises weather models and data on local crop yield and rainfall to more accurately predict and advise local farmers on when they should plant their seeds
- **Disaster Management:** An AI-based flood forecasting system has been deployed in Bihar and is now being deployed throughout the country. It gives warnings 48 hours earlier about impending floods.
- **Improve Ease of Doing Business**
- Natural Language Processing (NLP)
- Image Processing (Facial Recognition)

## 2) ADVANCEMENTS IN MACHINE LEARNING

### A) NEURAL NETWORKS

- Neural network, also known as Artificial Neural Network (ANNs) or simulated neural networks (SNNs), are a subset of machine learning and are at the heart of deep learning algorithms. Their name and structure are inspired by the human brain, mimicking the way biological neurons signal to each other.
- A neural network can fine tune its output based on the feedback given to it during stages of training.
- ANNs consist of node layers, containing an input layer, one or more hidden layers, and an output layer. Each node, or artificial neurons, connects to another and has an associated weight and threshold. If the output of any individual node is above the specified threshold value, that node is activated, sending data to the next layer of the network. Otherwise, no data is passed along the next layer of the network.



- **Note:** ANN also rely on training data to learn and improve their accuracy over time.
- **Neural Networks vs. Deep Learning:**
  - Terms are sometimes used interchangeably. ‘Deep’ in deep learning is just referring to the depth of layers in a neural network. A neural network that consists of more than three layers –

which would be inclusive of the inputs and output – can be considered a deep learning algorithm. A neural network that only has two or three layers is just a basic neural network.

## B) DEEP LEARNING

- Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans: learn by example. In deep learning, a computer model learns to perform classification tasks directly from images, text, or sound. It can achieve state of art accuracy, sometimes exceeding human-level performance. Models are trained by using a large set of labeled data and neural network architecture that contain many layers.
- Most deep learning methods use neural network architecture, which is why deep learning models are often referred as Deep Neural networks. The term deep usually refers to number of hidden layers in the neural network.
- **Where is it being used today?**
  - » **Automated Driving:** Automotive researchers are using deep learning to automatically detect objects such as stop signs and traffic lights. In addition, deep learning is used to detect pedestrians, which helps decrease accidents
  - » **Aerospace and Defence:** Deep learning are used to identify objects from satellites that locate areas of interest and identify safe or unsafe zones for troops.
  - » **Medical Research:** To detect cancer
  - » **Industrial Automation:** Improve work safety around heavy machinery by automatically detecting when people or objects are within an unsafe distance of machines.
  - » **Electronics:** Used in automated hearing and speech translation. For e.g., home assistance devices that respond to your voice and know your preferences are powered by deep learning applications.

## 3) GENERATIVE AI

### ABOUT CHATGPT:

It is an artificial intelligent tool developed by **OpenAI**.

**OpenAI** is a research institution and company that focuses on developing AI intelligence technology in a responsible and safe way. It was founded in 2015 by a group of entrepreneurs and researchers, including **Elon Musk**, **Sam Altman**, and **Greg Brockman**.

- ChatGPT is based on Generative Pre-trained Transformer Architecture. It is trained on massive amount of text data from the internet. It used 570 GB of text data mined from the internet. It is a type of neural network and was first introduced in 2017 in a paper titled “Attention is all you need”. A neural network can fine tune its output based on the feedback given to it during stages of training. This allows the model to better understand the context and meaning of the input and to generate conversational response.
- **ChatGPT** is more than a chatbot. You can even ask it to write a program or a software application. It can do creative work like writing a new story or poetry. It can answer scientific concepts and answer any question that needs factual answer.

- It is fine tuned to provide **conservative responses**, as against essay-type content. It is because the neural network behind it has been additionally trained on **conversational transcripts with human feedback**.
- In addition to the conversational nature of the tool, the **creative generative capability is very appealing**. ChatGPT can become a **powerful pedagogy** tool on any topic to anyone, because we can instruct it to “explain it to me like I am a six-year-old”. It can explain in simple terms anything from **philosophy** to cooking recipes, including **new recipes of its own**.
- **It is a Language Model** (rather than a chatbot) that can produce text that sound like human response in a conversation setting.
- It is also a **Neural Network**

#### GOOGLE BARD

- Google's Generative AI model

#### ABOUT GOOGLE GEMINI (DEC 2023)

- Google GEMINI is a new multimodal general AI model, which the tech giant calls its most powerful yet.
- It is now available to users through Bard, some developer platforms, and even the new Google Pixel 8 Pro phones.
- The flexible AI model comes in **three sizes** – Ultra (yet to be released), Pro, and Nano – is being seen as google's answer to ChatGPT, which has been ahead of the game so far when it comes to generative AI.
- Google claims that GEMINI Ultra is the first model to outperform human experts on massive multitask language understanding (MMLU), which uses a combination of 57 subjects such as math, physics, history, law, medicine, and ethics for testing both world knowledge and problem-solving abilities.
- **So, IS GEMINI better than ChatGPT 4?**

**Hard to say now.** But it does seem to be more flexible. Its ability to work with videos and on devices without internet, gives it some edge.

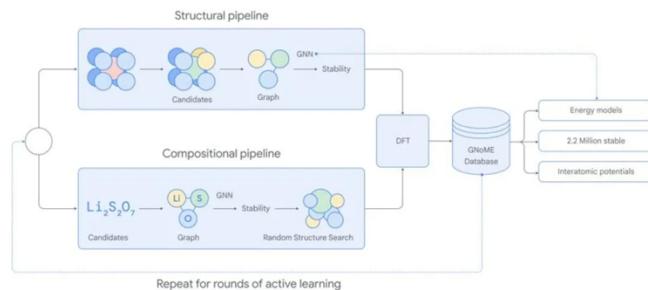
#### Some Concerns:

- Teachers are unhappy about it as they feel that it can be used to turn in plagiarized essays which could be hard to detect for invigilators. Recently, New York City's Education department banned ChatGPT in its public schools.
- **Skilled white collar jobs** like that of computer programmers in the IT sector is at threat.
- **India's IT services-based exports** may get impacted.

#### Way Forward (Class discussion)

## 4) GOOGLE DEEPMIND'S AI BREAKTHROUGH

- **How are new materials discovered in Chemistry?**
  - » New stable materials are generally discovered by the practitioners of solid-state chemistry through a process of trial and error that involves making small tweaks to known material or by fusing elements together. This is an expensive and time-consuming process.
  - » **In last decades**, experimentation by humans has resulted in the discovery of the structures of some 28,000 stable materials, which are listed in the Inorganic Crystal Structure Database, the largest database of identified materials.
- **What happened?**
  - » Google DeepMind AI Tool known as Graph Networks for Material Exploration (GNOME) has successfully predicted the structures of more than **2 million new materials**. This was done with the help of AI.
  - » While these materials will still need to undergo the process of synthesis and testing, DeepMind has published a list of 381,000 of the 2.2 million crystal structure that it predicts to be most stable.
- **How does GNOME actually work?**
  - » GNOME is a state of art graph neural network model or GNN, where the input data for the model takes the form of a graph that can be likened to connections between atoms.
  - » GNOME was trained using active learning, a technique to scale up a model first trained on a small, specialized dataset. Developers can then introduce new targets allowing machine learning to label new data with human assistance. This makes the algorithm well suited to the science of discovering new materials, which requires searching for patterns not found in original dataset.
  - » **GNOME uses two pipelines to discover low energy (stable materials).**
    - The **structure pipeline** creates candidates with structures similar to known crystals.
    - The **composition pipeline** follows a more randomized approach based on chemical formulas.
    - The output of both the pipelines are evaluated using established Density Function Theory (DFT) calculations and those results are added to the GNOME database, informing the next round of active learning.



- **Significance:**
  - » **Drastic increase in the number of 'stable materials' known to mankind by ten-fold.**

- DeepMind claims its current research is equivalent to nearly 800 years of knowledge, given that 3,80,000 of its stable predictions are now publicly available to help researchers make further breakthrough in materials discovery teams.
- » **The breakthrough** has huge implications for sectors such as renewable energy, battery research, semiconductors, and computing efficiency which have been looking for new material to improve the efficiency in the sector.

## 5) EU DEAL ON AI

- **Why in news?**
  - » EU has reached a landmark agreement to regulate AI (Dec 2023)
- **Need of Regulating AI:**
  - » **Generative AI systems** like OPENAI's CHATGPT have raised fears about the risks the rapidly developing technology poses to jobs, privacy and copyright protection and even human rights.
- **EU has adopted the world's first law on regulating AI** in Dec 2023.
  - » The EU Parliament will now vote on the proposed act early next year (i.e. in 2024), but with the deal done, it's just a formality.
- **What does the EU law propose?**
  - » The law regulates the use of Artificial Intelligence (AI).
  - » It includes safeguards on the use of AI within the EU, including clear guardrails on its adoption by law enforcement agencies.
    - The deal includes strong restrictions on facial recognition technology, and on Using AI to manipulate human behaviour.
    - Government can only use real-time biometric surveillance in public areas only when there are serious threats involved, such as terrorist attacks.
  - » **Provision for strong penalties:** The deal threatens stiff financial penalties for violations of up to 35 million euros or 7% of a company's global turnover.
  - » **Consumers** have been empowered to launch complaints against any perceived violations.
  - » The legislation also proposes to be "a launch pad for EU start-ups and researchers to lead the global AI race".
    - The act works as a unique legal framework for the development of AI you can trust. It will help in development of technology which doesn't threaten people's safety and rights.
- **Significance:**
  - » Strong and Comprehensive rules in EU can set a powerful example for many governments considering regulations.
  - » **AI Companies** who follow these regulations in EU are also expected to extend some of these protections in other jurisdictions.
- **Comparing EU's approach with other regulations:**
  - » EU has taken a tougher stance which segregates AI as per use case scenario based primarily on the degree of invasiveness and risk;

- » UK has seen regulation on the other end of the spectrum with a '**light-touch**' approach that aims to foster innovation in this nascent field.
  - » USA's approach lies in between that of EU and UK.
- **Leadership in tech regulation:**
- » Over the last decade, Europe has taken **decisive lead** over the US on tech regulation.
    - EU has enforced the landmark **GDPR (General Data Protection Regulation)** since **May 2018**. It is an overarching law focused on privacy and requires individuals to give explicit consent before their data can be processed and is now a template being used by over **100 countries**.
    - EU has also passed a pair of sub-legislations – the **Digital Services Act (DSA)** and the **Digital Markets Act (DMA)**. These take off from GDPR's overarching focus on the individual's right over her data.
      - DSA focuses on issues like hate speech, counterfeit goods etc.
      - DMA has defined a new category of "dominant gatekeeper" platforms and is focused on non-competitive practices and abuse of dominance by these players.
  - » On AI, though, the **US has made an attempt to take a lead** by way of the new White House Executive Order on AI, which is being offered as an elaborate template that could act as a blueprint for every other country looking to regulate AI. In Oct 2022, USA released a blueprint on an AI Bill of Rights – seen as a building block for the subsequent executive order

## 6) GPAI AND UPDATE

- **Why in news?**
  - » Global Partnership on AI (GPAI) members unanimously adopt New Delhi Declaration on AI (Dec 2023)
- GPAI is an international and multi-stakeholder initiative to guide the **responsible development and use of AI**, grounded in human rights, inclusion, diversity, innovation, and economic growth.
  - » This is also a first initiative of its type for evolving better understanding of the challenges and opportunities around AI using the experience and diversity of participating countries.
  - » It consists of **29 members** (28 countries and EU).
    - **Note:** India is a member. China, a major techpower is not a part of the grouping.
- **Beginning:** The partnership was proposed by Canada and France in 2018 G7 Summit, and was officially launched in June 2020.
- It is supported by a Secretariat hosted by OECD, Paris.
- **Dec 2023 Meeting:**
  - » India hosted the summit and will also chair GPAI in 2024.
  - » This summit was important as it was the first summit after the explosive release of ChatGPT.
  - » The GPAI has unanimously adopted 'New Delhi Declaration'.
  - » **Key Highlights of the New Delhi Declaration:**
    - It underscores the need to mitigate risks arising from the development and deployment of AI systems.

- It flagged concerns emanating from such systems including misinformation, unemployment, lack of transparency, and fairness, protection of IP and personal data and threat to human rights and democratic values.
- It also promotes equitable access to critical resources for AI innovation including computing and high quality diverse data sets.
- It also says that global framework for the use of AI should be rooted in democratic values and human rights; safeguarding dignity and well-being; ensuring personal data protection; the protection of IPR etc.
- Members also agreed to support AI innovation in the agriculture sector as a new 'thematic priority'.

» **Significance:**

- The declaration attempts to find a balance between 'innovation' and the 'risk associated with AI subsystems'.
- The New Delhi Declaration is very significant for India, which has batted for a collaborative approach towards building AI systems as it looks to push its model of digital public infrastructure (DPI) across the world.
- Besides, access to computing capabilities from member nations will also boost India's plan of building a sovereign AI system which will in turn counter dominance of handful of foreign companies in this space.

» **How this international cooperation can increase:**

- **Make GPAI more inclusive:** By making more developing countries join GPAI.

» **Other steps that India can take for better regulation of AI sector**

- **Statutory Authority:** TRAI has recommended setting up of a domestic statutory authority.
- **International Collaboration:** Collaboration with international agencies and government of other countries to form a global agency for the "responsible use" of AI.

**Conclusion:** The GPAI's commitment ensures that AI serves as a transformative force, providing clear and accountable guidelines to enable millions worldwide while upholding rights, safety, and security standards.

## 7) INDIA: PROMOTION OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

- **India has been ranked second on the Stanford AI Vibrancy Index** primarily on account of its large AI-trained workforce.
- In 2018, NITI Aayog launched **National Strategy for Artificial Intelligence** detailing core strategies and recommendations of promoting the use of AI in key areas of governance.
- **Five Key Sector identified by NITI Aayog** to focus its efforts towards implementation of artificial intelligence (AI) to serve societal needs.
  - » **Healthcare:** increased access and affordability of quality healthcare
  - » **Agriculture:** enhanced farmers income, increased farm productivity and reduction of wastage
  - » **Education:** Improved access and quality of education
  - » **Smart Cities** and infrastructure

» **Transportation**

- CBSE has integrated AI in the school curriculum to ensure students passing out have basic knowledge and skills of data science, machine learning and Artificial intelligence.
- **Responsible AI for Youth** – A National Program for the youth launched by MEITY – Launched in May 2020
  - The program is designed to reach out to students from Government schools pan India and provide them with opportunity to become part of the skilled workforce in an inclusive manner.
  - It is open to students of classes 8 - 12 from Central and State government-run schools (including KVS, NVS, JNV) from across the country - all 28 States and 8 Union Territories.
- **National Education Policy 2020** provides for setting up of the **National Research Foundation**, which should boost research in AI.
- **RAISE (Responsible AI for Social Empowerment) 2020**
  - It is a first of its kind, global meeting of minds on Artificial Intelligence to drive India's vision and roadmap for social transformation, inclusion and empowerment through Responsible AI.
  - It was organized by GoI through MEITY and NITI Aayog.
- India joins **Global Partnership on Artificial Intelligence (GPAI)** as a founding member to support the responsible and human centric development and use of AI (July 2020)
- **MEITY** launches National AI Portal of India – [www.ai.gov.in](http://www.ai.gov.in) (May 2020)
  - The portal has been jointly developed by the MEITY and IT Industry.
  - National E-Governance Division of MEITY and NASSCOM from IT Industry will jointly run the portal.
  - It will be a one stop digital platform for AI related developments in India, sharing of resources such as articles, startups, investment funds in AI, resources, companies and educational institutions related to AI in India.
- **Key Pain Points challenges** involved in the implementation of Artificial Intelligence in India
  - i. **Human Resource Shortfall** in terms of number of AI experts including PhDs.
  - ii. **Lack of trained professionals:** Only around 4% of Indian AI professionals are trained in emerging technologies such as deep learning.
- **Way Forward**
  - » **Promote More R&D in AI**
    - Better facilities at HEIs
    - More academia-Industry collaboration
  - » **Human Resource Development: Rejuvenate Higher Education Sector for AI**
    - Come up with a clear-cut action plan for rejuvenating Higher education system for development of AI
    - Dealing with **faculty shortage** by increasing attractiveness of Indian HEIs for highly qualified PhDs and experienced faculties (salaries, infrastructure, recognitions etc.)
  - » **AI-Startups** should be encouraged through tax breaks, reduced compliance burden and increased support from R&D institutions.
  - » **Institutional commitment** to excellence, politically open environment and the motivation of individual researchers to unlock the potential of AI will, in long run success of AI in a country.
  - » **Strong, high tech regulatory framework** to deal with problems which may be created by **deep fakes** etc.

- **Conclusion:** India, with its “AI for ALL” strategy, a vast pool of AI-trained workforce and an emerging startup ecosystem, has a unique opportunity to be a major contributor in AI-driven solutions that can revolutionize healthcare, agriculture, manufacturing, education and skilling.

LevelUpIAS



# CURRENT AFFAIRS PROGRAM

## PRE CUM MAINS 2024

### DEC 2023: BOOKLET-8

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## 1. GENERAL STUDIES-2

### 1) DECRIMINALIZATION OF MEDICAL NEGLIGENCE?

- **Why in news?**
  - Bhartiya Nyaya Samhita has kept the punishment for medical negligence lower than the punishment for causing death by other kinds of negligence (Dec 2023)
- **Introduction**
  - As per the **Section 106(1)** of the Bhartiya Nyaya (Second) Sanhita (BNSS), doctors will continue to face a two year imprisonment and/or fine if convicted. This is lesser than the Sanhita's recommended punishment of five years for other cases of death by negligence (for e.g. by rash driving).
  - **Note:** The maximum imprisonment of doctors with this amendment remains the same as it was under IPC section 304A - upto 2 years of imprisonment or fine or both.
    - Medical negligence has not been clubbed with other accidental deaths where punishment has been kept higher.
- **Need of lower punishment for medical negligence:**
  - Doctors shouldn't be punished for honest mistakes and negligence is a complex issue in medical field and therefore this shouldn't be clubbed with other kinds of negligence.
  - It will also reduce harassment of doctors from frivolous lawsuits and harassment.
  - It will ensure that doctors will be able to provide care without fear of persecution and patients can be assured of quality care.
- **Criticisms:**
  - Critiques argue that doctors should be more careful, and the scope of negligence should be lesser here.
  - Owing to the "power imbalance" in the doctor-patient relationship, an act of negligence on the part of the doctor calls for a lower punishment but a higher one.
- **Way Forward**
  - **Consult all stakeholders** including patients.
  - **Need for comprehensive data** - to understand the extent of negligence and extent of harassment.
  - **Blanket exemption** will not be a good idea as honest mistakes can be decriminalized, but carelessness needs to be punished.

## 2. GENERAL STUDIES-3

### 1) ECONOMY: INDIA'S INCLUSION IN JP MORGAN'S GOVERNMENT BOND INDEX – EMERGING MARKET (GBI-EM)

- In Sep 2023, JP Morgan Chase & Co. announced that it will add Indian government bonds into the GBI-EM Index.
- India's weight is expected to reach the maximum weight threshold of 10% in the GBI-EM Global Diversified and approximately 8.7% in the GBI-EM Global Index.
- **The process of inclusion** is set to commence on June 28, 2024, and will span a duration of ten months. These 10 months will see an incremental increase of 1% in India's index weighting, ultimately reaching an allocation of 10%.
- As per JP Morgan, around 23 IGBs with a combined national value of \$330 billion are considered eligible. All these bonds fall under the "fully accessible" category for non-residents.
- **Impact:**
  - » **Increased foreign Investment** in India's debt market.
    - It will also lead to increased passive investment by various index tracking funds.
    - Moreover, it can also be a trigger for other financial institutions to include India in their index.
    - For e.g. the foreign funds have already started pouring money into government bonds with their investments in the fully accessible category more than doubling to Rs 1.28 lakh crore by Dec 2023 (from around 60K crores last year).
  - » **Reduction in government bond yield** as more money will be available now. This will reduce government's cost of borrowing and thus will lead to ease of fiscal deficit.
  - » It will also deepen bond markets in India.
  - » It will also lead to improved BoP condition and appreciation of rupee.
- **Impact: Negative:**
  - India may get exposed to global market fluctuations, as it will be subject to shifts in sentiments, economic conditions, and policies in major economies, influencing the bond prices and yields.
- **Conclusion:** India's inclusion in JP Morgan's GBI-EM index is yet another shining example of India's growing importance in the world economy. And the benefits of index inclusion outweigh the associated risks linked to such index inclusion.

### 2) ECONOMY: GIG ECONOMY AND GIG WORKERS

- **Why in news?**
  - » In Oct 2023, in response to a delegation of Gig Workers Association, the CM of Delhi, Arvind Kejriwal announced that the government would certainly address the concerns of the gig workers and even legislate if the need arises.
- **Example Questions**

- » Discuss the key promises and perils of increasing gig economy and gig workforce in India [10 marks, 150 words]
- **About Gig Economy:**
- » A **gig economy** is a free market system in which temporary positions are common and organizations hire independent workers for short term commitments. The term "gig" is a slang word for job that lasts a specified period of time.
  - » According to Ministry of Labour and Employment, "a gig worker is a person who engages in income-earning activities outside of a traditional employer-employee relationship, as well as in informal sector"
    - **Gig workers** can be classified into platform and non-platform workers.
      - Platform workers are those whose work is based on online software apps or digital platforms, while non-platform gig workers are generally casual wage workers, working part time or full time.
- **Factors behind rise in Gig Economy:**
- » **A rapidly expanding service sector-Startup ecosystem:** Startups, including some celebrated unicorns like Ola, Uber, Zomato, and Swiggy, have emerged as a major driver of the gig economy in India. They hire contractual freelancers in both skilled and unskilled jobs to reduce cost.
  - » **The unconventional work approach of millennials, Gen Y & Gen Z**
  - » **COVID-19 Pandemic** led to many people losing their fixed jobs
  - » **Fast clipped emergence of free lance platforms**
  - » **Various other advantages** (see details below)
- **Advantages of Gig Economy/ Bright Side of Gig Economy**
- » **For Employees:**
    - **Employment opportunities:** As per NITI aayog, more than 75 lakh workers are engaged in gig economy in 2020-21, and this is expected to go to 23.5 million by 2029-30.
    - **Independence and flexibility** offered by the gig economy to choose projects and work hours has attracted millions of people to join the gig workforce.
    - **Additional income:** To impoverished population (particularly the jobless, women, and students)
  - » **For Enterprise:**
    - **An efficient and speedy go-to-market solution** that allows them to offload core business functions on demand while removing hurdles like fixed costs, long recruitment cycles, and other compliance.
    - **It improves productivity** by reducing idle and unproductive time.
    - It also offers **agility to enterprises**, making it easy to scale up or down to meet business requirements.
  - » **For Consumers**
    - Cost effective, high quality services (for e.g. Urban Company, Ola, Zomato etc.)
  - » **Benefit for overall economy:**
    - Increased labor force participation and contributes to reduction in unemployment.
    - Skilled work force such as make-up artists can find business without setting up a physical shop.

- **Key Highlights of NITI Aayog's Report: 'India's Booming Gig and Platform Economy'**
    - **Size of workforce:** In 2020-21, the gig workers constituted 2.6% (7.5 million) of the non-agricultural workforce and by 2030 they would constitute 6.7% (23.5 million) of non-agricultural workforce.
    - **Skill Levels:** As per the report, around 31% workers are in low skilled jobs; 47% of the gig work is in medium skilled jobs, and 22% work is in high skilled jobs.
    - **Female Labour Force Participation** in India has remained low (between 16% - 23%) in last few years.
      - Why? -> Structural barriers such as less access to education and skilling opportunities.
    - **Other key issues faced by workers in Gig Economy:** While platform companies have created avenues of employment, it has often been marred by:
      - **Contractual (non-permanent) work:**
        - » **No Social Security:** They don't have benefits like paid sick and casual leaves, travel and housing allowances, and provident fund saving among others.
      - **Poor Service Conditions:**
        - » Low wages, Opaque payment calculations, increasing commission deductions etc.
        - » Lack of possibility of upward mobility within an organization
        - » Gig economy can bring loneliness. It would be especially true for designers, copywriters etc. working on their laptops from home.
      - The labor codes are vague about social protection for unorganized workers.
        - » The new **Code on Social Security** of 2020 replaced all existing laws on the subject. Gig workers find a place as unorganized sector workers in this code but the actual security cover remains vague and implementation of the code remains poor.
- **Other Concerns:**
  - Traditional players like (non-app based taxi service providers) are not able to survive in this cut-throat competition environment.
- **Key Recommendations of NITI Aayog**
  - **Extending Social Security for gig and platform workers:** Extend social security measures such as income support, paid sick leave, insurance and pension plans to people working for platform economies like Swiggy, Zomato, Ola and Uber.
    - Such plans and policies may be uniquely designed by a firm, in partnership with insurance companies, or could be designed and offered in collaboration with the government, as envisaged under the Code on Social Security, 2020.
  - **Skill Development for platform jobs:** Platform led models need to be created for skilling purposes.
  - **Social Inclusion:** Niti Aayog has recommended fiscal incentives, like tax rebates or start-up grants, for companies with about 1/3rd of their workforce as women or people with disabilities.
    - **Business should have Higher share of female managers and supervisors** in the organization to ensure that communication to workers doesn't perpetuate gender stereotypes.

- **'Platform India Initiative'** - on the lines of Startup India Initiative: This should be built on the pillars of accelerating platformisation by simplification and handholding, funding support and incentives, skill development, and social financial inclusion.
- **Self-employed individuals** - selling regional and rural cuisine, street food etc., may also be linked to platforms so that they can sell their produce to wider markets in towns and cities.
- **RAISE Approach for operationalizing the Code on Social Security (CoSS), 2020:**
  - Recognize the varied nature of work to design equitable schemes.
  - Allow augmentation of social security through innovative financing mechanism
  - Incorporate, while designing schemes, the specific platforms, factoring the impact on job creation, platform businesses and workers
  - Support workers to subscribe to government schemes and welfare programs through widespread awareness campaigns
  - Ensure benefits are readily accessible to workers.

- **Conclusion:**

- Long term solution lies in creation of more better paying, secure jobs. But, at the same time there is need to ensure minimum wages, and social protection for gig and other organized workers who constitute the bulk of Indian workforce

#### A) THE RAJASTHAN GIG AND PLATFORM WORKERS (REGISTRATION AND WELFARE) ACT, 2023

- **The act provides for every platform worker to have a unique id** that would anchor all future benefits for them.
- **Welfare Fund:** The act levies a fee on every transaction as a source of revenue for the welfare fund.
- **Tripartite Welfare Board:** The act creates a tripartite welfare board made up of government, companies and workers to administer the fund.
  - » A tripartite board administered fund with the revenue source being the company, serves as an inoculation against corrupt rogue unions from striking deals because the fund can never come under just a single company's control nor the control of any one party.
  - » This is based on Hamal model of Maharashtra.
- **Information sharing to ensure transparency:** The act makes it mandatory for companies to give control over transaction level data as it requires the data to reside in a government-controlled database with an information system/app frontend through which workers have access to data.

#### 3) S&T: DEEP OCEAN MISSION (DOM)

- **Practice Questions:**
  - » Discuss the key pillars of Deep Ocean Mission (DOM). Examine how the DOM will contribute towards India's sustainable economic growth [10 marks, 150 words]
- **Introduction:**
  - » Deep Ocean Mission is India's quest to explore and harness the depths of the ocean.
    - One of its components is Samudryaan Mission which is aimed to develop an indigenous, self-propelled manned submersible to carry **3 human beings** to a **water depth of 6,000 meters in the ocean** with a suite of scientific sensors and tools for deep ocean exploration.

- » DOM is being implemented by **Ministry of Earth Science** and was approved by the union cabinet in 2021 at a cost of **Rs 4,077 crores** over a five year period (2021-22 to 2025-26).
- The mission has six pillars:
  - i. Development of technologies for **deep sea mining and a manned submersible** to carry three people to a depth of 6,000 meters in the ocean. The submersible will be equipped with **suit of scientific sensors, tools, and an integrated system for mining polymetallic nodules from the central Indian Ocean.**
  - ii. Development of **ocean climate change advisory services**, involving an array of ocean observations and models to understand and **provide future climate projections.**
  - iii. Technological innovations for the **exploration and conservation of deep-sea biodiversity.**
  - iv. Surveys and exploration aimed at **identifying potential sites of multi-metal hydrothermal sulphides mineralization** along the Indian ocean mid-oceanic ridges.
  - v. Harnessing **energy and freshwater** from the ocean
  - vi. Establishing an **advanced Marine Station for Ocean Biology**, as a hub for nurturing talent and driving new opportunities in ocean biology and blue technology.
- DOM is one of the **nine missions under the PM's Science Technology and Innovation Advisory Council (PMSTIAC)**. It is imperative that DOM supports the blue-economy priority area, blue trade, and blue manufacturing in India.
- Various institutions involved in achieving the objectives of DOM:
  - » MoES institutes, especially the **Centre for Marine Living Resources and Ecology (CMLRE)**, **Indian National Centre for Ocean Information Services (INCOIS)**, **National Centre for Coastal Research (NCCR)**, **National Centre for Polar and Ocean Research (NCPOR)** and **National Institute of Ocean Technology (NIOT)** will **collaborate with other national institutes and academia to achieve the objectives outlined in DOM**, albeit with well-segregated responsibilities
- Progress:
  - » The **National Institute of Ocean Technology (NIOT)**, an autonomous institute under MoES, has been entrusted with the **mandate of developing indigenous technologies to address engineering challenges associated with exploring and utilizing ocean resources.**
  - Matsya6000 is the **deep ocean submersible designed to accommodate a crew of three members (aquanauts)**. It boasts of an **operational endurance of 12 hours**, which is extendable to 96 hours in the event of an emergency.
  - Progress:** The **design of Matsya6000** has been completed.
    - Now tests will start, with a **depth of 5,000 meters** which will eventually be expanded for a **depth of 6000 meters.**
  - » NIOT has also successfully conducted **deep-sea locomotion trials on the seabed** at a depth of **5,270 meters** using India's underwater mining system, '**Varaha**'. The trial was able to **collect the polymetallic modules from the ocean bed during the trial**. This milestone is a **step towards future exploration and harvesting of deep sea resources.**



- **Why the target of 6000 meters depth?**
  - » **Polymetallic modules**, which contain precious metals like copper, manganese, nickel, iron, and cobalt, are found approximately 5,000 m deep.
  - » **Polymetallic sulphides** occur at around 3,000 m in the central Indian Ocean.
  - » **Therefore**, India's interest spans to depths of 3,000 m to 5,000 m. By equipping ourselves with the ability to explore upto a depth of 6,000 meters, we can effectively cater to both the Indian EEZ and the Central Indian Ocean.
  
- **Key challenges of India's DOM:**
  - » **High Pressure in Deep Ocean**: Operating under such high pressure requires the use of meticulously designed equipment crafted from durable metals or materials. Electronics also find it difficult to function under this high pressure.
  - » **Landing on the Ocean bed is another challenge**. It is due to incredibly soft and muddy sea bed.
  - » **Extracting minerals** will also require a lot of energy as they will have to be pumped to the surface.
  - » **The difficulty of propagation of EM waves** make it difficult to rove remotely operated vehicles.
  - » **Visibility** poses another challenge as negligible light reaches a depth of 6,000 meters.
  
- **Where does India stand in comparison to other countries?**
  - Countries such as USA, Russia, China, Japan, and France have already achieved successful deep ocean crewed mission. India is poised to join the rank of these nations.
  
- **Way Forward:**
  - » **Focus on Environment Sustainability**: The extraction of resources should be sustainable and should only minimally hamper the deep ocean ecosystem.
  - » **International Collaboration** can be crucial in understanding the key challenges and their resolution from the countries which are already doing deep ocean exploration.
  - » **Focus on training human resources** which would be specialized to work in the deep ocean systems.
  
- **Conclusion:**
  - » **DOM** with its focus on research and development, deep sea mining, biodiversity conservation and climate studies embodies the very essence of scientific zeal that India needs to move towards Atmanirbharta.

#### **4) INTERNAL SECURITY: TERRORISM IN JAMMU AND KASHMIR**

- **Why in news?**
  - The Army is moving in additional troops to the Rajouri-Poonch sector after a spate of attacks on security personnel and increased activity by Pakistan origin terrorists who have created hideouts in thick forests close to LoC (Dec 2023)
  
- **Practice Question:**
  - Highlight the key emerging trends of the insurgency situation in Jammu and Kashmir. Discuss the measures that need to be taken to deal with the emerging challenges [15 marks, 250 words]

- **Introduction:**
  - In 2019, the GoI abrogated Articles 370 and 35A in a bid to end radicalization, separatism, and terrorism.
  - Various counter-terrorism measures have been successful:
    - » Pakistan's proxy war networks have been neutralized.
    - » The overground workers (OGW) have been dismantled.
    - » Infiltration has been reduced to a trickle.
    - » Increased crackdown on terror funding has made things difficult for terror groups operating within the valley, especially in south Kashmir.
    - » Terror recruitment has dipped:
      - In the first 9 months of 2023, only 25 individuals joined terrorist groups, which is significant decline compared to 143 in 2019 and 100 in 2022.
      - » Increase in surrenders due to invigorated surrender and rehabilitation policy.
        - It has also led to several youth giving up militancy quietly.
      - » Fast paced developed in J&K.
- **Key emerging trends in the issue of Insurgency in J&K:**
  - **Relative Peace in the Kashmir Valley**: In recent times, the Kashmir zone - the traditionally volatile area - is relatively quiet.
  - **Increased terrorist strikes outside the Kashmir Valley**:
    - » Unable to face security forces in urban environment, terrorists are choosing dense forests to engage with security forces.
      - It's the Pir Panjal (south) in Jammu sector which has emerged as a hub of terrorism.
      - This is particularly visible since 2020, when terrorist groups shifted their operations from the valley to the forested areas of Poonch and Rajouri in the Pir Panjal ranges.
    - » Terrorists are adopting guerrilla tactics - Target the security forces and then go back to dense forests and regroup for another attack.
    - » By striking outside the Kashmir valley, they are trying to depict the inclusivity of their resistance and are promoting the rhetoric of being influential even outside the valley. This is an attempt to keep terrorism alive and maintain international focus on Kashmir.
  - **Emergence of Virtual Terrorist Groups** which ostensibly has no antecedents.
    - In last three years, groups like the Resistance Front (TRF), Jammu Kashmir Ghaznavid Force, and People's Anti-Fascist Front (PAAF) have come to the fore. These are nothing but organizations for LeT and other terrorist outfits. TRF for instance uses the funding channels of LeT.
    - These groups have adroitly used social media platforms like X, Telegram, Facebook to push their narrative and propaganda, primarily focusing on issues like the alleged conspiracy to turn Kashmir valley into Muslim-Minority region.
  - **More well-trained and tech savvy militants**: This is evident in the way militants are able to cover their tracks.
    - For e.g. terrorists are not using their own communication system but are dependent on the phones of locals.

- **Israel-Hamas conflict** can intensify terrorist radicalization in the region and in other parts of the country.
    - » Pan-Islamic and Pakistan based terrorist organizations are weaponizing the deluge of footage from the Gaza strip.
- **Why has terrorist presence and activity shifted to the Poonch-Rajouri sector?**
  - » **Abrogation of Article 370** has also made Kashmir less conducive to separatist trends.
  - » **Kashmir's strong and layered counter-infiltration (CI) and counter terrorism (CT) grid** makes planning of proxy operations difficult.
  - » **Weaknesses in Poonch Rajouri Sector:**
    - **Chequered history of local support** to terrorists: For e.g. the security agencies are facing the problems of disinformation.
    - **The treacherous terrain of Rajouri and Poonch districts** gives the terrorists **impunity**, and they need not seek a mass support based for survival.
    - **Shifting out of security forces**: In 2020, after the Galwan clash, several companies of Rashtriya Rifles were moved from the hinterlands of Poonch, Rajouri etc.
    - **Poor Informers Network**: New officers who have shifted to the region, didn't work as hard as they should in cultivating an informers' network.
- **2023 Terrorist Incidents in J&K:**
  - Militants ambushed truck of security forces in Poonch on 20th April 2023; In May 2023, five army personnel were killed in an explosion in a forested area in Rajouri.
  - In Sep 2023, encounter in Anantnag lead to loss of four lives, including three senior security forces officials.
  - **Ambush on 21st Dec 2023 of security forces near Dera Ki Gali (DKG)** resulted in four soldiers being killed in action. The attack was claimed by the banned People's Anti-Fascist Front (PAFF), an offshoot of Pakistan backed Jaish-e-Mohammed.
- **Way Forward:**
  - **Strong operations** should be conducted in the lower reaches of the Pir Panjal with drone support.
  - **Strengthen public outreach** to build confidence and trust among civilians as was done in the Kashmir valley.
    - Mistakes like alleged death of civilians in military custody should also be dealt in a transparent manner to build trust.
  - **Inclusive development** throughout J&K.
    - The general focus on Kashmir valley has led to the Rajouri-Poonch region being at a disadvantage in terms of development funds, implementation of government programs, infrastructure development, etc.
  - **Indian agencies** need to step up their vigil in monitoring the renewed radicalization drive by the terrorist masterminds and their well-resourced benefactors.
  - **Other steps discussed with the terrorism topics:**
    - **Strengthening border infrastructure**
    - **Countering terrorism politically and diplomatically**
      - Raising the issue on international forums to isolate countries sponsoring terrorism.
      - Working towards resolving the Kashmir dispute through political negotiations.

- Strengthening Police (having a counter-terrorism cell)
- Role of educational institutions, religious institutions and Civil Society

- Conclusion:

- In the current context of receding footprint of militancy in J&K, the fight against the terrorist has to enter a decisive phase with bold and imaginative initiatives. The security forces need to set different parameter of success to include non-kinetic means, as part of a whole-of-government approach.

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By **Abhishek Inamdar**  
M.Sc. Mathematics, BITS Pilani

## PRELIMS MASTER PROGRAM

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### 3. PRELIMS FACTS

#### 1) CULTURE: INTANGIBLE CULTURAL HERITAGE/ MASTERPIECE OF THE ORAL AND INTANGIBLE HERITAGE OF HUMANITY

- **Why in news?**
  - » Garba dance from Gujarat becomes the 15th cultural item from India to make it to UNESCO's Intangible Cultural Heritage List (Dec 2023)
- **About Intangible Cultural Heritage**
  - » An intangible cultural heritage is a practice, representation, expression, knowledge, or skill as well as instruments, objects, artifacts, and cultural spaces that are considered by UNESCO to be part of a place's cultural heritage. It is sometimes called the living cultural heritage.
  - » It focuses on intangible aspects of culture.
- **About Convention for the Safeguarding of the Intangible Heritage, 2003**
  - » It is an international treaty signed in 2003, acknowledging that cultural heritage is more than tangible places, monuments and objects. It also encompasses traditional and living expressions.
- **Intergovernmental Committee of UNESCO's 2003 Convention**
  - » The Intergovernmental Committee of the 2003 Convention consists of 24 members and is elected in the General Assembly of the Convention according to the principle of equitable geographical representation and rotation.
  - » **Core Functions** of the Committee:
    - Promoting the Objective of the Convention
    - Providing guidance on best practices
    - Making recommendations on measures for safeguarding of intangible cultural heritage.
  - » The committee also examines the requests submitted by State Parties for the inscription of intangible heritage on the lists as well as proposals or programs and projects.
  - » India has been elected as a member of the Intergovernmental Committee of UNESCO's 2003 Convention for the Safeguarding of the Intangible Cultural Heritage for the 2022-26 cycle.
    - In the past India has served as a member in two stints - 2006 - 2010 and 2014-18.
  - » The elections took place during the 9th general assembly of the 2003 Convention held at UNESCO headquarters, Paris, from 5th to 7th July 2022.
- **India** ratified the convention in Sep 2005.
- **Intangible Cultural Heritages of India:** So far, 15 Intangible Cultural Heritage (ICH) elements from India have been inscribed till date on the UNESCO's List of the Intangible Cultural Heritage of Humanity.
  - » **How is an element included in this list?**
    - Nomination by a state party. (In India, Ministry of culture has appointed the Sangeet Natak Akademi, as nodal office for matters relating to preparation of the nomination dossiers for UNESCO).
  - » **Elements inscribed from India so far include:**

S.No.	ICH Element	Year of Inscription
1	Tradition of <b>Vedic chanting</b>	2008
2	<b>Ramlila</b> , the traditional performance of the Ramayana	2008
3	<b>Kutiyattam</b> , Sanskrit theatre	2008
4	<b>Ramman</b> , religious festival and ritual theatre of the Garhwal Himalayas, India	2009
5	<b>Mudiyettu</b> , ritual theatre and dance drama of Kerala	2010
6	<b>Kalbelia</b> folk songs and dances of Rajasthan	2010
7	<b>Chhau</b> dance	2010
8	<b>Buddhist chanting of Ladakh</b> : recitation of sacred Buddhist texts in the trans-Himalayan Ladakh region, Jammu and Kashmir, India	2012
9	<b>Sankirtana</b> , ritual singing, drumming and dancing of Manipur	2013
10	Traditional <b>brass and copper craft of utensil making among the Thatheras</b> of Jandiala Guru, Punjab, India	2014
11	<b>Yoga</b>	2016
12	<b>Nawrouz</b> , Novruz, Nowrouz, Nowrouz, Nawrouz, Nauryz, Nooruz, Nowruz, Navruz, Nevruz, Nowruz, Navruz	2016
13	<b>Kumbh Mela</b>	2017
14	<b>Durga Puja</b> in Kolkata	2021
15	<b>Garba</b> of Gujarat	2023

## 2) PLACES IN NEWS: SIERRA LEONE

**Geography:** It is a country located on the southwest coast of West Africa. It shares the southeastern border with Liberia and the northern half of the country is surrounded by Guinea. It has tropical climate, with diverse environments ranging from Savanna to rainforests.

**Religion:** Muslims constitute 75% of the population. Christian are minority but quite influential.

**Capital:** Freetown.



### What led to Coup attempt in Sierra Leone? (Dec 2023)

- In Nov 2023, unidentified gunmen targeted the **Wilberforce military barracks** and several police stations and correctional centres in Freetown, Sierra Leone. It was considered a coup attempt.
- Key issues in Sierra Leone:
  - a. **Political Instability:** This instability has been there since June 2023, when President Julius Maada Wonie Bio was re-elected. Opposition have claimed that elections were manipulated.
  - b. **Economic instability:** Inflation (upto 50%); Poverty (more than 50% of population); unemployment
  - C. **Police aggression:** For e.g. the Aug 2022 riots left six police officers and 27 protestors dead.

### 3) PLACES IN NEWS: MOUNT MERAPI

**About Mount Merapi:** It is the most active volcano of Indonesia and have erupted regularly since 1548. It is located on Java Island. It is a stratovolcano whose height is 2,930 miles.

It is located at a subduction zone, where the Indo-Australian Plate is subducting under the Sunda Plate.

It is also **one of the 16 Decade Volcanoes**

#### About Decade Volcanoes

- The Decade volcanoes are 16 volcanoes identified by the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) as being worthy of particular study in light of their history of large, destructive eruptions and proximity to populated areas.
- The **Decade Volcanoes project** encourages studies and public-awareness activities at these volcanoes, with the aim of achieving a better understanding of the volcanoes and the dangers they present, and thus being able to reduce the severity of natural disaster.
- They are called decade volcanoes because the project was initiated in the 1990s as part of the United Nations - sponsored International Decade for Natural Disasters Reduction.



#### Dec 2023 Eruption:

Mount Merapi erupted again and killed at least 11 hikers. This eruption sent hot ash and other volcanic debris three kms into sky.

## About IVCEI

It is an **international NGO** that focuses on research in volcanology, efforts to mitigate disasters, and research into closely related disciplines, such as igneous geochemistry and petrology, geochronology, volcanogenic mineral deposits, and the physics of the generation and ascent of magmas in the upper mantle and crust.

## 4) ECONOMY: BANKING: DSIBS

- **Why in news?**
  - » RBI releases 2023 list of DSIBs (Dec 2023)
- **Introduction**
  - » D-SIBs means the bank is **too big to fail** i.e. their failure would be **significant disruption to the essential services** they provide to the banking system and the **overall economy**.
  - » According to RBI, these banks have become **systematically important** due to their size, cross jurisdictional activities, complexity and lack of substitution and inter-connection. Banks whose assets exceed **2% of the GDP** are considered part of this group.
  - » **An additional common equity requirement** has to be applied to DSIBs.
  - » Too big to fail indicates that **in case of distress government is expected to support these banks**. Due to this perception, they **enjoy certain advantages in funding/investment**.
- **Beginning of DSIB-Framework:**
  - » The RBI issued the **framework for dealing with D-SIBs in July 2014**.
  - » SBI was included in the list in 2015, HDFC in 2016.
- The list of D-SIBs is as follows (as of Dec 2023)
  - » SBI, HDFC, and ICICI continue to be **identified as DSIBs**.
  - » While **ICICI** continues to be in **Bucket-1**; Both HDFC (from Bucket-1 to Bucket-2) and SBI (from Bucket-3 to Bucket-4) have been shifted to higher bucket.
  - » So, **starting 1st of April 2025**, both SBI and HDFC will have **to fulfill higher buffer requirements** of the higher bucket.
    - Till 31st March 2025, **surcharge applicable will be 0.60% for SBI and 0.20% for HDFC Bank**.

Bucket	Banks	Additional Common Equity Tier 1 requirement as a percentage of Risk Weighted Assets (RWAs)
5	-	1%
4	State Bank of India*	0.80%
3	-	0.60%
2	HDFC Bank*	0.40%
1	ICICI Bank	0.20%

\* The higher D-SIB surcharge for SBI and HDFC Bank will be applicable from April 1, 2025. Hence, up to March 31, 2025, the D-SIB surcharge applicable to SBI and HDFC Bank will be 0.60% and 0.20% respectively.

## 5) S&T: HEALTH: MEASLES AND MEASLES VACCINE

- Measles is a highly contagious infectious disease caused by measles virus. It spreads through air when an infected person coughs or sneezes. It is an acute respiratory illness. Infection is characterized by a prodrome of fever (as high as 105-degree F) and malaise, cough, coryza, and conjunctivitis - the three "C"s, followed by maculopapular rash. The rash spreads from the head to the trunk to the lower extremities.
  - It can severely sicken young children, but is normally kept under check due to large-scale vaccination.
- About the Virus:
  - » It is a single stranded, enveloped RNA virus with 1 serotype. It is classified as a member of the genus Morbillivirus in the Paramyxoviridae family.
  - » Humans are the only natural host of the measles virus.
- Detection:
  - » RT-PCR
  - » Anti-body test
- Vaccinations:
  - » Measles can be prevented with Measles-containing vaccine, which is primarily administered as the combination of measles-mumps-rubella (MMR) vaccine.
  - » It can be used for children aged 12 months through 12 years. One dose of MMR vaccine is approximately 93% effective, and two doses are approximately 97% effective.
- Rise of Cases in 2022:
  - » This was primarily due to disruption of routine vaccination during 2020 and 2021 due to focus on COVID-19 and lockdown
- WHO Report and India's Response (Nov 2023)
  - » A new report from the WHO and US Centre for Disease Control and Prevention (CDC) said measles cases in 2022 have increased by 18%, and deaths by 43% globally, compared to 2021.
    - **Cases:** 9 million & **Deaths** - 1,36,000
  - » The report also said that globally 22 million children and in India 1.1 million infants didn't get the first dose of vaccine.
  - » **India has differed from this report:**
    - MoH&FW says that just over 21,000 Indian children didn't get the shot.

## 6) S&T: HEALTH: RUBELLA

- Rubella is a contagious viral disease caused by a virus. Most people who get Rubella usually have a mild illness, with symptoms that can include a low-grade fever, sore-throat, and a rash that starts on the face and spreads to the rest of the body. It can cause a miscarriage or serious birth defects in a developing baby if a woman is infected while she is pregnant.
- **The best protection** against rubella is **MMR** (Measles,Mumps,Rubella) vaccine

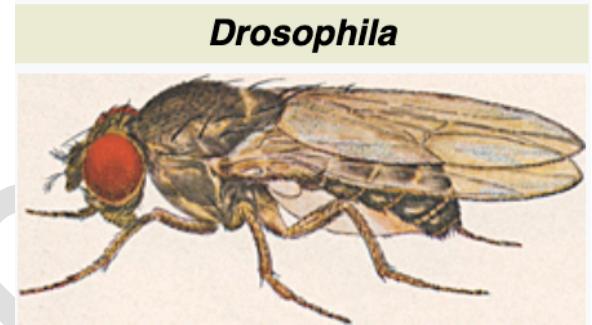
## 7) S&T: BIOTECHNOLOGY: HUNTINGTON'S DISEASE AND GM FRUITFLIES

- **What is Huntington's disease?**
  - » It is a rare, inherited disease that causes the progressive breakdown (degeneration) of nerve cells in the brain.
  - » **Symptoms:** It starts with mild symptoms like forgetfulness, loss of balance, and clumsiness in performing simple tasks. But the condition progressively worsens eventually leading to death.
  - » **Understanding the cause of Huntington's disease:**
    - The patients with Huntington's disease carry a mutated version of gene HTT. This gene codes for a protein called huntingtin, or Htt.
      - Each one of us have two copies of the HTT gene: one we inherit from father and one from mother. The disease is triggered even if only one copy of the gene is mutated while the other is normal.
    - **Use of huntingtin protein:** Nerve cells in our body needs Htt protein for their normal functioning and survival.
    - **Normal HTT gene** contains a stretch of DNA that specifies the number of times the amino acid glutamine is repeated in the Htt protein. This number varies from 11 to 31.
    - **Mutated HTT gene** however encodes abnormal Htt protein that instead destroys the neurons that regulate movement, thinking and memory. The mutated HTT the number of repetitions of glutamine amino acid is expanded to encode 35 or more repeats. **As the number of repetitions increase, the severity of Huntington's disease increases, and its debilitation begins at an earlier age**.
- **How fruitflies (*Drosophila melanogaster*) are helping us understand Huntington's disease?**
  - » Researchers genetically modified fruitflies so that their neurons produce Htt proteins that had 120 repeating units of glutamine. These flies displayed neuronal degeneration, an impaired ability to climb surfaces, and lower viability as well as longevity.
  - » Researchers also had a 'control group', with fruit flies whose neurons made proteins with 25 repeating glutamine units. These flies were largely unaffected.
  - » **In other words**, expressing the longer tract produced symptoms in the fruit flies resembling those of Huntington's disease in humans - whereas expressing the shorter tract didn't.

- **Yod1 Gene** and its impacts:
  - » Scientists studied several other genes and found that overexpression of one, called Yod1, removed all of the disease-like effects in flies caused by overexpression of Htt, including the neurodegeneration, impediments to motor activity, and lower viability and longevity.
- **Future:** Scientists now need to establish that fruit flies that overexpress the human version of the Yod1 gene will also suppress the Huntington's-like pathogenesis.

## B) DROSOPHILIA

- Drosophila is a genus of flies, belong to the family Drosophilidae, whose members are often called "small fruit flies" or pomace flies.
- One species of the Drosophila in particular **D. melanogaster**, has been heavily used in research in genetics and is a common modern organism in developmental biology for last 100 years. Several discoveries in biology have been made using this. Its genome is entirely sequenced and there is enormous information available about its biochemistry, physiology, and behavior. The terms fruit fly and Drosophila are often used synonymously with D. melanogaster in modern biological literature.
- **Developmental biology** is the field of biology that studies the process by which multi-cellular organisms grow and develop, controlled by their genes.



## 8) EB&CC: BIODIVERSITY: LANTANA CAMARA

It is also known as big-sage, wild sage, red sage and tickberry. It is a species of flowering plant within the verbena family, Verbenaceae, that is native to American tropics.

### How was it introduced in India?

Lantana arrived in India as a decorative shrub in the British colonial period but quickly took over several ecosystems as an invasive species.

**Current Spread:** The plant currently covers 40-50% of India's area and have also invaded national parks and pasture lands.

It has spread from its native Central and South America to 50 different countries, where it has become invasive species.

- **Reduces biodiversity:** It often outcompetes more desirable species, leading to reduction in biodiversity.
- **Impacts Agriculture:** It can also cause problems if it invades agricultural areas as a result of its toxicity to



Flowers and leaves of the Lantana camara. (Via Wikimedia Commons)

livestock as well as ability to form dense thickets which if left unchecked can greatly reduce the productivity of farm land.

**Recent Updates:** A decade long initiative in MP to reclaim land overrun by Lantana helps residents restart agriculture and restore natural biodiversity. (Dec 2023: Source: DTE)



## 9) EB&CC: BIODIVERSITY: THE NAMDAPHA FLYING SQUIRREL (*BISWAMOYOPTERUS BISWASI*)

The Namdapha flying squirrel is an arboreal, nocturnal flying squirrel endemic to India.

It was sole in the genus *Biswamoyopterus* until the description of the **Laotian giant flying squirrel (*Biswamoyopterus laoensis*)** in 2013.

It was first recorded in 1981 where a single individual was found in Namdapha Tiger Reserve. After that it wasn't seen till 2022.

**Updates: Missing for 42 years, Namdapha flying squirrel resurfaces in Arunachal (Dec 2023)**

**IUCN:** CR

**WPA:** Schedule-1 (after 2022 amendment)

**Habitat:** Tropical forests

**Distribution :** It is now restricted to as single valley in the Namdapha N.P. (or) W.L.S. in Arunachal Pradesh.

- Namdapha National park is the **largest protected area in the Eastern Himalayan Biodiversity hotspot** and is located in Arunachal Pradesh. It is also **one of the largest National Park in India in terms of area** (after hemis, desert, Simlipal and Gangotri)

**Threats:** Habitat loss is the primary threat. In the past it was also hunted for food, skins/fur.



**Note:** Namdapha is home to another flying squirrel (Red Giant Flying Squirrel) (*Petaurus petaurus*), whose IUCN status is LC. Like other flying squirrels, Red Giant Flying Squirrel is also mostly nocturnal and is able to glide long distance between trees.



# CURRENT AFFAIRS PROGRAM

## PRE CUM MAINS 2024

### DEC 2023: BOOKLET-9

## SPECIAL BOOKLET ON CLIMATE CHANGE

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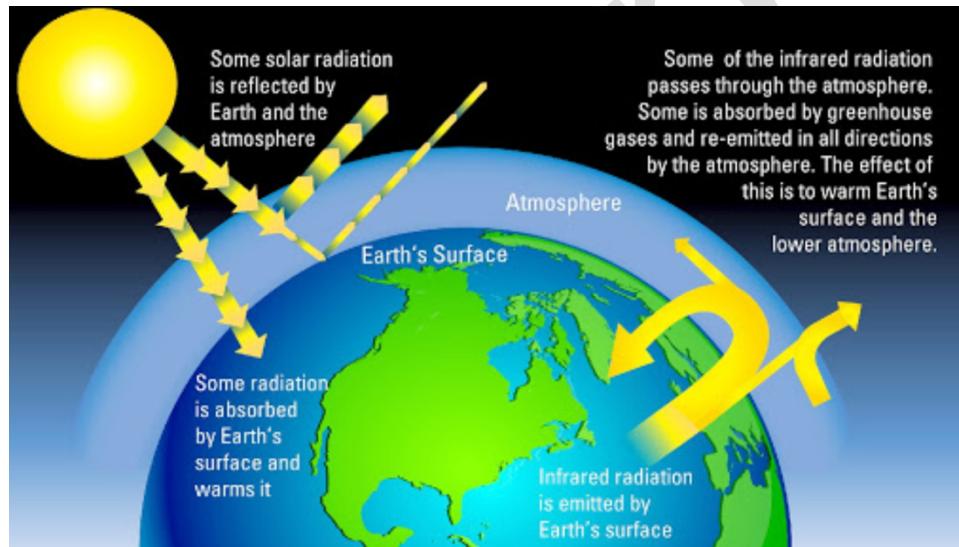
## 1. PYQ

- i. Discuss global warming and mention its effects on the global climate. Explain the control measures to bring the level of greenhouse gases which cause global warming, in the light of Kyoto Protocol, 1997 [Mains 2022, 15 marks, 250 words]
- ii. Do you think India will meet 50% of its energy needs from renewable energy by 2030? Justify your answer. How will the shift of subsidies from fossil fuels to renewables help achieve the above objectives? Explain [Mains 2022, 15 marks, 250 words]
- iii. Describe the major outcomes of the 26th session of the COP to the UNFCCC. What are the commitments made by India in this conference? [Mains 2021, 15 marks, 250 words]
- iv. Explain the purpose of Green Grid Initiative launched at World Leaders Summit of COP26 UNFCCC in Glasgow in Nov 2021. When was this idea first floated in the International Solar Alliance (ISA)? [Mains 2021, 10 marks, 150 words]
- v. Assess the impact of global warming on coral life system with examples (Answer in 150 words) (2019) [GS1]
- vi. 'Climate change' is a global problem. How India will be affected by climate change? How Himalayan and coastal states of India will be affected by climate change? (2017)
- vii. Should the pursuit of carbon credits and clean development mechanisms set up under UNFCCC be maintained even though there has been a massive slide in the value of a carbon credit? Discuss with respect to India's energy needs for economic growth. (200 words) (2014)

## 2. CLIMATE CHANGE

### 1) CLIMATE CHANGE, GLOBAL WARMING AND GREENHOUSE GASES

- **Climate:** Long term pattern of weather in a particular area.
- **Global warming** refers to the long-term increase in earth's average surface temperature due to the accumulation of greenhouse gases in the atmosphere.
- Gases in the earth's atmosphere that trap heat are known as **Greenhouse gases**. They let sunlight pass through the atmosphere, but they prevent the heat that the sunlight brings from leaving the atmosphere. Greenhouse gases are crucial for survival of life on earth. In the absence of Greenhouse gases, the average temperature on earth would have been -18 degree Celsius instead of the present 15 degree Celsius.
- But the excess of greenhouse gases in the atmosphere is leading to extra warming of the earth's surface causing Global Warming and thus Climate Change.
- **Green House Effect:**



### 2) GREENHOUSE GASES – CO<sub>2</sub>, METHANE, NITROUS OXIDE (N<sub>2</sub>O), OZONE, FLUORINATED GASES, BLACK CARBON, BROWN CARBON ETC.

#### A) CO<sub>2</sub>

- It is produced by **burning of carbon containing substances**, mostly fuels (Coal, natural gas, oil), Solid waste, trees, other biological materials etc.
- CO<sub>2</sub> is removed from atmosphere when it is absorbed (sequestered) by plants during photosynthesis.
- **Concentration of CO<sub>2</sub> in atmosphere:**
  - » For the first time in history, the atmospheric CO<sub>2</sub> level reached 419 parts per million (PPM), as measured by the United States' National Oceanic and Atmospheric Administration's Mauna Loa Atmospheric Baseline Observatory in Hawaii.

- This is nearly 45% above the pre-industrial baseline of 278 PPM in 1750 accepted by IPCC.
- » Our **annual CO<sub>2</sub> emission** have grown about 70 times since the pre-industrial era reaching nearly **36.4 Gt** in 2019.

## B) METHANE

- **Practice Questions:**
  - Discuss the sources, implications, and potential mitigation strategies of methane emissions in the context of global warming and climate change. How can international cooperation play a significant role in addressing this significant environmental concern? [15 marks, 250 words]
- **Introduction:**
  - As per UNEP, Methane is a GHG which is responsible for 30% of the warming since pre-industrial times. Its contribution is 2nd only to carbondioxide.
- **Why special focus on methane is needed in our fight against climate change?**
  - Methane has much higher global warming potential than CO<sub>2</sub>.
  - IPCC had said that the methane mitigation has the **greatest potential to slow warming** over the next 20 years.
    - A 0.3% reduction per year in methane is equivalent to net-zero for CO<sub>2</sub> - there would be no additional warming if this level of reduction is achieved.
- **Methane Emission: Sources:**
  - **Natural Sources:** Wetlands, termites etc.
    - **Wetlands** are the largest source of methane.
  - **Agriculture** - Rice cultivation, animal husbandry etc. generate substantial amount of methane.
  - **Energy Production** (fossil fuel) - Among anthropogenic factors, after Agriculture, it is this sector which contributes to the highest methane production. It is released during the extraction, processing, and transport of fossil fuels, including coal, oil, and natural gas.
  - **Leakage:** For e.g., the ruptures in the underwater Nord stream in Sep 2022 caused the single largest such release of the greenhouse gas.
  - **Landfills** in recent times are also becoming a big source of methane emissions.
  - **Thawing of permafrost** in polar region is also releasing methane. In future, it may become a big source of methane emissions.
- **Steps being taken:**
  - **International Steps:**
    - » **Improving Detection:**
      - UNEP has launched International Methane Emissions observatory - the Methane Alert and Response System (MARS) at COP27. It is focused on scaling up global efforts to detect and act on major emissions sources in a transparent manner and accelerate implementation of the global methane pledge.

- **Global Methane Pledge** announced at COP26
  - » By COP27, 150 countries have joined the initiative lead by USA and EU. They have promised to cut their methane emission by at least 30% from 2020 levels by 2030.
  - » **Significance:**
    - Global warming would be reduced by at least 0.2 degree Celsius by 2050, if countries deliver according to the pledge.
    - **Health benefits:** Oxidation of methane is responsible for formation of ground-level ozone (smog), which is a harmful air pollutant.
  - » **Why has India not joined the pledge?**
    - India's methane emissions are 'survival emissions' and not 'luxury' emissions.
      - The two prominent source of methane in India are enteric fermentation and 'paddy cultivation' and any restriction on them would harm small and marginal farmers.
    - Other than harming farmers, it may also reduce agri production. Currently, India is one of the largest producers and exporters of rice.
    - India also argues that 6th IPCC report has highlighted that CO2 is the major global warming gas and this pledge is shifting focus to methane which has a lifetime of only 12 years, whereas CO2 can survive for more than 100 years.
- **India has not joined the global methane pledge**, but it doesn't mean the India is not worried about methane emissions. There are several fronts on which India is working.
  - » National Innovation in Climate Resilient Agriculture (NICRA) project of ICAR has developed several technologies with the potential to mitigate methane emissions.
    - For instance, the 'System of Rice Intensification' has the potential to enhance rice yield from 36-49% with 22-35% less water than conventional transplanted rice. It also uses less seed, fertilizers, and pesticides.
      - Key steps involve:
        1. Planting young seedlings (less than 15 days old) with only one or two leaves
        2. Planting them singly, spaced widely apart
        3. Maintaining soil moisture at a level that promotes aerobic soil conditions.
        4. Controlling weeds by mechanical means, such as hand weeding or using a rotary hoe
        5. Using organic matter to improve soil fertility.
        6. Applying small amounts of fertilizer at specific stages of plant growth
    - Another technology, 'Direct Seeded Rice' reduces methane emissions as it does not involve raising nurseries, puddling, and transplanting. Unlike transplanted paddy cultivation, standing water is not maintained in this system.
    - **Harit Dhara:** It is an anti-methanogenic feed supplement developed by ICAR. It can cut down cattle methane emissions by 17-20% and can also result in higher milk production.
    - Under Crop Diversification Program, methane emission is being avoided due to diversion of paddy to alternate crops like pulses, oilseeds, maize, cotton, and agro-forestry.

- **Way Forward:**
  - » **Renewable Energy Transition:** In long run it will reduce dependency on fossil fuels which will reduce emissions of both CO<sub>2</sub> and methane.
  - » **Alternate Agricultural practices:**
    - Improving the effectiveness and yield of rice cultivation methods like System of Rice Intensification and Direct Seeded Rice and encouraging more farmers to adopt these practices.
    - Crop diversification to reduce dependency on rice.
  - » **Focus on Burp Control:**
    - Promote anti-methanogenic feed supplement like **Harit Dhara**.
    - More R&D on alternatives. For e.g. in 2021 EU approved a food supplement, Bovaer, saying that it can consistently reduce methane emissions from dairy cows by 30-80%.
  - » **Scientific Waste Management:** Reduce the waste disposal on landfills; ensure installation of landfill gas capture systems etc.; converting organic waste into biogas which can be used for energy etc.
  - » **Leak Detection and Repair:** Regular monitoring and maintenance of oil and gas infrastructure can minimize methane leaks.
  - » **Improved International Cooperation:** Global targets; data sharing, finance mobilization; technology transfers; Improved R&D are some of the methods by which international cooperation can contribute in fighting the challenge of methane.
- **Conclusion:** Addressing methane emissions is critical for mitigating global warming and its associated impacts. A comprehensive approach dealing with fossil fuel sector, agriculture sector and international cooperation will be needed for a more resilient and climate-resilient future.

### 3) IMPACT OF GLOBAL WARMING/CLIMATE CHANGE

GWG emissions is breaching all the records: As per the AR6, **Emissions of Carbon dioxide, methane and nitrous oxide breached records in 2020.** CO2 Concentration in the atmosphere - at around 419 parts per million - are the highest they have been in 2 million years.

**Three factors** make carbon budgeting complex:

1. **The pollutants** - primarily GHGs like CO2 and methane - have an extraordinary long life. Thus, historic emissions continue to warm up the planet just like current emissions.
2. GHG emissions are linked to economic growth.
3. **Sharing of burden** becomes difficult as the emissions are associated with economic growth.

#### 1. Rising Temperatures

- » As per the AR6 of IPCC, the global temperature has already risen by 1.1 degree C since preindustrial 19th century. This could increase upto 1.5 degree Celsius in less than 20 years (before 2040).
  - **Further, the 2 degree C warming** is likely to get exceeded by the end of this century unless immediate and deep reductions in greenhouse gas emissions are initiated immediately.
  - **In business-as-usual approach**, or in **worst case scenario**, the temperature rise by the end of this century would exceed even 4 degree Celsius'
  - The report is also '**unequivocal**' (i.e., there is almost no doubt) that most of the observed warming of the planet since the late 1800s is caused by human activities.
- » As per the WMO, the **decade 2010-20 and the five years (2015-20)** were the hottest in the earth's history

#### 2. Melting of Glaciers and Sea Level Rise -> Submergence of coastal region

- » AR6: Sea level rise has tripled compared with 1901-1971. The Antarctic sea ice is the lowest in last 1,00 years.
- » The temperature of Antarctica rose above 20 degree Celsius for the first time on record.

#### 3. Heating up of Oceans -> marine heat waves, intense cyclones etc.

- » Ocean temperatures are better indicators of global warming as 93% of the excess solar energy trapped by GHG accumulate in the world's oceans

#### 4. Increasing variability in weather patterns

- » **Heat waves and floods** which used to be once-in-a century event are becoming more regular occurrence.
- » **Weather Disasters** have displaced millions of people this year and affected rainfall patterns from India to northern Russia and the Central United states.
- » **For instance: India saw 13 Deficit Monsoons in 18 years between 2001-18.**

#### 5. Compounding extremes (several climate change drivers operating together) are maximizing disaster in India and elsewhere.

- » E.g., heavy rainfall, landslides, snow avalanches, and flooding occurring together is an example of compounding event.

## 6. Thawing of Permafrost and Arctic Lakes Bubbling Methane

### » Introduction

- Recent months have seen **thousands of lakes in Arctic Tundra, Alaska and Siberia bubbling** with gases and producing a hiss sound along with bubbles.

### » Permafrost Thawing producing methane gas

### » Warmer temperature increases the thawing of permafrost and release methane to the atmosphere.

- But this also means that growing season increases, more plant growth takes place and thus more CO<sub>2</sub> getting absorbed. But overall, the increase in release of GHGs would be much higher.

### » Presently Arctic is a net carbon sink

- But soon arctic could become a carbon source, if the earth continues to warm, and a lot of permafrost thaws out. This would start a cycle of releasing more carbon from permafrost thawing and less absorption where the extra carbon in the atmosphere results in increasing warming.

## 7. Sea Water is **26% more acidic** than at the start of the industrial era. This is leading to degradation of marine ecosystem.

## 8. Biodiversity Loss

- » At least **1 million species were at risk** because of the rising CO<sub>2</sub> concentration in the atmosphere and global warming.

- For instance, a recent study shows that seal pups (IUCN: LC) are finding it tough to survive in the Baltics in the absence of ice. 100s of grey seal pups are dying on the shores of the Baltic Sea in Estonia and Latvia as the Nordic coastline faced winter without ice in decades.

## 9. Negative Impact on Food Security, Agriculture and Economy

- » Variability in rainfall
- » Increased temperature and evaporation of water sources
- » Increased chances of Locust attacks
- » Extreme weather events triggered by climate change costs India \$87 billion annually: State of Climate in Asia, 2020 (report by WMO)

## 10. Climate change has adversely affected both physical and mental health of people.

- » Impacts on health is mediated by both through natural and human systems, including economic and social conditions and disruptions.
- » Extreme heat events -> Mortality and morbidity
- » Climate related food borne, and water borne diseases has increased. The incidence of vector borne diseases have also increased due to range expansion and/or increased reproduction of disease vectors.
- » Some mental health challenges are associated with increasing temperatures, trauma from weather and climate extreme events, and loss of livelihood and culture. Exposure to wildfire

smoke, atmospheric dust, and aeroallergens have been associated with climate sensitive cardiovascular and respiratory distress.

**11. Achievements of SDG targets are negatively hindered.**

**12. Impact on Cities, Settlements and Infrastructure**

- » Hot extremes including heatwaves have intensified in cities. This has also aggravated air pollution events and limited functioning of key infrastructure. Infrastructure, including transportation, water, sanitation and energy systems have been compromised by extreme and slow onset of events.

**13. Economic Impact:**

- » Damages due to variability in weather pattern (e.g. slow onset of Monsoons) and extreme weather events.
- » Climate exposed sectors like agriculture, forestry, fishery, energy and tourism have been adversely affected. Outdoor labour productivity have gone down
- » Extreme events like cyclones hinder economic growth in short run too.

**14. Climate Migration:**

- IPCC's 6th AR says that through displacement and involuntary migration from extreme weather and climate events, climate change has generated and perpetuated vulnerability.
- Since 2008, an average of more than 20 million people per year have been displaced by extreme weather events, many of which were exacerbated by climate change.

**15. Shrinking of Stratosphere:**

- » According to a study published by NASA on June 15, the earth's energy imbalance doubled over the 14-year period between 2005 - 2019, doubling the pace at which the Earth retains heat from 2005. As a result of this we are already on the brink of losing stratosphere.

## 4) IPCC AND ITS REPORTS

### A) ABOUT IPCC

- The Intergovernmental Panel on Climate Change (IPCC) is the UN body for assessing the science related to climate change. Its job is **to assess already published scientific literature** to update our knowledge of climate change science.
  - IPCC's Assessment Reports (ARs), which are produced every few years, are the most **comprehensive and widely accepted** scientific evaluations of the state of Earth's climate.
  - They form the basis for government policies against climate change and provide scientific foundation for the global Climate Change negotiations.
  - So far, **Six Assessment Reports** have been produced.
- **IPCC was set up in 1988** by World Meteorological organization (WMO) and United Nations Environment Program (UNEP) to provide policy makers with regular assessment of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigations.

---

## B) WHAT HAVE PREVIOUS REPORTS AR1-AR5 SAID?

- The **first Assessment Report** (1990) noted that anthropogenic emissions are increasing atmospheric GHGs. In the business-as-usual scenario, temperature was likely to increase by 2 degree C compared to pre-industrial levels by 2025, and 4 degree C by 2100.
  - The report formed the basis for the negotiation of the UNFCCC in 1992, known as the Rio Earth Summit.
- The **Second Assessment Report** (1995) revised the projected rise in global temperature to 3 degree C above pre-industrial level by 2100. It was the scientific underpinning for the Kyoto Protocol of 1997.
- The **third Assessment Report** (2001) projected the rise in global temperature to 1.4 to 5.8 degree C by 2100 compared to 1990.
- The **fourth Assessment Report** (2007) said that the GHG emissions increased by 40% between 1970 and 2004 and the atmospheric CO2 was the most in 650,000 years. In the worst case scenario, the global temperature could rise by 4.5 degrees.
  - The report won the 2007 Nobel Peace Prize for IPCC. It was also the scientific input for the 2009 Copenhagen Climate meeting.
- The **fifth Assessment Report** (2014) said that more than 50% of the temperature rise since 1950 is due to human activities. The rise in global temperature by 2100 could be as high as 4.8 degree C from pre-industrial times, and more frequent longer heatwaves were "virtually certain". It formed the scientific basis of the Paris Agreement in 2015.

## 5) 6<sup>TH</sup> ASSESSMENT REPORT OF IPCC

- The sixth report was published in three parts: - the first in Aug 2021, the second in Feb 2022, and the third in April 2022. These three parts were by three working groups of scientists:
  - » **Working Group-1:** Deals with **scientific basis of climate change**
  - » **Working Group-2:** Looks at **likely impacts, vulnerabilities, and adaptation issues**.
  - » **Working Group-3:** Deals with **action that can be taken to combat climate change**

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## A) THE FIRST REPORT “CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS” HIGHLIGHTED THE FOLLOWING:

- Climate was changing more rapidly than originally anticipated by climate scientists.
- Rise in global temperature was direct result of human activities and there are 'unequivocal evidence' about it.
- Temperature has already rise by 1.1 degrees from the pre-industrial 19th century.
- **Greenhouse gas Emissions:**
  - Emissions of Carbon dioxide, methane and nitrous oxide breached records in 2020.

- CO<sub>2</sub> Concentration in the atmosphere - at around 416 parts per million - are the highest they have been in 2 million years.
- **Impact:**
  - A more intense and frequent heatwaves; increased incident of extreme rainfall; a dangerous rise in sea-levels; prolonged droughts; Melting of glaciers.

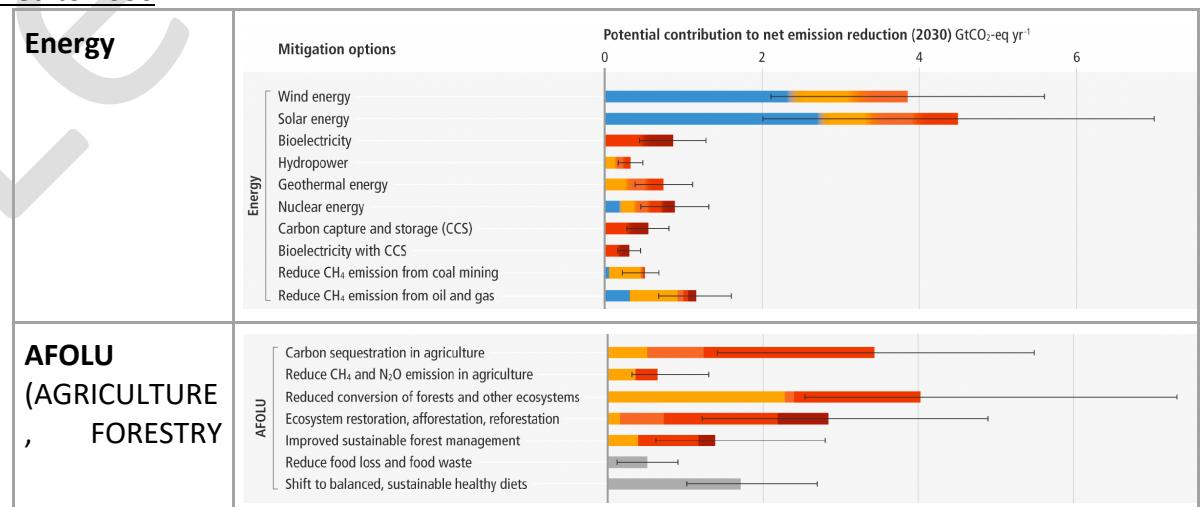
## **B) THE SECOND REPORT: CLIMATE CHANGE 2022: IMPACTS, ADAPTATION, AND VULNERABILITY**

- The report recognizes the interdependence of climate, ecosystem, and biodiversity, and human societies and integrates knowledge more strongly across the natural, ecological, social and economic sciences than earlier IPCC reports.
- **Impact of Climate Change** (already discussed)
- **Risk in Near Term (2020-2040)**
  - Global warming, reaching 1.5 degree C in near term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
    - All the current problems would be intensified, and some irreversible damages would occur.
  - Near term actions that limit global warming to close to 1.5 degree C would substantially reduce projected losses and damages related to climate change in human systems and ecosystems, compared to higher warming levels, but cannot eliminate them all.
- **Mid to Long-Term Risks (2041-2100)**
  - Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems. For 127 identified key risks, assessed and mid- and long-term impacts are upto multiple times higher than currently observed.
- **Complex Compound and Cascading Risks**
  - Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.
- Multiple climate change-induced disasters were likely in the next two decades even if strong action was taken to reduce the emissions of greenhouse gases.

## **C) THE THIRD REPORT: CLIMATE CHANGE 2022: MITIGATION OF CLIMATE CHANGE**

- The report lays out actions that the world can take to stop global temperatures rising beyond certain levels by the end of the century.
- If countries stick to current NDC commitments, it would lead to breach of 1.5 degree C temperature rise.
  - » Even the 2-degree Celsius target, in that case, would rely on "rapid acceleration" of climate actions after 2030.
- **Global warming would stabilize if emissions reach net zero.**
  - For 1.5 degree C target, this meant achieving net zero emissions globally in the early 2050s; for 2 degree C, it is in early 2070s.

- Even limiting warming to 2 degree C would require greenhouse gas emissions to peak before 2025 at the latest and be reduced by a quarter by 2030.
- **Carbon Inequality remains pervasive** as ever with LDCs emitting only 3.3% of global emissions in 2019.
  - Their average per capita emissions in the period 1990-2019 were only 1.7 tonnes CO<sub>2</sub>e, compared to global average of 6.9 tCO<sub>2</sub>e.
- **Abundant and Affordable Solutions exist across sectors including energy, buildings, and transport, as well as individual Behavioural changes.**
  - The report has detailed 60 different options and pathways that can lead to 40-70% reduction in global emissions.
  - It states with high confidence that "**several mitigation options**, notably solar energy, wind energy, electrification of urban systems, urban green infrastructure, energy efficiency, **demand side management**, improved forests - and crop/grassland management and reduced food wastage and loss, are technically viable, are becoming increasingly cost effective and are generally supported by the public".
  - The per-unit costs of several low emissions technologies have fallen continuously since 2010, however innovation has lagged in developing countries due to weak enabling conditions.
    - On a unit costs basis, solar energy has dropped 85%, wind by 55%, and lithium-ion by 85%.
      - Their deployment and usage has increased multifold since 2010 - 10 times for solar and 100 times for electric vehicles.
    - **Factors:** Higher public spending in R&D; Funding for demonstration and pilot projects; and demand pull instruments such as deployment subsidies to attain scale.
- The report covers **demand side mitigation** and states that it can help reduce emissions by 40-70% by 2050.
- **Individuals can also contribute in other ways:**
  - Putting political pressure on leaders.
- **Many options available now in all sectors are estimated to offer substantial potential to reduce net emissions by 2030.** Relative potential and cost will vary across countries in the longer term compared to 2030.





- **Implementing these mitigation strategies** would come at a substantial cost. The report estimates that taking the actions to keep temperature below 2 degree C could reduce global GDP by 1.3% to 2.7% by 2050, but not doing so has its own costs
- **Climate Finance:**
  - Tracked financial flows were still falling short of the levels needed to achieve mitigation goals across all sectors and regions.
  - The gaps are the widest for the agriculture, forestry, and other land use (**AFOLU**) sector and for developing countries.
  - But, the **global financial system is large enough** and "sufficient global capital and liquidity" exist to close these gaps.

### 3. UNFCCC – FROM PARIS AGREEMENT (COP21) – COP28

## 1) UNFCCC (UNITED NATION FRAMEWORK CONVENTION ON CLIMATE CHANGE)

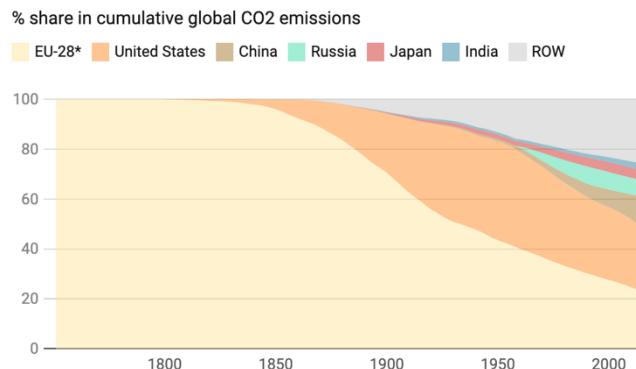
- It is one of the three conventions adopted at the Rio Earth Summit (UN summit Conference on Environment and Development (UNCED)) in 1992. Its sister Rio Conventions are the UN Convention on Biological Diversity and the Convention to Combat Desertification.
- This was the first multilateral legal instrument on climate change and came into force in 1994 after a sufficient number of countries had ratified it.
- **Ultimate Aim** of UNFCCC: Prevent dangerous human interference with the climate system by stabilizing greenhouse gas concentration in atmosphere.
- It sets on non-binding limits on greenhouse gas emission for individual countries and contain no enforcement mechanism.
- **Parties to Convention**
  - **197 parties**
    - All UN member states, Palestine (observer state), Niue and Cook Island (non-member states) and the European Union.
    - **Annex 1 Parties** -> Industrialized OECD countries, Economies in Transition (EIT), EU
    - **Annex 2 Parties** -> OECD members of Annex-1, NO EIT.
      - Provide financial and technical support to EITs and developing countries for mitigating Climate change.
    - **Non-Annex 1 Parties** -> Mostly developing.
    - **Least Developed Countries (LDCs)**
- **Key Significance of UNFCCC** - 1) Recognition of the problem 2) Setting target of stabilizing GHGs 3) Onus on Developed countries 4) Funds and technology transfer to developing countries 5) Regular Reporting -> Keep a tap on the problem.

## 2) KYOTO PROTOCOL (COP-3)

- It was an international agreement to reduce greenhouse gas emissions. It was negotiated under the UNFCCC during a meeting held in Kyoto, Japan, in 1997 and came into force in 2005 (due to complex ratification process)
  - **The first commitment period** was 2008-2012
  - **The second commitment period** beginning 1 Jan 2013 to 2020.
    - » Launched by Doha Amendment (2012)
- The **objectives of KP** included reducing greenhouse gas emissions through enforcement of compliance; promote sustainable development through tech-transfer and investment; and encourage developing countries and private sector to contribute to emission reduction.
- **Parties to Kyoto Protocol**
  - **Annex B:** Nearly identical to Annex - I of the UNFCCC; Agreed for emission reduction.
  - **Non-Annex B Parties:** Countries which are not listed in Annex B of KP.
- **Key Features**
  - The protocol 'operationalized' the UNFCCC. It commits industrialized countries to stabilize greenhouse gas emissions based on the principles of the Convention.

- Binding Emission targets for 38 industrialized countries and the European Community (Annex 1 Parties) in its first commitment period.
- Only bound developed countries - Common But Differentiated Responsibility (CBDR)

**Over the last 250 years, Europe and the US have contributed to most of the world's CO2 emissions**



\*28 nations in the European Union

Source: Global Carbon Project; Our World in Data • [Get the data](#) • Created with Datawrapper

- Flexible Architecture of KP Regime to meet target.
  - » National Measures and Market Based Mechanisms
    - This market-based mechanism allows GHG abatement to start where it is most cost-effective - for e.g. in the developing world.
  - » 3 Components - Carbon Trading, Clean Development Mechanisms and Joint Implementation
- Penalties for not meeting the targets.

- What happened to Kyoto Protocol?

- Were targets met?
  - » Most countries didn't meet the targets for emission reduction assigned for the first period of commitment (2008-2012).
  - » So, protocols impact was very small.

- Kyoto Beyond 2012

- At Doha in 2012, the amendments to Kyoto Protocol for the 2nd commitment period (the Doha Amendment) were successfully adopted for the period 2012-2020.
  - » **It never entered into force** as the required number of countries didn't deposit their instrument of accession.
  - » But some developed countries started implementing their commitments under the '**opt-in**' provisions of the Doha Round.
  - » Note: India ratified the second commitment period of Kyoto Protocol in Jan 2017.

### 3) PARIS AGREEMENT (COP21)

- The Paris Agreement and the accompanying COP decisions are focused on enhancing **efforts to mitigate and adapt to climate change beyond 2020**.
  - a. Long Term Goal:

- » Limiting global temperature increase well below 2 degrees Celsius, while urging efforts to limit the increase to 1.5 degrees.
  - » Two long term emission goals
    - Peaking of emissions as soon as possible (with a recognition that it will take longer for developing countries)
    - A goal of Net Green House Gas Neutrality (expressed as "a balance between anthropogenic emissions by sources and removals by sinks") in the second half of this century.
- b. Ends the Strict Differentiation between developed and developing countries:** Provides for a framework that commits all countries to put forward their best efforts against climate change and keep strengthening these efforts.
- c. Mitigation - Binding Procedural Commitments** -> Preparing, communicating and maintaining NDC; Communicate new progressive NDC every five years.
- » The agreement commits parties to "pursue domestic measures with the aim of achieving the objectives" of its NDC.
  - » Doesn't make implementation or achievement of NDCs a binding obligation.
- d. Carbon Markets**
- Though the agreement avoided any direct reference to the use of market-based approaches, it recognized that the parties may use 'internationally transferred mitigation outcomes' to implement its NDCs.
- e. STOCKTAKE/SUCCESSIVE NDCs**
- To ensure successive improvement in efforts, the agreement provides for two linked processes, each on a five-year cycle.
    - Global Stocktake to assess collective progress towards the agreement's goals. The first global stocktake took place in 2023.
    - New NDCs every five years informed by the outcomes of the global stocktake. Signatories should ensure that the new NDCs are more ambitious than the previous ones.
- f. Finance**
- Provisions for Support to poor developing countries by Developed countries.
  - Finance Mobilization goal
    - The COP decided to extend the \$100 billion-a-year goal through 2025, and beyond that, by 2025 COP will set a "new collective quantified goal from a floor of "\$100 billion a year".
- g. Adaptation:**
- A major priority for many developing countries was strengthening adaptation efforts under the UNFCCC. The agreement does that by :
    - Establishing a global goal of "enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change"
    - Committing enhanced adaptation support for developing countries

- Including a review of adaptation progress, and of the adequacy and effectiveness of adaptation support, in the global stocktake to be undertaken every five years.

#### **h. Loss and Damage:**

- In a victory to small island countries and other countries highly vulnerable to climate impacts, the agreement includes a free standing provisions extending the Warsaw International Mechanism for Loss and Damage
  - The mechanism, established at COP-19 is charged with developing approaches to help vulnerable countries cope with unavoidable impacts, including extreme weather events such as sea-level rise.
  - Potential approaches include early warning systems and Risk insurance.
- Loss and Damage provision "did not involve or provide a basis for any liability or compensation.

#### **- When Paris Agreement of COP 21 entered into force**

- » It required approval of atleast **55 countries accounting for atleast 55 percent of greenhouse gas emission.**
- » It came into force on **Nov 4, 2016** (a month after required number of ratification).

#### **- Analysis: Positives**

- » **PARIS Agreement** was a major breakthrough whose significance could be understood from the fact that with **150 Presidents and Prime Ministers**, it was the largest ever single day gathering of heads of state surpassing even the UN summits.
- » **It turned the corner after the failure of Kyoto Protocol** and inability to reach an agreement in previous COPs. It represented a change in global attitude and recognized that climate change is a global problem which should be dealt immediately.
- » The agreement is more Comprehensive than Kyoto protocol which was limited to assigning greenhouse gas emission targets for a group of developed countries.
- » **Regular stock take** would increase the chances of world community rectifying its targets to prevent climate crisis.
- » **Best Compromise possible:** Developed countries ensured climate action would be joint responsibility of every nation unlike Kyoto Protocol; Developing countries were able to take heart by the fact that all important principle of differentiation - has been retained, even though in diluted form; Island nations and least developed countries were happy to force the rest of the world to acknowledge the need to take a 1.5 degree path instead of the 2 degree it is more comfortable with.

#### **- Analysis: Negatives/Limitations**

- » **NDCs** are not ambitious enough and the world is moving towards missing the goal of limiting the temperature rise to 1.5 degree celsius.
- » **Non-Binding nature** raises a question on effectiveness of the implementation.
- » **Frequent reviews by stocktaking** may be challenging to achieve as it is difficult to generate a Paris like consensus regularly.
- » **Exit Clause is also problematic:** A country can exit from the agreement with one year's notice after three years have passed from the time a country ratifies the Agreement.

- Given the fractured politics in many countries withdrawal of any major emitter would lead to rapid unraveling of the agreement. (for e.g. the US had withdrawn from the agreement)
- » **Financing in real terms have come down when various data shows need for increase**
- » **Even after eight years of the deal**, by 2023, a lot of work still needs to be done about market mechanism; increasing funding; and making NDCs more ambitious.

#### **A) INDIA'S UPDATED NDC UNDER PARIS AGREEMENT (AUG 2022)**

- India submitted its INDC on 2nd Oct 2015.
- The NDC submitted in Aug 2022 is India's first NDC under the Paris Agreement. The Article 4, paragraph 9 of the Paris Agreement provides that each Party shall communicate a nationally determined contribution every five years in accordance with the decision of COP21.
- So, in Aug 2022, India communicated an update to its first NDC submitted earlier on Oct 2, 2015 for the period upto 2030, as under:
  - To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation, including through a mass movement for 'LIFE' – 'Lifestyle for Environment' as a key to combating climate change [ UPDATED].
  - To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
  - To reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level [UPDATED].
  - To achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030, with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF) [UPDATED].
  - To create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030.
  - To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.
  - To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
  - To build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology in India and for joint collaborative R&D for such future technologies.
- This update to India's existing NDC is a step towards our long-term goal of reaching net-zero by 2070.

#### **B) INDIA'S LONG TERM LOW EMISSION DEVELOPMENT STRATEGY (LT-LED STRATEGY) (NOV 2022)**

- **Why in news?**
  - India on Nov 14, 2022, announced its long-term strategy to transition to a "low emissions" pathway at the UNFCCC COP.
- **Details**

- LT-LED is a requirement emanating from the 2015 Paris Agreement whereby countries must explain how they will transition their economies beyond achieving near-term NDC targets, and work towards the larger climate objective of cutting emissions by 45% by 2030 and achieve net zero around 2050. This is what scientists say, offers the best chance of keeping temperature rise below 1.5 degree C. So far, no country is on track towards such a pathway.
- While 195 countries, signatories to the UN Climate agreements, were obliged to submit the long-term document by 2022, only 57 countries (to which India is the latest addition) have done so.
- **Highlight of India's Long Term Strategy:**
  - i. **Nuclear Power Capacity** - It will be increased at least 3 fold in the next decade.
  - ii. India will focus on increasing the proportion of ethanol in petrol - with ethanol blending to reach 20% by 2025 and a strong shift to public transport for passenger and freight traffic.
  - iii. India would also become an international hub of producing green hydrogen.
  - iv. India will also focus on **energy efficiency** by the Perform, Achieve and Trade (PAT) scheme; increasing electrification; enhancing material efficiency; and recycling and ways to reduce emissions.
  - v. The country is also on track to achieve the NDC commitment of 2.5 to 3 billion tonnes of additional carbon sequestration in forest and tree cover by 2030.
  - vi. The emphasis is on ensuring energy security, energy access and employment, while keeping focus on our vision of Atmanirbhar Bharat.

#### 4) THE CONTINUING UNFCCC NEGOTIATION

- **The Continuing UNFCCC Negotiations:**
    - After the COP-21 - Paris Agreement, the negotiations have continued. COP-22 (Marrakech Summit, 2016), COP-23 (Bonn Summit, 2017), COP-24 (Katowice Summit, 2018), COP-25 (Madrid Summit, 2019), COP-26 (Glasgow, 2021);
- 
- A) COP 26 (GLASGOW PACT) - KEY OUTCOMES: 2021**
- **Mitigation:**
    - » It asked countries to strengthen their 2030 climate action plan or NDCs by 2022.
    - » First clear recognition of the need to move away from fossil fuels -> it called for "phase down of coal" and "phase out of inefficient fossil fuel subsidies".
  - **Adaptation:**
    - » Asked developed countries to atleast double the money being provided for adaption by 2025 from the 2019 levels.
    - » It created a two year work program to define a goal on adaptation.
  - **Paris Rule Book has been finalized.**
    - » 'Transparency Framework' was completed - it included reporting rules and formats for emissions, progress on pledges and financial contributions.
    - » Carbon Market provisions have been finalized [a major achievement of COP26].

- Credit generated from earlier periods, including through Clean Development Mechanism were transferred to the Paris Agreement but only since 2013. This will allow developing countries to meet its first NDC targets.
- On the issue of double counting, it has been decided that a country that generates a credit will decide whether to authorize it for sale to other nations or to count towards their climate targets. The emission cuts will be counted only once.
- Various Positive "Parallel Outcomes" (not part of the official COP26 negotiations)
  - » India's announcement of a Panchamitra
  - » Plurilateral Agreement on Methane Reduction among 100 countries is crucial. (Note: India is not a member)
  - » Plurilateral Agreement to reverse deforestation among another group of 100 countries. (Note: India didn't join the group due to concerns over a clause on possible trade measures related to forest products).
  - » COP26 Transport Declaration -> 100% transition to emission less (electric vehicles) cars by 2040.
    - This has also been signed by over 30 countries.
  - » Glasgow Financial Alliance for Net Zero (Gfanz): 450 of the world's banks and other financial institutions have pledged to report annually on the carbon emissions linked to the projects they lend to.
    - They also plan to lend trillions of dollars in green finance - while committing to net zero emission across the board by 2050.
- Problems that remained:
  - » Funding
  - » L&D
  - » Didn't specifically raise emission reduction targets.

## B) COP-27 (SHARM EL SHEIKH, EGYPT)

- Quotes:
  - » The UN Secretary General had declared at the start of the conference, "We are on a highway to climate hell with foot still on the accelerator".
- Key Highlights:
  - » Nod for establishment of Loss and Damage Fund.
  - » Estimates of Financial Requirements -> COP27 agreement for the first time, quantified the financial needs for climate action. It said about US\$ 4 trillion had to be invested in the renewable energy sector every year till 2030 if the 2050 target of net zero was to be achieved.

## C) COP28: DUBAI, UAE (30<sup>TH</sup> NOV 2023 – 12<sup>TH</sup> DEC 2023)

- Practice Question:
  - "The COP28 Declaration has left almost all the problems where they were before" Elaborate [10 marks, 150 words]

- The meeting reviewed the Progress of commitment made by 197 countries under the Paris Agreement to mitigate the razing global warming.
- **Outcome: Dubai Consensus:**
  - Negotiators adopt resolution titled "Dubai Consensus"; the text reflects a compromise between developed and developing countries on emissions.
- **Highlights of Global Stocktake (GST):**
  - The GST text echoed the GST input findings that 1.5 degree target would require "deep, rapid and sustained" reduction in global emissions of 43% by 2030 and 60% by 2035 from the 2019 levels and eventually reaching net zero by 2050.
  - **Fossil Fuel Phase-out:**
    - » Fossil fuels was the most hotly contested issue of the COP28; It was first time that fossil fuel was at the centre of discussion at UNFCCC COP.
    - » **Outcome:**
      - COP28 agreement has called upon countries to contribute towards "transitioning away" from fossil fuels and phase down of unabated coal power so as to achieve net zero by 2050.
    - » **Criticisms:**
      - No timelines
      - Not using the phrase "fossil fuel phase-out" and instead the use of "transitioning away".
      - While calling for phase down of "unabated coal power", the door was left open for "low-carbon fuels", "low emission" technologies, "low-carbon hydrogen" - all terms with very loose definitions.
  - **Tripling global renewable energy capacity by 2030** (from 3400 GW today to 11000 GW) and doubling of global average rate of energy efficiency improvements by 2030.
    - COP28 calls the member countries to achieve these two targets which have the potential to avoid emissions of about 7 billion tonnes of carbondioxide equivalent between now and 2030.
    - **Tripling is a global** targets for renewables is not incumbent on every country individually. It is not thus clear how this tripling will be achieved.
    - This is the only outcome that contribute to additional emission reduction between now and 2030.
  - **Accelerating and substantially reducing non-carbon-dioxide emissions globally**, including in particular methane emissions by 2030.
    - **Criticisms:** No target mentioned
    - **Note:** A group of about 100 countries at Glasgow (in 2021) had made a voluntary commitment to reduce methane emissions by 30% by 2030.
  - **Reduction of emission from road transport** on a range of pathways, including through development of infrastructure and rapid deployment of zero-and low-emission vehicles;

- **Phase down of inefficient fuel subsidies** that don't address energy poverty or just transition, as soon as possible.
- **Operationalization of L&D Fund:**
  - **Background:** A decision to set up a Loss and Damage Fund had been taken last year in Sharm el-Shaikh (COP27) but it had not been created, and no money had been promised.
  - **COP28 operationalized the fund** and several countries have already made commitments worth around \$800 million by the end of the conference.
    - COP28 decided that the fund will be serviced by new, dedicated and independent secretariat. It will be supervised and governed by the Board.
    - The fund is accountable to and functions under the guidance of the CoP serving as the meeting of the Parties to Paris Agreement (CMA).
  - **This is the most significant outcome for vulnerable countries** as L&D fund is meant to provide financial help to countries trying to recover from climate-induced disasters.
  - **Santiago network** has also decided to avert, minimize, and address loss and damage to catalyze the technical assistance of relevant organizations, bodies, networks and experts for the implementation of relevant approaches associated with climate change impacts.

**Santiago Network:** At COP25, the parties to UNFCCC decided to set up a Santiago network as part of Warsaw International Mechanism (WIM) for loss and damages. It is aimed to organize the technical assistance of relevant organizations for the implementation of relevant approaches in developing countries that are particularly vulnerable to adverse impacts of climate change.

- **Global Goal on Adaptation (GGA):**
  - » **Background:** COP26 at Glasgow had decided to set up a two-year work program to define the contours of adaptation framework.
    - Adaptation hasn't received enough attention and the entire focus of various agreements have been on mitigation. But, developing countries have been arguing for a global framework for adaptation.
    - The two year work program resulted in identification of some common adaptation goals like reduction in climate-induced water scarcity, attaining climate-resilience in food and agricultural production, supplies and distribution and resilience against climate induced health impacts.
  - » The COP28 retains calls for a doubling in adaptation finance and plans for assessment and monitoring of adaptation needs in the coming year.
    - An explicit 2030 date has been integrated into the text for targets on water security, ecosystem restoration, health.
- **Issue of Climate Finance Targets** will be reviewed in next COP:
  - » Currently, the \$100 billion goal hasn't yet been met (although it appears on track this year) and is far short of what is needed.
  - » **COP28 saw an agreement to draft a post 2025 finance target ahead of COP29**. This is a step forward, but details will only be hammered next year.

- **COP28 Declaration on Climate Change and Health**
  - » This is the first ever move to commit action and finance to combat the health impact of climate change.
  - » The COP28 Presidency and the WHO together issued the 'COP28 UAE Declaration on Climate and Health'.
    - Its signatories aim to accelerate action to protect public health and communities from negative and growing climate impacts and strengthen healthcare systems to cope with the effects of extreme heat, air pollution, infectious and zoonotic diseases and environmental risk factors.
  
- **Other Related Outcomes:**
  - » A group of **22 countries** signed a declaration to triple nuclear energy capacity between 2020 and 2050, in order to reduce dependence on oil, gas, and coal.
  - » **G7 countries** have announced to phase out coal by 2030 and have urged G20 countries to also agree on it.
  - » India and Sweden co-launched Phase II of the Leadership Group for Industry Transition (LeadIT 2.0) for the period 2024-26 at COP-28. They also launched the Industry Transition Platform, which will connect the governments, industries, technology providers, researchers, and think tanks of the two countries.
  - » **Green Industrialization Initiative**: African leaders came together on the third day of COP28 to launch the initiative. The GII is set to accelerate green growth of industries in Africa and attract finances and investment opportunities.
  
- **Limitations/Criticisms:**
  - » **Countries failed to adopt rules to set up global carbon market**: Civil society has hailed the move as parties didn't agree to adopt weak rules for carbon markets.
  - » **Climate Finance issue** is still pending and would be taken up in COP25.
  - » **No timelines for fossil fuel transitioning**: The text related to fossil fuel transitioning is weak, in-adequate and with loopholes.
  - » **NDCs remain far away from achieving Net Zero by 2050**.
  - » **Net Zero by 2050** target is expected to bring pressure on China and India whose net zero targets are for 2060 and 2070 respectively.
  - » **Major Decisions** have not been integrated with agendas like 'Common but differentiated responsibilities'.

## 5) NET ZERO

- **Details**
  - » Achieving a global balance between emissions and removal of greenhouse gases to and from the atmosphere is called net zero (or no net emissions). The Paris agreement targets this to be achieved somewhere in the second half of this century, but the earlier this happens, the greater the chances of keeping global warming below 2-degree C.

- » Electricity and heat are responsible for 25% of global GHGs. The International Energy Agency envisages that in a net-zero world, almost 90% of electricity could come from renewable sources, mostly solar and wind, with nuclear power making up most of the rest.
- Achieving Net Zero:
- » Focus on 2030 goal first:
    - IPCC's AR6 emphasized that to keep temperature rise within 1.5 degree C, global emissions should be reduced by 45% from 2010 levels by 2030, on the way to net zero by 2050.
    - But the UN NDC report says that as per the current NDCs, the global emission is expected to increase by 16.3% in 2030 (compared to 2010 levels).
  - » Energy Conservation and Efficiency: Global emissions show that energy is the biggest emitter (73.2%) including its use in transport, industry, and building. Therefore, energy efficiency can play a crucial role in achieving net zero.
    - Targeted consumer education and behavioral change would also be important here.
  - » Renewable Energy: Gradually phasing out thermal energy (coal, petrol, gas etc.) and increase the capacity of renewables with improved grid infrastructure, smart grids, etc.
    - Insure against Renewable Droughts through other sources like Nuclear Energy.
  - » Transport Sector: Accelerated transition to e-mobility and non-motorized transport is required.
  - » Create Offset: Inspite of all the efforts, humans would still produce some billions of tonnes of emissions by mid-century. This will have to be balanced by removals to achieve net zero. Offset can be in the form of afforestation, increasing soil organic carbon, and advanced carbon sequestration techniques.
  - » Enhancement in Funding: The Promised funding from developed to developing countries need to be delivered.
  - » More R&D in advanced technology like low and zero emission technologies across all sectors. There is also a need of innovation for renewable integration, power to x-storage, and conversion and reconversion pathways. Moreover, carbon-removal technologies need to be focused upon.
  - » CBDR should not be ignored: Developed countries should achieve net zero earlier and few extra decades should be available to developing countries.

- Conclusion:

- » Net zero will be achieved in three decades if driven by clear policies, supported by technology development, and delivered through massive financial mobilization.

## 6) INDIA'S DECISION TO ACHIEVE NET ZERO BY 2070: CRITICAL ANALYSIS

- At COP26, PM Modi has proposed a **fivefold strategy** for India to play its part in helping the world get closer to 1.5 degrees Celsius. India's 'Panchamrita' promises include:
  - » India will get its **non-fossil energy capacity** to **500 GW** by 2030.
    - This is a **50 GW increase** from its existing target.
  - » India will **meet 50% of its energy requirements** till 2030 with **renewable energy**.
  - » India will **reduce its projected carbon emission** by **one billion tonnes** by 2030.
  - » India will **reduce the carbon intensity** of its economy by 45% by 2030.
  - » India will **achieve net zero** by 2070.

- **India's demand from developed countries:**
  - » In the spirit of climate justice, the developed countries should be providing at least \$1 trillion in climate finance to assist the developing countries and those most vulnerable.
  
- **Analysis:**
  - This is a very positive move as India had resisted any net zero target in the run up to the COP26. This announcement is expected to put India on a firm path towards decarbonization.
  - This announcement also keeps in mind the Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC).
    - India's net zero comes in 2070 and NDC is subject to funding from developed countries
  - **India is contributing more than its share:** Despite a 2070 net zero year for India, India's cumulative emissions between 1900-2100 would be lower than the US, China or EU.
  - **India continues to show international leadership** - It has launched the Infrastructure for Resilient Island States - an initiative under the coalition for Disaster Resilient Infrastructure to support vulnerable island countries. India has also launched Green Grids Initiative in partnership with UK to tap into renewable energy resources everywhere.
  
- **Critics of shifting to a Net Zero target**
  - **Over-appropriation of global carbon budget** by a few.
    - Countries which have higher emissions presently are taking more advantages of the environment.
    - The campaign to achieve net zero by 2050 is designed to achieve Paris goals by the "lowest cost" methods, foregoing equity and climate justice.
  - **Wasn't mandated by Paris Agreement**.
  - **India is anyways a small contributor** - Our emissions are 4.37% of the world's share (with 18% population).

#### **Critics of Sustainability of India's Net Zero Strategy**

- India's plan to increase dependence on hydro projects and nuclear energy will create displacement, deforestation, hazardous radiation etc.
- Solar and Wind Energy is also focused on Mega energy parks which may cause displacements.

#### **Way Forward:**

- **Identify short-term and medium-term targets** to achieve the long-term goals.
- **Areas of GHG Reduction:**
  - **Decarbonizing India's Energy Sector** - Replace fossils with renewables; Improve efficiency of existing fossil fuel using sectors; Remove unavoidable carbon release through Carbon Sequestration.
  - **Green Transformation of Mobility:**
    - Shift in modal mix from road to rail and fuel diversification approach to encourage sustainable fuels (biofuels, CNG, LNG) in short term.
    - Electrification in medium term.
    - Hydrogen based heavy mobility in the long term.
- **Radical Decarbonization of Industrial sector** including steel, cement, chemicals and fertilizers.
  - Accelerate circular economy; efficiency improvement; electrification of heat; carbon capture and low carbon fuels such as biomass and hydrogen.

- **Green Building, Infrastructure and Cities:** India's top 25 cities contribute to 15% of its estimated GHG emissions.
  - Rethink urban planning with a focus on transit oriented urban development and an emphasis on low-carbon buildings and infrastructure construction.
- **Agriculture:** Agriculture sector is the largest contributor to nitrous oxide ( $N_2O$ ) and Methane ( $CH_4$ ).
  - A national campaign to empower, educate and enable more than 100 million farmers in adopting precision agriculture, sustainable animal husbandry, and green energy.
- **Integrate emission reduction with Climate Adaptation**
  - Strengthen a suit of social protection program, especially for people facing rural distress.
  - Invest in disaster preparedness.
- **Corporate India** has a vital role to complement government efforts. The goals of 21st century India Inc should be to foster innovative and inclusive green development.
- **Strengthening State Capacity** can help the country move from reactive decision making to proactive planning and execution. A **Low-Carbon Development Commission** supported by the overarching framework of a climate law, could play this role.

**Conclusion:**

- Through its announcement of 'Net-Zero' target, India has silenced its critics. Now, its time to follow through on these commitments with transparent and credible action. This would allow India to demonstrate genuine climate leadership for the rest of the developing world, and secure a better, greener future for its citizens.

## 7) MECHANISMS AND ISSUES WITH CLIMATE FUNDING

- **Introduction**
  - » Money has been central to many a fight at the Climate Change negotiations. UNFCCC as part of its CBDR principle requires developed countries to provide financial assistance to developing nations in their fight against the climate change.
  - » Globally, there are two funding mechanisms - **The Green Climate Fund** and the **Global Environment Facility**.
- **Green Climate Fund (GCF)**
  - » Established at COP-16 in 2010, it is the financial mechanism for UNFCCC under article 10. It is regarded as the chief instrument for the fulfillment of developed world's annual support of \$100 billion annually till 2025.
  - » COP-21 held at Paris also decided that GCF shall serve the Paris Agreement.
- **Global Environment Facility (GEF)**
  - » Created at Rio Earth Summit in 1992 to help tackle planet's most important environmental problems.
  - **What has it done so far? / What does GEF do?**
    - » GEF also serves as financial mechanism for the following conventions:
      - CBD
      - UNFCCC
      - UNCCD

- Stockholm Convention on Persistent Organic Pollutants (POPs)
  - Minamata Convention on Mercury
  - It also supports implementation of Montreal Protocol on substances that deplete the ozone layer in countries with economies in transition.
  
- **Current Funding Situation:**
  - **Requirement:** As per COP27 (Sharm el-Sheikh agreement), the global transition to a low-carbon economy would likely require about US\$ 4-6 trillion every year till 2050. This is 5% of the global GDP.
    - The cumulative requirement of developing countries, just for implementing their climate action plans, was about US\$ 6 trillion between now and 2030.
  - **Availability:**
    - The \$100 billion amount, that the developed countries have promised is the only money in play right now. And of this only around US\$50-80 billion per year is being mobilized. This indicates that the fund available in less than 10% of what is required.
  
- **Key Problems of current climate funding are:**
  - **Requisite finance** hasn't been mobilized.
  - **Funding bias in favour of climate change mitigation activities.** This bias is there because mitigation efforts are easily visible in short run and returns from adaptation efforts will be visible after long time.
    - For e.g., if we adapt by moving away from coasts, the benefit of this adaptation efforts would be visible much later.
  - **Developing world** in itself cannot fight the climate crisis as they are still struggling for finance for their development needs.
  - **A number of countries** are unable to access global finance. Present rules and regulations of global financial systems, make it difficult for many countries to access international finance, particularly those with political instabilities
  - **Lack of transparency** is leading to problems of double counting and green washing.
  
- **Way Forward:**
  - **Availability and Access** are two main dimensions to the problem of climate finance.
  - **Increasing Availability:**
    - **Developed countries** need to increase their contribution.
      - But, even if this happens, this won't be able to fulfill the requirement of around \$6 trillion needed annually.
    - **Mobilize resources from private sector:** Businesses and Corporations need to invest money into green projects.
      - In climate finance thus far, private investment have lagged behind public money. Barely 30% of current financial flows are coming from private sources.
    - **Creation of right environment for investments in green project** -> Private sector will not invest unless they are reasonably sure of healthy returns.
      - Here, international financial institutions should engage with governments, central banks, commercial banks etc. to incentivize climate friendly investments and discouraging, or even penalizing, dirty investments.
    - **Carbon Tax** - Common citizens will have to contribute to the bulk of the additional financial resources.

- **Increasing Access:** There is a need to simply lending mechanisms and overhaul credit rating systems.
- **Increased Transparency:**
  - Climate finance flows through a maze of channel - bilateral, regional, multilateral. It is in the form of grants, concessionary loans, debt, equity, carbon credit, and more. As a result, there are widely different opinion on the quantum of climate finance currently being mobilized. This needs to be addressed.
- **Conclusion**
  - » Though, more money is flowing in green economy than a few years ago, but the pace of increase is nowhere adequate. When it comes to climate change, along with money, it is the time which is in short supply.

## 8) GEO-ENGINEERING, CARBON CAPTURE AND STORAGE (CCS) AND CARBONDIOXIDE REMOVAL (CDR) TECHNOLOGIES

- **Introduction:**
  - » **Definition:** Geo-engineering is a theoretical concept which aims to modify and cool environment to defeat the global warming. It may involve reduction of Sunlight reaching earth or absorption of CO<sub>2</sub> to reduce global warming (Carbon Capture Technologies).
  - » Since the global community is looking for a Net Zero target by 2050, the Geo-engineering technologies are expected to play a key role in this.
- **Reduction of sunlight reaching Earth:**
  1. **Stratospheric Aerosol Injection:** Injecting the atmosphere with Sulphur/ Hydrogen Sulphide (copies volcanic effect and scatters sunlight).
  2. **Putting Large Mirrors in Space** - reduce the amount of sunlight reaching earth.
  3. Using Wind-Powered Motors to **whiten the cloud** -> by spraying water into the sky -> reflect solar radiation.
- **Carbon Capture and Storage (CCS)** (Or Carbon Capture Utilization and Storage (CCUS)) refers to technologies that can capture CO<sub>2</sub>, at a source of emissions before it is released into atmosphere.
  - The process starts with capture of CO<sub>2</sub> which undergoes a compression process to from a dense fluid. This eases the transport and storage of the captured CO<sub>2</sub>.
  - This dense fluid is transported via pipelines and then injected into the underground storage facilities. It can also be used as a raw material in other industrial processes such as bicarbonates.
- **CDR** takes the form of both natural means like afforestation or reforestation, and technologies like direct air capture where machines mimic trees by absorbing CO<sub>2</sub> from their surrounding and storing it underground.
  - E.g. Fake Trees containing compounds which can react with CO<sub>2</sub> to absorb it and store it in solid form.
- **Other Carbon Capture Technologies**
  - i. **Ocean Iron Fertilization:** Seeding the Sea with Iron
    - Phytoplankton prefer iron and flourish in its presence, thus absorbing a lot of CO<sub>2</sub>.

- How significant is the role of CCS and CDR in achieving net-zero by 2050?
  - » In IPCC AR6, there is no pathway to 1.5 degrees C that doesn't use CDR.
- Limitations/Problems with these CCS and Geoengineering method:
  - » CCS and CDR are still technologies under development without demonstrated feasibility at large scale despite decades of development.
    - It also suffers from other challenges like high energy requirements; high cost; challenges in the transport and long term storage of carbon.
  - » CDR methods like afforestation, reforestation, Bioenergy with Carbon Capture and Storage (BECCS) are constrained by their need of land. It may also hamper food and water security.
  - » Ocean Iron Fertilization: The Convention of Biological Diversity has already imposed a de facto moratorium based on precautionary principle. It could result in eutrophication, which may adversely affect the ocean ecosystem.
  - » Stratospheric Aerosol Injection is also highly controversial as this could have unintended effects on global and regional climates.
  - » Further, there are concerns related to fairness, equity, and justice in the adoption of geo-engineering technologies as most of the R&D is dominated by North American and Western Euro.
- So far, there has been very little progress on these technologies and most of the R&D is dominated by North American and Western European Nations. Emerging economies like China and India have also begun to look into these options more seriously.
  - » CCS is absent from INDCs of most of the countries, indicating that most of the countries have not yet accepted it as promising technology.
- Why very little progress? - Lack of policy support and spending on R&D.
- Situation of CCS in India - Not much progress
  - » Some industries, especially steel and cement have been proactively pursuing CCS as part of their emission reduction ambitions. In Sep 2020, an 'Industry Charter' for near zero emissions by 2050 was agreed to by six Indian companies that will explore different decarbonization measures including carbon sequestration.
  - » Government initiatives: The DST has established a nation wide program on CO2 storage research and in Aug 2020, made a call for proposals to support CCS research, development, pilot and demonstration projects. This is part of the accelerating CCS technologies (ACT) initiative, for which India has committed one million Euros to support Indian participants.
- Geopolitics of Geoengineering:
 

Since, developed countries dominate the R&D and discussions on futuristic governance framework, there are concerns about the representation of positions of developing and underdeveloped countries.

  - It could widen north-south divide, by dividing the world into haves and havenots.
  - Then there are concerns about potential militarization of these technologies.
- Way forward

- » **Improved policy support**
- » **Learn from successful implementation of technology in industrialized countries.** Increased collaboration with global industries.
- » **Strengthen international geo-engineering governance:**
  - Future use of geo-engineering should take into consideration the core principles of UNFCCC like common but differentiated responsibilities.
  - The international governance should introduce accountability, oversight and transparency into the use of geo-engineering in future. The governance framework should be inclusive in approach.

## 4. EFFORTS BY INDIA TO FIGHT CLIMATE CHANGE

### 1) NATIONAL ACTION PLAN ON CLIMATE CHANGE

- Launched in 2008
- Consist of 8 submissions – National Solar Mission, National Mission on Enhanced Energy Efficiency; National Mission on Sustainable Habitat; National Water Mission; National Mission on Sustainable Himalayan Ecosystem; the National Mission on Strategic Knowledge for Climate Change; National Mission for Green India; National Mission for Sustainable Agriculture.

### 2) UPDATED NDC TO UNFCCC

### 3) LONG TERM-LOW EMISSION DEVELOPMENT STRATEGY

### 4) MISSION LIFE

- **Details about Mission LiFE**
  - It was first proposed by PM Modi at COP 26 of UNFCCC in Nov 2021. It is envisioned as an India led global mass movement that will nudge individual and collective action to protect and preserve the environment.
    - PM Modi has underlined that Mission LiFE makes the fight against climate change democratic, in which everyone can contribute with their respective capacities.
    - It emboldens the spirit of the P3 Model: Pro Planet People.
    - It functions on the basic principles of 'Lifestyle of the planet, for the planet and by the planet'.
  - At the launch, PM Modi also highlighted that the concept of 'Reduce, Reuse and Recycle' and circular economy; and mentioned that it has been part of the Indian Lifestyle for thousands of years.
  - LiFE also resonates with **climate justice** -> it highlights enhanced obligations for those in developed countries and supports climate adaptation and mitigation for those most affected and yet least responsible.
- NITI aayog will curate and incubate Mission Life in the first year, and it will subsequently be implemented by MoEF&CC.
- It is a five-year program.

- **Significance:**
  - According to UNEP, more than 2/3rd of the GHG emissions can be attributed to household consumption and lifestyles -> therefore the urgent cuts to global emissions we need can only be achieved through widespread adoption of greener consumption habits.
  - Life recognizes that small individual actions can tip the balance in the planet's favor.
    - Actions such as saving energy at home; cycling and using public transport instead of driving; eating more plant-based foods and wasting less; and leveraging our position as customers and employees to demand climate-based friendly choices.
  - Many of the goals of LiFE can be achieved by deploying 'nudges', gentle persuasion technique to encourage positive Behaviour.
    - The UNEP employs proven nudging techniques:
      - Discouraging Food waste by offering smaller plates in cafeterias.
      - encouraging recycling by making bin lids eye-catching;
      - and encouraging cycling by creating cycle paths
- **Note: Other Recent global initiatives launched/initiated by India:**
  - Panchamrita Targets announced by Mr Modi at COP26
  - International Solar Alliance
  - The Coalition for Disaster Resilient Infrastructure

## 5) SCALING UP EFFORTS TO MOBILIZE GREEN FUND

- Though the Paris Agreement provides for mobilization of resources from developed countries, the process has been very slow.
- Thus, India has scaled up its efforts towards greater mobilization of private capital to meet its ambitious climate action goals.
- **Green Bonds** are financial instruments that generate proceeds for investment in environmentally sustainable and climate suitable projects.
  - Developed countries such as UK, France, Germany etc have been using Green bonds to raise billions of dollars of sovereign green debts.
- In India, as per SEBI's data between 2017 and Sep 2022, 15 Indian corporates have issued green bonds of value of Rs 4,539 crores. Most of this is related to renewable energy generation.
- **Union Budget 2022-23** announced the issuance of **Sovereign Green Bonds**.
  - The final sovereign green bond framework of India has been issued.
  - The Green Financing working committee has also been set up to oversee and validate key decisions on the issuance of Sovereign green bonds.
    - The committee has the mandate to select the projects for allocation of proceeds, do a time-bound review of the allocation and carry out annual reporting along with an impact assessment of the proceeds from sovereign green bonds issued.
  - The RBI also regularly notifies indicative calendar for the issuance of sovereign Green Bonds (SGrB)

- The security-wise allocation would include 5 year and 10 year SGrBs for ₹4,000 crore each for both auctions.
  - Five per cent of the notified amount of sale has been reserved for retail investors as specified under the ‘Scheme for Non-competitive Bidding Facility in the auction of Government of India Dated Securities and Treasury Bills’.
  - The SGrBs will be designated as specified securities under the ‘Fully Accessible Route’ for investment in Government Securities by non-residents.
  - Over time, the SGrBs would provide a pricing reference for private sector entities in India for their domestic borrowings through Environment, Social, and Governance (ESG) bonds.
  - Thus, the issuance of SGrBs would help in creating an ecosystem which fosters a greater flow of capital into green projects and entities undertaking such projects.

## 6) OTHER STEPS TO PROMOTE RENEWABLE ENERGY AND ENERGY EFFICIENCY



# CURRENT AFFAIRS PROGRAM

## PRE CUM MAINS 2024

### JAN 2024: PART-1

### LAND REFORMS

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## 1. SYLLABUS: LAND REFORMS IN INDIA

## 2. PYQS

- a. State the Objectives and measures of land reforms in India. Discuss how land ceiling policy on landholding can be considered as an effective reform under economic criteria [Mains 2023, 10 marks, 150 words]
- b. How did land reforms in some parts of the country help to improve the socio-economic conditions of marginal and small farmers? [Mains 2021, 10 marks, 150 words]
- c. Discuss the role of land reforms in agriculture development. Identify the factors which were responsible for the success of land reforms in India [Mains 2016, 12.5 marks, 200 words]
- d. In the view of the declining average size of land holdings in India which has made agriculture-nonviable for a majority of farmers should contract farming and land leasing be promoted in agriculture? Critically evaluate pros and Cons [Mains 2015, 12.5 marks, 200 words]
- e. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 has come into effect from 1st Jan 2024. What are the key issues which would get addressed with the act in place? What implications would it have on industrialization and agriculture in India [2014, 12.5 marks, 200 words]
- f. Establish relationships between land reforms, agriculture productivity, and elimination of poverty in the Indian economy. Discuss the difficulties in designing and implementation of agriculture-friendly land reforms in India [2013, 10 marks, 200 words]
- g. Give your assessment on land reforms in India [1997, 20 marks]

## 3. OTHER PRACTICE QUESTIONS

- a. Critically analyze the role of land reforms in post-independence agrarian and economic development. Have the objectives of these reforms been fully achieved? Give reasons. [15 marks, 250 words]
- b. Why were Land Ceiling Acts introduced in India? Have they been able to achieve their objectives? [10 marks, 150 words]
- c. Evaluate the influence of land reforms on the socio-economic structures of rural India. [10 marks, 150 words]
- d. Analyze the achievements and limitations of Bhoodan Movement [10 marks, 150 words]
- e. Analyze the role of land reforms in achieving the SDGs particularly the eradication of poverty (Goal 1) and zero Hunger (Goal 2) [10 marks, 150 words]
- f. Climate change poses significant challenges to land and agriculture. Discuss the role of land reforms in promoting climate-resilient agriculture and sustainable land use. [10 marks, 150 words]
- g. **Land Fragmentation** is a common problem in Indian agriculture. Analyze its causes and consequences and suggest measures to address this issue. [15 marks, 250 words]

- h. Land Acquisition for development projects has often been a contentious issue in India. Critically examine the existing legal framework for land acquisition and suggest possible reforms to balance development with the rights of landowners and affected communities [15 marks, 250 words]

#### 4. LAND REFORMS IN INDIA

- **Introduction:**
  - **Definition:** Changes brought in the agrarian structure through direct intervention are characterized as land reform.
- **Need of Land Reforms in India after Independence:**
  - **The exploitative nature of land tenure system** (Zamindari and Ryotwari system) prevailing during the pre-independence period:
- **Under Zamindari System:**
  - **High rent:** As much as 25% of produce was taken away by the intermediaries in the form of rent.
  - **Illegal extraction:** Encroachment of communal rights in pastures, forests, etc and the farmers were made to pay for accessing these.
  - **Begar and force labor were common:** Other than high rent and illegal extractions, farmers were also forced by zamindars into forced labor
  - **Low capital investment:** Low income for famers led to lack of investment in agriculture, low capital intensity and antiquated methods -> stagnant productivity.
  - **Poor records maintenance:** It led to difficulty in mortgaging and selling of land. It also led to poor development of credit institutions in these areas.
- **Even under Ryotwari system** where rent was directly paid by Ryots (cultivators) to government, several shortcomings had developed. Here, moneylenders and Mahajan had come to play a very important role. By the time of independence, more than 20% of the area under cultivation had passed under open tenancy.
- **Objectives of Land Reforms:** The government defined the objectives of land reforms as follows:
  - i. **Increased Agri-Productivity:** Land reforms were focused on removing impediment to agri production through creation of efficient landholding; encouraging investment in agriculture and boosting production.
  - ii. **Ensuring Equity and Social Justice:** Land reforms would provide equality of status and opportunity to all sections in the rural areas.
  - iii. **Reducing Exploitation:** Tilers for e.g. are provided with security of tenure; higher share of crops with sharecroppers etc.
- **Measures taken** to achieve the above objectives were:
  - i. **Abolition of intermediaries:**
    - » Abolishment of Zamindars and bringing farmers in direct contact with state
  - ii. **Tenancy Reforms:**
    - » It included regulation of rent, security of tenure and ownership rights of tenants.
  - iii. **Ceilings on Agricultural Landholdings**

- » So that access land could be redistributed.
- iv. **Reorganization of Agriculture**
  - » Redistribution of land, consolidation of land holding and cooperative farming.
- v. **Land Titling and Registration:** Establishing a clear system of land titling and registration to secure land rights.

**Despite various implementation challenges**, these land reforms significantly contributed to rural poverty reduction, and social equity in India, thus underlining the importance of land reforms in advancing the socio-economic conditions of marginal and small farmers.

## 5. ABOLITION OF INTERMEDIARIES

- **Questions:**
  - » Discuss the challenges faced in implementing the Zamindari abolition policy in India. How successful was it in its objective of land distribution?
- **Background: The main cause of stagnation in agricultural sector was the exploitation by Zamindars.**
  - » Even before independence it was understood that exploitation of zamindars is the main cause of stagnation in India's agriculture which in turn was the main reason behind stagnation in agricultural growth.
- **So, some states had passed laws to abolish zamindari system, but the primary work related to this was done during the first five year plan.**
- **Outcome:**
  - » Official documents claimed that **intermediaries were completely abolished** by the end of the First Plan excepting a few small pockets in some areas.
  - » It is estimated that in all 173, million acres of land was acquired from the intermediaries and, as a consequence, about **2 crore tenants were brought into direct relationship with the state**.
- **Assessment:**
  - » **Challenges:**
    - **Absence of land records** in the permanently settled areas: Here the land records and administrative machinery had to be built from scratch.
    - **Delays**: Due to delay in making of laws (for e.g. UP Zamindari Abolition act, took 4.5 years) and then due to Zamindar's challenging it in court.
    - **Flaws in legislations:**
      - **"Personal Cultivation"** provision was misused. Zamindars could obtain land for 'personal cultivation' upto a ceiling limit. The zamindars could even evict tenants for the purpose.
      - **"Ceilings were very high"** -> very few zamindars were affected.

- **Transfer of land to family members:** Flaws in the legislation have also enabled them to transfer their land to other members of their families and thus escape the ceiling law.
  - For e.g. in post reform Bihar, there existed estates of 500, 700 or even 1,000 acres and older structure of landowner, occupancy raiyat, non-occupancy raiyat, bataidars etc. continued.
- **Zamindari only changed its 'garb':** The previous zamindars acquired large areas for personal cultivation on which cultivation is done with the help of hired agricultural labor. They are now designated as 'big landowners' and along with rich peasantry, have formed "a new and dominant class of rural capitalist".

» **Positives:**

- Most of the states had passed zamindari abolition law by the end of first five-year plan. This perhaps reflected on the popular sentiments against zamindars and their exploitative practices.
- Exploitation and oppression of tenants and actual tillers of the soil declined steeply and the feudal rural structure crumbled.
- Reforms led to skimming of great absentee landlords.
- Land reforms measures in Kerala (1959) and West Bengal (1967) are particularly significant.
  - In Kerala, the government declared eviction illegal and sharecroppers were granted the right to purchase land. They were not allowed to retain more than 10 acres of land.
  - The United Front Government of West Bengal acted decisively in favour of the bargees and agricultural workers and against landlords and rich farmers.

- **Conclusion: Overall**, while the policy marked an important step towards reducing economic inequality and rural poverty, its implementation was marred by several challenges, and its success was uneven across the country. For the policy to achieve its objectives fully, these challenges needed to be, and still need to be, addressed more effectively.

## 6. TENANCY REFORM

- **Background:**
  - Before reforms, tenants at will and sub-tenants were in a precarious position.
  - Their very existence dependent on the mercy of landlords and this made them prone to various exploitative practices adopted by latter.
  - According to experts, before green revolution, approximately 50% of agricultural land in India was under one or other form of tenancy.
- **Key Reforms:**
  - i. **Rent Regulation:** In the pre-independent India, exorbitant rent was extracted from tenants. In the country as a whole, the rent varied from 34 to 75%.
    - **Reduction in Rent:** The first five-year plan stated that maximum rent should be fixed at 1/4th or 1/5th of the total produce. Except in Punjab, Haryana, J&K, TN and Andhra

Pradesh, this limit was observed in all the states. Even in these states, it didn't go beyond 40%.

- **Limitations:**

**Violation of the law:** Because of the strong **socio economic and political hold of the landowners** in the countryside, they have been able to extract considerably more rent from the peasants. For e.g. in Bihar, share croppers are mostly required to pay 50%. In the absence of any security of tenure, the peasants are not willing to confront landlords.

ii. **Security of Tenure:** To protect tenants from ejection and grant them permanent rights in land, legislations have been passed in most of the states.

- » **Legislation for security of tenure had three essential aims:**

- No ejection except as per the provision of the law.
- Land may be resumed by the owner, if at all, for 'personal cultivation' only
- In the event of ejection, tenant is assured of a prescribed minimum area.

- » **Limitations:**

- **Some sharecroppers not covered by this law:** In WB and Uttar Pradesh, sharecroppers were not included in the definition of tenants and thus were not protected by these laws.
- The '**Right of resumption**' combined with flaws in the definition of personal cultivation rendered all tenancies insecure.
- The '**Provision of voluntary surrender**' was also misused.
  - Socio-economic conditions allowed landlords to compel their tenants to give up the tenancies.
- **No (or incomplete) records of tenancy:** This leads to laws related to security of tenure not getting implemented.

iii. **Ownership rights for Tenants:**

- » Some states have also passed law to confer ownership rights to tenants.

- It is estimated that as a result of this, 1.2 crore tenants have acquired ownership right over 6.32 million hectares of land.
  - **West Bengal, Karnataka, and Kerala** have achieved more successes than the other states.
  - In West Bengal, 14 lakh sharecroppers have been recorded under the '**Operation Barga**'.
    - **Operation Barga** was a land reform movement, throughout the rural WB for recording the names of the sharecroppers (Bargadars) while avoiding the time-consuming method of recording through the settlement machinery. It bestowed on the bargadars, the legal protection against eviction by the landlords (jotedars), and entitled them to the due share of the produce.
    - It was launched in 1978 and concluded in mid 1980s.
    - Till date the operational barga recorded the names of approximately 1.5 million bargadars. Since then, it has been marked as one of the most successful land reform programs in India.

- In Kerala, **applications of 24 lakh tenants** for conferment of ownership rights were accepted.
- **Limitations:**
  - » On the whole, the **progress was very unsatisfactory**.
  - » A few states didn't adopt a legislation while in some others implementation has been very poor.
  - » For a long period, tenant didn't exercise their rights to purchase ownership of land they cultivated due to following reasons:
    - Many tenants couldn't afford to pay the purchase price.
    - Many tenants were unwilling to purchase. This reflected the dominant controlling power of the landowner's vis-a-vis the tenants.

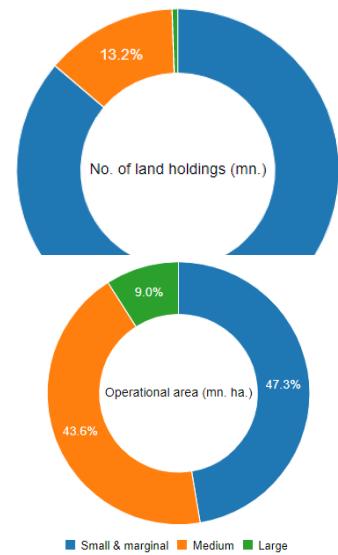
## 7. CEILING ON AGRICULTURAL HOLDING

- A ceiling on agricultural holdings means **statutory absolute limit** on the amount of land which an individual may hold.
- **Need of Ceiling:**
  - i. **The Social Rationale:** It is socially unjust to allow a small number of people to hold a large part of land and thereby subjugate the interests of millions of laborers to the interest of this handful minority.
  - ii. **Improving the position of poor:**
    - » According to FAO, "Redistribution of only 5% of farmlands in India, coupled with improved access to water, could reduce rural poverty level by 30% under what otherwise would be, so that in India conditions land and water reform would be a key approach.
    - » Various studies have shown that the per capita income of the rural poor has more than doubled, as is their share in total personal incomes.
  - iii. **The Efficiency Factor:** With ownerships, small farms can be more effectively managed in comparison to large farms. Small farms offer more opportunities for employment as they are less capital intensive as compared to large farms.
  - iv. **Inculcating the Spirit of Cooperation:** The land redistribution can be done with a condition that farmers form cooperatives for its cultivation and management. This practice will enable the hitherto landless laborers and petty peasants to learn the techniques of social management and joint cultivation on the one hand, and enable them to realize the benefits of large-scale farming as well.
- **Steps taken to promote ceilings:**
  - » It had two aspects - Ceiling on future acquisition and Ceiling on existing holdings.
  - » **The 2nd Five Year Plan** provided that ceiling should apply to all future acquisitions of land and all existing agricultural land holdings held under 'personal cultivation'.
  - » **Compensation:** The plan said that it should be recovered from persons to whom allotments are made.
  - » The priority should be accorded to tenants displaced as a result of resumption of land for personal cultivation, farmers with uneconomic holdings and landless workers.
- **Limitations:**
  - » The above guidelines haven't been applied uniformly across the state laws.

- » Malafide transfers, Benami properties have reduced the sting out of the ceiling laws and have tended to defeat the aim of these laws.
  - » In some cases, too many exemptions permitted evasion of ceiling on a considerable scale.
- **1972 Conference of Chief Ministers:**
- » To bring uniformity in the different policies regarding imposition of ceilings being pursued by the states, a conference of chief ministers was called in July 1972. Based on the consensus at the conference, a new policy on land ceiling was evolved.
- **Aim of the new policy of land ceiling:**
- i. Lowering the ceiling to 18 acres of wet lands and 54 acres of unirrigated land.
  - ii. The change over to family rather than the individual as the unit for determining land holding - lowered ceiling for a family of five.
  - iii. Fewer exemptions from ceilings
  - iv. Retrospective application of the law for declaring Benami transactions null and void.
  - v. To insulate measures from being challenged in the court, most of the laws were introduced under the 9th schedule of the Constitution.
- **But, even its implementation was poor.** Only around 3 million hectares has been declared surplus so far, which is hardly 2% of net sown area in India.
- » About 30% of the land hasn't been distributed as it is caught up in litigations.
  - » A number of Benami and Clandestine transactions have resulted in illegal possession of significant amount of land above ceiling limits.
  - » The balance of power in rural India is so heavily weighted against the landless and the poor that implementing land ceilings law is difficult.
  - » A new problem also emerged. In certain states like Karnataka, the industry and the large farmers are being given exemption from ceiling laws without seeking the permission of Government of India

## 8. CURRENT LANDHOLDING SITUATION IN INDIA: AGRI-CENSUS 2015

- **Current Situation of Agriculture Holding In India: Agri-Census 2015**
  - » Small and marginal landholdings (<2 hectare area) constituted **86.21%** of the total landholding, an **increase of 1.2% points** compared to 2010-11.
    - Farmers holding 10 hectares and more account for just **0.57%**.
    - Semi-Medium and Medium: **13.2%**
  - » Decline in average size of landholding from 1.15 hectare to 1.08 hectare.
  - » Average size of farm holding was the **highest in Nagaland** at 5.06 hectares and **lowest in Kerala** at 0.18 hectares.
  - » It is noteworthy that small, marginal and medium landholdings constitute the lion's share of operated area - large landholding account for only **9%** of the total operated area.



- **Causes of Subdivision and Fragmentation:**

- i. **Law of Inheritance:** Land gets equally divided among all the siblings.
- ii. **Increasing Population:** The land under agriculture has increased marginally, but the population has kept on going up.
- iii. **Decline in joint family system**
- iv. **Farmer's Indebtness:** This sometimes leads to farmer selling a part of the land to someone else.
- v. **Psychological Attachment to land:** Even if people migrate to urban areas, they would want that their land in village remain owned by them. Every child want to have a share in father's land and is not willing to accept payment in lieu of land.
- vi. **The Practice of share cropping:** This allows a farmer to manage several fragmented pieces of land.

- **Disadvantages:**

- » **Wastage of land:** Sometimes after division, the land become so small, that it can't be used for agriculture. It has been estimated that in Punjab around 6% of land is wasted on this account.
- » **Difficulty modernization:** Investment on farm equipment, irrigation facilities etc. become very probable. This also contributes to low productivity.
- » **Difficulties in land management:** For a farmer, several small pieces of land fragmented in entire village is less manageable, than one large field located together.
- » **More fragmentation leads to more boundaries** leading to more disputes. This one several occasion hamper the peace in the village.
- » **Disguised unemployment:** Small piece of land fail to provide work for all members of the farmer's family. But they still remain dependent on it, causing disguised unemployment.

- **Efforts towards Consolidation:**

- » **Land Consolidation** is designed to solve the problem of fragmentation of holdings. The method that was adopted was to give one consolidated holding to the farmer equal to the total of the land in different scattered plots under his possession. Initially the program was voluntary, but it was later made compulsory.

- **Critical evaluation of Consolidation Program:**

- » **However, the progress under the initiative have been quite low.** Consolidation has been done only on 1/3rd of the consolidable area of the country. It is a continuous process, but most states have stopped consolidation. Only in Punjab and Haryana the task has been consolidated so far.
- » **Factors:**
  - **Different quality of soil from land to land:** This makes it difficult to convince farmer to accept other piece of land which may be smaller.
  - **Emotional attachment to land:** She doesn't willingly cooperate with consolidation officer.
  - **Most states were engaged in the immediate land reform programs** like abolition of intermediaries, tenancy reform etc and thus consolidation reforms were postponed.
  - **Failure of other aspects of land reform** reduces the scope of land consolidation.
  - **Socio-Economic Factors:** Rich and influential often mange to get fertile and well situated land, whereas the poor and uninfluentiel get inferior lands.

## 9. COOPERATIVE FARMING

- Cooperative farming has been advocated to solve the problems created by subdivision of holdings. The idea is that farmers having very small holdings should join hands and pool their lands for the purpose of cultivation.
  - Farmers will be able to pool resources, implements and cultivate jointly and thus can reap the benefit of large-scale farming.
- **Arguments in favor of Cooperative farming: Solving the problems created by small uneconomical holdings.**
  - Small holding can be pooled together with this method and joint cultivation on the pooled land enables the members to reap all benefits of large scale farming.
  - Reduce input cost -> Inputs bought in bulk will cost less
  - Modernize -> Big agricultural implements and machinery like tractors, harvesting machines, etc. which small individual farmers can't purchase can now be purchased on a collective basis by the society and can be rented out to individual farmers.
  - Marketable surplus of food grains and industrial raw materials can be obtained more easily from large farms and can be transported to the market on a bulk basis in an easier way. Thus agriculture surplus can be located and transported more easily.
  - It is also easy to collect agricultural data from large scale cooperatives farms instead of subdivided and fragmented small farms. This increases the reliability and authenticity of agricultural data which is a sine qua non of all good agricultural planning.
  - **Social Cohesion:** Cooperative farming will inculcate, the spirit of cooperation among members of the society which can go a long way in inspiring mutual confidence, collective action, joint thinking, and feeling of fraternity and friendship among members.
  - **Foundation for strong democracy** can be laid by such cooperatives.
    - In recent years, there have been a lot of talk about 'public participation in planning' and 'planning from below'. This will remain mere slogans unless and until the spirit of cooperation develops at the village level.
- **Progress:**
  - In the first three plans, there was a push for cooperative farming through various incentives and facilities for the development of these societies like financial assistance, technical assistance, subsidies, preference in allocation of improved supply of seeds etc. However, the progress was extremely low and as of June 1969 there were only 8,160 such societies with 2,20,047 members.
- **Other limitations:**
  - An analysis by planning commission had found that cooperatives were formed mostly by well-to-do farmers to enjoy the benefits of government initiatives. Very few farming cooperatives are true cooperatives formed by small landholders.
  - **Lack of necessary professional skills:**
    - » Inefficient administration and corrupt practices eroded the confidence of members of the society who were soon disillusioned by the experiment of cooperative farming.
    - » Thus, this led to reversal to individual farming. This failure discouraged other peasants also who were either planning to join the existing societies or to form new societies.

## 10. KEY THINGS WHICH LIMITED THE SUCCESS OF LAND REFORMS

### i. Snags in the legislation:

- **Definition of 'Personal Cultivation'** broadly led to large scale ejection of tenants.
- **Limits for retention of land for personal cultivation:** Intermediaries were allowed to retain substantial areas of land for personal cultivation. This enabled zamindars to resume large areas of land for cultivation defeating the entire purpose of abolition of zamindari system.
- **Transfer of land to family members:** To escape the law related to land ceiling there was large-scale transfer of land to family members. For quite some time there was no law in some states to prevent such transfers.
- **Definition of tenant inadequate:**
  - In some states, sharecroppers were kept out.
  - Further, considerable number of tenancies in India are oral and informal and these tenants are not protected under the law.
- **The problem of voluntary surrender:** Due to the dominant position of the landlord/zamindar
- **Inadequacies in ceiling laws:**
  - The list of exemptions were unduly large.
  - A lot of benami and clandestine transaction had taken place by then.

ii. **Lack of Political Will and determination** on the part of authorities

- Given the tardy progress of land reforms, it seems that governments were not interested in the implementation of the legislation enacted. The structure of grassroot democracy and huge influence of landlord class may have been a strong factor.

iii. **Apathy of Bureaucracy:**

- Most of the officials and bureaucrats also came from the landed class and thus they also sympathized with the landed class more. The rich peasant power not only dominated the state government but also the regional and local administration and serves as the principal instrument of land grabbing and as a strong impediment in the implementation of land reforms.

## 11. LAND LEASING REFORMS NEEDED TODAY

- **Past year Questions**
  - » In view of the declining average size of land holdings in India which has made agriculture non-viable for a majority of farmers, should contract farming and land leasing be promoted in agriculture? Critically evaluate the pros and cons [Mains 2015]
- **Background**
  - » Land leasing laws relating to rural agricultural land in India were overwhelmingly enacted during decades immediately following the independence.
    - Focus on **abolition of Zamindari and Redistribution of Land**.
    - Tenancy and Sub-Tenancy were seen as integral to feudal land arrangements and therefore **discouraged**.
  - » Therefore, state governments brought tenancy law reforms which
    - Focus on transferring ownership rights to tenant.
    - **Prohibited or heavily discouraged leasing** and sub-leasing
    - Imposed ceiling on rent (at 1/4th of the produce)
    - Provided tenant the right to purchase land after specified period of time.
- **Unintended Consequences of above laws**

» **Negative consequence for tenant**

- Contracts became informal and oral i.e. the above laws forced tenant underground. Almost 1/3rd of India's land may be under tenancy but only 10% is under formal mechanism.
- Tenants lost security of tenure

» **Negative Consequence for Owners**

- Felt insecure in leasing the land and thus chose to leave the land fallow. This became increasingly prevalent with landowners and their children seeking non-farm employment.
- As per official records (NSSO, 2012-13), only about 10% of agricultural land is under tenancy, down from 20% in 1953-54.

» **Negative Consequence for Agriculture sector**

- Lack of investment in the land
- Lack of credit availability to tenant farmers

» **Negative consequences for government policies**

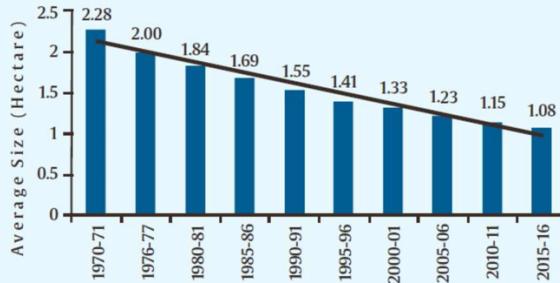
- **Crop Insurance** -> how to ensure that tenant who bears the bulk of the risk of cultivation receives the benefit
- **Disaster Relief** -> How to ensure actual cultivator gets the disaster relief.
- **Direct Benefit Transfer** for e.g. for Fertilizer subsidy
  - Difficulty in identifying real cultivators and therefore intended beneficiary. DBT cannot be satisfactorily implemented.

- **Other benefits which liberal land leasing would have**

- » **Difficulty in land acquisition** under the, 2013 land acquisition law, can be solved. States wishing to facilitate industrialization can benefit from liberal land leasing if they simultaneously liberalize the use of agricultural land for non-agricultural purposes.

- » **Decreasing landholding size** also requires that easy land leasing options should be available.

FIGURE 1: AVERAGE SIZE OF OPERATIONAL HOLDINGS AS PER DIFFERENT AGRICULTURE CENSUS



Source: Agriculture Census, 2015-16 and various issues of NSSO Reports

- **Model Agriculture Land Leasing Act, 2016**

- » The act seeks to permit and facilitate leasing of agricultural land to improve access to land by the landless and marginal farmers.
- » It also enables recognition of farmers cultivating on leased land to enable them to access loans through institutional credit.
- » **Key Provisions**

- Ownership rights protected
- Right of tenant to cultivate the land for the leased period protected
  - Tenant eligible to raise loans without mortgaging the leased in land
  - Entitled for compensation from owner for any improvement investment on land.
- Ban on sub-leasing -> to prevent misuse

- **Way Forward**

- » The introduction of transparent land leasing laws that allow the potential tenant or sharecropper to engage in written contracts with landowner is a win-win reform.
  - Long term investment
  - Landowner would not be apprehensive of losing the land
  - Government will be able to implement its policies efficiently
  - Will ensure availability of land for landless and small and marginal farmers.
- » A potential hurdle to the land leasing reform laws is that landowners may fear that a future populist government may use the written tenancy contract as the basis of transfer of land to tenant and therefore would oppose the reform.
  - This is a genuine fear and may be addressed by give landowners indefeasible titles.
- » **State governments must seriously consider revisiting their leasing (and land use) laws** to determine if they could bring about the simple but powerful changes provided in the Model Agricultural Land Leasing Act, 2016 to enhance productivity and welfare all around.

## 12. CONTRACT FARMING

- **Example Questions**
  - » "In spite of many advantages associated with contract farming, the practice is not very popular in India" Give reasons. [10 marks, 150 words]
  - » Critically analyze the provisions of the Model Agriculture Produce and Livestock Contract Farming and Services (Promotion and Facilitation) Act, 2018. [15 marks, 250 words]
- **Introduction**
  - » Contract Farming refers to a system of farming, in which bulk purchasers including agro-processing/exporting or trading units enter into a contract with farmer(s), to purchase a specified quantity of any agricultural produce (including livestock and poultry) at pre-agreed prices.
  - » Studies by Food and Agriculture Organization (FAOs) show that contract farming can indeed benefit both parties by increasing efficiency, productivity and farmer's income, while at the same time giving private player a larger say in farming methods, type and quality of produce.
- **Advantages of Contract Farming**
  - » **For Buyers** it ensures quality product availability and price stability.
  - » **For producers** it reduces the risk of fluctuation in market price and demand. Research have shown that contract farmers earn considerably more than non-contract farmers.
  - » **Increases private participation** in agricultural reforms.
  - » Contract farming also **improves the quality of input** as the producer get support from the buyer in the form of technology, pre-harvest and post-harvest support etc.
  - » It **reduces the subsidy burden** on government on procurement.

- **Situation in India**
  - » Despite the above advantages, the Contract farming is not very common in India.
  - » The 2003 model law provided for contract farming, but it suffered from various limitations including APMCs being designated as authority of registration and dispute; provisions for stockholding limits on produce limited the participation by bigger players and finally poor awareness/publicity about contract farming and its benefits among farmers.
  - » **2018 Model Law** tried to bring some changes but wasn't very effective.
  - » **2020 Ordinance and law** - withdrawn in 2021
    - This law tried to bring some simplification and protection for farmers, but had to be withdrawn because of farmer protests.

- **Conclusion**
  - » While contract farming, if implemented wisely, does have the potentials to alleviate the sufferings of India's farmers, improved yields, and greater technology transfer, it is imperative that the state government takes a cautious, research backed approach and implements the model law with modifications suitable for the state.

## 13. LAND POOLING POLICY

- **Example Question**
  - » "A transparent and well regulated Land Pooling system has the potential to solve the problems associated with the current Land Acquisition Framework" Critically Analyze [15 marks, 250 words]
- **Background**
  - » India is a country with high population density and huge land scarcity. Therefore, land acquisition is slowly becoming more and more difficult and it is hindering developmental activities. Further, the land acquisition system had also become unpopular due to complaints of low compensation and forceful acquisition. The system of land pooling comes as a ray of hope in this scenario to ensure that the developmental activities are not hindered and the original land owners are also satisfied.
- **What is Land Pooling?**
  - » Under Land Pooling Policy, a development agency pools land parcels owned by individuals, a group of owners or a builder. Then it develops the land and returns a part of it to the original owners. In this way, the land is made available for development work and a part of developed land returned to owner is worth more than the original value of the land, thus satisfying the original owners.
- **Advantages of Land Pooling Policy**
  - » **Unlocking huge parcel of land for development** -> Land Acquisition is becoming unattractive for people and this may appear as an alternative and attractive option.
    - This would also contribute to reducing stress on already developed area and may also restrict price escalation in these areas.
    - It thus emerges as an **transformative step for urbanization**.
  - » It also **promotes public-private partnership and trust** -> this is due to wider community participation in the whole process of land pooling, development and return of ownership.

- » **Aggregates small land piece** for bigger projects. This leads to more efficient utilization of land.
- » **Reduced initial cost for development authority** -> As there is no need of buying the land for the developmental projects
- » **Less conflict ridden** as is the case of Land Acquisition due to inadequate compensation, consent, process etc.
- » **Original Owners** will also be benefitted as the land returned to them, though smaller in size, have access to infrastructure and services which increases the value of the land drastically. Further, the landowners are not displaced in the land pooling scenario.

- **Concerns**

- » **Poor System of land records** can be concern here. As participation in land pooling is dependent on the owner having proper land ownership documents.
- » In case of pooling for Amravati even **fertile agricultural land** was also pooled.
- » Unlike land acquisition, the provisions for the **social or environmental impact assessment is absent** in case of land pooling. Therefore, the impact on landless laborers and on environment are generally ignored or very meagre compensation is paid to landless workers.
- » There have been instances of mandatory land pooling. For e.g. in case of Navi Mumbai Airport Land Pooling, the pooling was made mandatory because of the delays in the process.

- **Way Forward**

- » There is a need of a **transparent regulatory frameworks with statutory backing** to ensure that the land pooling process is transparent, consensual and doesn't use agricultural or environmentally sensitive zones. Further, this framework should also provide for mandatory social and environmental impact assessments before the beginning of the developmental work.

- **Conclusion**

- » Land Pooling if done on non-agricultural land (for e.g. in urban villages) and along with social and environmental impact assessments, can emerge as a tool of transformative urban development which is beneficial for all the three parties i.e. the land owners, the private sector and the government. Land owners get better value and better quality of land, private players are able to participate in commercial and developmental process and the government is able to facilitate development.



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### JUNE 2023- BOOKLET-1

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### 1) SEDITION

- **Why in news?**
  - The 22nd Law Commission has recommended that Section 124A of the Indian Penal Code (IPC) dealing with offence of sedition be retained and that the minimum jail term for the offence be enhanced from three to seven years (June 2023)
- **Example Questions**
  - Discuss the provisions and scope of Section 124A of the Indian Penal Code (IPC) pertaining to sedition. Examine its constitutionality in light of freedom of speech and expression [15 marks, 250 words]
  - In light of the recent report by 22nd Law Commission of India, evaluate the need for legislative reforms or amendments to the sedition law in India [10 marks, 150 words]
- **Intro**
  - **Definition:** Conduct or speech inciting people to rebel against the authority of a state or monarch can be considered as sedition.
  - **Section 124A of IPC** defines sedition as "any action whether by words, signs or visible representation which brings or attempts to bring into hatred or contempt, or excites or attempt to excite disaffection towards the Government established by law in India". The section also contains a clarification to the effect that the word "disaffection" includes disloyalty and all feelings of enmity.
    - Under this section, Sedition is punishable with imprisonment for life.
- **Evolution of Sedition Law from the beginning**
  - Not a part of original IPC enacted in 1860.
  - Added a decade later as fears of possible uprising plagued the colonial authorities.
    - Note: Other laws to suppress dissent at that time -> Dramatic Performance Act, 1876 and the Vernacular Press Act, 1878.
  - **The British India government liberally used this provision** during India's freedom struggle to suppress any kind of dissent.
  - **Constituent Assembly:** An attempt to include sedition as an express ground for limiting speech under Article 19(2) was successfully resisted.
  - The law was in a way reimposed in 1951 through First Constitutional Amendment which added two expressions - "friendly relations with foreign state" and "public order" - as grounds for imposing "reasonable restrictions" on free speech.
  - A **Constitutional Bench of the Supreme Court upheld** the validity of Section 124-A in the celebrated case of **Kedar Nath Singh vs. State of Bihar in 1962** but at the same time **attempted to restrict the scope of its misuse**.
    - The Court upheld the right to comment in strong terms upon the measures or acts of **government** and laid down that that a person can be charged with **sedition only if there is incitement to violence in his speech or writing or an intention or tendency to create disorder or disturbance of law and order**.

- The court said "A citizen has a right to say or write whatever he likes about the Government, or its measures, by way of criticism or comment, so long as he does not incite people to violence against the Government established by law or with the intention of creating public disorder"
- In the **Menaka Gandhi** case of 1978, the Supreme Court held that criticizing and drawing opinion against the government's policies and decisions within a reasonable limit that does not incite people to rebel is consistent with the freedom of speech.
- **Inspite of these Supreme Court verdicts**, the law continues to be misused.
  - NCRB report says 356 cases of sedition under Section 124A of the IPC has been registered and 548 people arrested between 2015-2020, with just six convictions.
- **The supreme court** has to pitch in regularly to protect citizen's freedom of speech being suppressed by the sedition law. For e.g.
  - In March 2021, while hearing a plea to "terminate" the Lok Sabha membership of **Dr. Farooq Abdullah** and book him for sedition, the court held that voicing dissent against government doesn't amount to sedition.
  - In June 2021, a two-judge bench of the Supreme Court quashed a sedition case registered against journalist and Padma Shri awardee **Vinod Dua** for his critical remarks against the Prime Minister and Union government in a Youtube telecast.
- **Analysis: Criticism**
  - » **Too Broad and vaguely worded definition** is used to suppress liberty of citizens and Criminalize dissent.
    - This vagueness was misused to suppress dissent and imprison freedom fighters such as Mahatma Gandhi and BalGangadhar Tilak who criticized the policies of the colonial administration.
    - This reduces government accountability as the government is able to ignore its critics and in turn charge them with sedition.
  - » **Very strict nature** of the law - non-bailable, cognizable and punishment that can extend to life - has a strong chilling effect on free speech and dissent.
    - Note: "**Doctrine of Chilling Effect on Speech** considers the probability of a legal provision causing psychological barriers in the free exercise of the right"
    - Critics of the sedition law argue that this doctrine was not sufficiently developed in 1962 and thus the Kedarnath Singh Judgment should be revised.
      - E.g. After Hathras gang rape case 22 sedition cases were filed. "Vinod Dua" - a journalist was charged with sedition for criticizing governments activities during COVID-19 lockdown.
  - » **Scope of misuse of Law as Political Tool:**
    - Gandhi had said "*Section 124-A under, which I am happily charged, is perhaps the prince among the political sections of the IPC designed to suppress the liberty of citizen*".
    - More than 20 cases were filed under sedition law after the CAA protests.

- » Trial Courts have mostly ignored the 1962 Supreme Court Judgment and have imposed the law even in cases where there was no incitement to violence or attempt towards public disorder.
  - » Sedition is not one of the grounds for reasonable restrictions on free speech provided under Article 19(2).
  - » Law commission of India in a consultation paper, in Aug 2018 observed that berating the country or a particular aspect of it cannot be treated as “sedition” and the charge can only be invoked in cases where the intention is to overthrow the government with violence and illegal means.
  - » UK, which introduced sedition in India, have also abolished it.
    - In fact, in March 2023, even Lahore High Court in Pakistan annulled the offence of 'Sedition' in the Pakistan Penal Code.
  - » Our Criminal law is equipped with other provisions to deal with most of the violations as defined right now under sedition
- **Support of the law**
- » Supreme court has upheld constitutionality of the law. Without sedition, the state would be in jeopardy if the government was subverted.
  - » Law itself might not be problematic, but its implementation is.
  - » Misuse of the law doesn't invalidate it.
  - » Country faces many threats - Terrorism, Naxalism, Enemy states etc. and thus a strong law preventing incitement of violence against state is important to protect unity and integrity of the country.
- **Supreme Court puts the Sedition Law on Hold (May 2022)**
- » A three-judge bench of the Supreme Court has suspended pending criminal trials and court proceedings under Section 124A (sedition) of the IPC till the Centre completes its exercise in re-examining its provisions.
- **22nd Law Commission of India on Section 124A of IPC: Key Recommendations:**
- » The commission recommended that the law should not be repealed but it should be retained with some changes.
    - Why?
      - A necessary legal instrument in the face of threats to India's Internal Security including Maoism, Militancy, secessionist movements etc. The report also quotes NSA Ajit Doval on wars against Invisible Armies, and on a "civil society" that can be subverted, divided and manipulated to hurt the interest of the nation.
      - Allegation of misuse don't automatically justify the repeal of the Section 124A.
      - Further, in the absence of provisions like Section 124A of IPC, any expression that incites violence against the government would invariably be tried under special laws and counter-terror legislation, which contain much more stringent provisions to deal with the accused.
      - While any alleged misuse of section 124A of IPC can be reined in by laying down adequate procedural safeguards, repealing the provisions altogether can have "serious adverse ramifications for the security and integrity of the country", while the subversive forces getting a free hand to further their sinister agenda as a consequence.

- » It has recommended that the **following amendments be made to Section 124A of IPC:**
  - **Include the Kedarnath ruling into the provisions of the law** by adding the words "with the tendency to incite violence or cause public disorder". The report also defines the tendency to incite violence as a "mere inclination to incite violence or cause public disorder rather than proof of actual violence or imminent threat to violence".
  - **Enhancing the imprisonment for sedition** to "remove an oddity"
    - One of the criticisms against the provision is that it **leaves judges with wide discretion on sentencing**.
    - Section **124A has a jail term of up to three years or life imprisonment**. It means either imprisonment for life or imprisonment upto three years only, but nothing in between.
    - The **law commission** has now proposed enhancing the jail term upto seven years or life imprisonment.
  - **To prevent the misuse of the law**, the report suggested including a procedural safeguard that no FIR shall be registered for sedition "unless a police officer, not below the rank of inspector, conducts a preliminary inquiry and on the basis of the report made by the said police officer the Central Government or the State government, as the case may be, grants permission for registering a FIR.
  - Other general suggestions:
    - The police should not use Section 124A to stifle dissent or criticism of the government.
    - The courts should interpret Section 124A narrowly and should not convict a person under this section unless there is clear and convincing evidence that the person has committed the offence.

- **Analysis: Criticism:**

- These recommendations are a step backwards.
  - The Supreme Court in May 2022 had stayed the law and expressed strong reservation and indicated that it could hear arguments in favor of striking down the colonial provision that has proved to be prone to misuse.
  - The report doesn't engage seriously enough with criticism of the sedition provision, including concerns expressed by the Supreme Court.

- **Way forward**

- **Parliament** should do an exhaustive re-examination of the law to determine if it will be appropriate or not to continue the usage.
- **Clarifications given by Supreme Court in Kedarnath case and Law Commission of India should be strictly followed** - "section 124A applies only when there is violence or incitement to violence"

against government". These provisions should be introduced through an amendment to the bill as suggested by 22nd Law Commission of India.

- Simplify the definition to prevent its misuse for curbing dissent and for political reasons.
- Reduce the severity of the law - make it bailable, non-cognizable etc.
- A sign of mature republic is its willingness to stand up to scrutiny by its citizens and accommodate dissent and criticism of the government should not be construed as sedition.

- **Conclusion1 (Supporting the law)**

- The word sedition is extremely nuanced, and the law needs to be applied with caution. It should only be used against serious cases which involves provocation to raise arms against government, demand for separate country etc. But, the legal system needs sedition provision (with some amendments), mostly to act as a deterrent, and on occasion to use against serious offenders.

- **Conclusion2 (Critical of the law)**

- Personal Liberty and Right to Free Speech are hallmarks of liberal democracy and sedition laws and their gross misuse attack the very foundation of these liberties enshrined in the Indian Constitution. The need of the hour requires the judiciary to review the colonial law.
- Even if abolishing of the law is not feasible, it should be toned down and string guidelines should be issued to limit its indiscriminate abuse of the law. This will not only help India's democratic standing but would also safeguard freedom of expression in the country.

### 1) ECONOMY: FOREIGN TRADE POLICY, 2023

- **Why in news?**
  - » On 31st March 2023, Ministry of Commerce and Industry announced India's Foreign Trade Policy 2023 and it came into force from 1st of April 2023.
- **Example Questions:**
  - » What are the key objectives of India's Foreign Trade Policy, 2023? Highlight some of the challenges to the implementation of this policy. Suggest measures to make this policy more effective in boosting India's exports [15 marks, 250 words]
- **Introduction:**
  - Foreign Trade Policy (FTP) refers to a set of guidelines, regulations and measures formulated by a government to govern its international trade.
- **FTP, 2023** is a policy document which is based on continuity of time tested schemes facilitating exports as well as a document which is **nimble and responsive** to the requirements of trade.
- **The Key Approach** to the policy is based on these **4 pillars**:
  1. Incentive to Remission
  2. Export Promotion through collaboration - Exporters, States, Districts, Indian Missions
  3. Ease of Doing Business, reduction in transaction cost and e-initiatives.
  4. Emerging Areas - E-commerce, Developing Districts as export Hubs and **streamlining SCOMET Policy**.
    - Note: SCOMET stands for Special, Chemicals Organisms, Materials, Equipment, and Technologies (SCOMET) policy.
- **Key Aims and Objectives** of India's FTP, 2023 are:
  - » Boost India's exports to USD 2 trillion by 2030.
  - » Strengthen India's export competitiveness.
  - » Diversify export basket, expand export market, and promote sustainable exports.
  - » Focus on promoting exports from small and medium enterprises (SMEs). For this policy envisages support in the form of access to finance and markets.
  - » Provide incentives for exporters, including duty drawback, export promotion capital goods (EPCG) scheme, and interest subvention schemes.
  - » Encourage collaboration between exporters, states, and districts to promote exports.
  - » Simplify and streamline the process of exporting goods and services:
  - » Focus on emerging areas of export, such as e-commerce, green technology, and defence and aerospace. These are the areas where India has a competitive advantage, and the policy aims to help businesses take advantage of these opportunities.
- **The Policy aims to boost India's exports through several measures:**
  - » Process Re-engineering and Automation (technology enablement) for facilitating exporters.

- » **Expanding the scope of Town of Export Excellence (TEE)** by including Faridabad, Mirzapur, Moradabad and Varanasi in the existing list of 39 towns listed as Towns of Export Excellence (TEE).
  - **Note:** Under this scheme recognised associations of units are provided financial assistance under the Market Access Initiative Scheme on a priority basis, for export promotion projects for marketing, capacity building and technological services, and to visit various trade exhibitions/fairs for exploring more marketing avenues
- » **Promoting Exports from districts** by building partnerships with state government and taking forward the District as Export Hubs initiative to promote exports at the district level.
  - Institutions like State Export Promotion Committee and District Export Promotion Committee will identify export worthy products and services.
  - District specific export action plans will be prepared for each district.
- » A robust export control system in India would provide access of dual use High end goods and technologies to Indian exporters while facilitating exports of controlled items/technologies under **SCOMET** (Special Chemicals, Organisms, Materials, Equipment, and Technologies) from India.
- » **Facilitating E-Commerce Exports** through establishment of e-commerce hubs and other related elements.
  - The consignment wise cap on E-commerce exports through courier has been raised from Rs 5 Lakh to Rs 10 lakh.
  - A comprehensive e-commerce policy addressing export/import ecosystem is planned to be brought soon.
- » **Export Promotion of Capital Goods (EPCG) Scheme** has been rationalized.
  - Prime Minister Mega Integrated Textile Region and Apparel Parks (PM MITRA) scheme has been added as an additional scheme eligible to claim benefits under CSP(Common Service Provider) Scheme of Export Promotion capital Goods Scheme(EPCG)
  - Battery Electric Vehicles (BEV) of all types, Vertical Farming equipment, Wastewater Treatment and Recycling, Rainwater harvesting system and Rainwater Filters, and Green Hydrogen are added to Green Technology products – will now be eligible for reduced Export Obligation requirement under EPCG Scheme.
- » **Introduction of provisions for merchanting trade.**
  - **Note:** Merchanting trade involves shipment of goods from one foreign country to another foreign country without touching Indian ports, involving an Indian intermediary.
- » **Amnesty Scheme** to provide relief to exporters who have been unable to meet their obligations under EPCG and Advance Authorization schemes. This will reduce litigations and foster trust based relationship.

- **Challenges:**

- » **Global Economic Uncertainty:** The global economy is facing a number of challenges, including the COVID-19 pandemic, the Russia-Ukraine war, and rising inflation. These challenges could impact India's exports, as they could lead to lower demand for Indian goods and service.
  - » **Competition** from other emerging economies : Countries like China, Vietnam etc are also competing to increase its export base and may become a hurdle in India's achievement of its export targets
  - » **Domestic challenges** such as infrastructure bottleneck, regulatory hurdles, lack of skilled workforce and high cost of logistics may also become a hindrance to India's exports.
- **Way Forward:**
- » **Increased government support** to exporters in the form of access to finance and market.
  - » **Improvement in infrastructure** such as roads, railways, airways etc for easier and faster export of goods and services.
  - » **Streamlined regulations** related to customs and taxation.
  - » **Increased investment in R&D** for development of innovative products and services fulfilling the global demands.
  - » **Promoting Brand India** in global market. This will attract foreign buyers and increase demand for Indian goods and services.
- **Conclusion1:**
- » Overall, the Foreign Trade Policy 2023 is a comprehensive and ambitious document that has the potential to boost India's exports and promote economic growth. Though, it faces some challenges, but with strong political will, and collaboration with various stakeholders, these challenges could be overcome.
- **Conclusion2:**
- » The new FTP is a shift from an incentive based approach and creates an enabling ecosystem for exporters, which is a move in line with India's vision of becoming 'Atmanirbhar' (self-reliant).

## 2) ECONOMY: FOREIGN TRADE POLICY, 2023 AND E-COMMERCE

**Question:** "The Foreign Trade Policy, 2023 approaches digitally enabled cross-border trade in an inclusive manner and seeks to make small players part of India's exports" Elaborate [10 marks, 150 words]

- **Introduction:**
- » India's e-commerce market is one of the largest in the world. It has been made possible due to increase penetration of smart phones, internet and digital payment systems. However, when it comes to e-commerce exports, it accounts for only a very small fraction of India's total exports.
  - » But, FTP, 2023 looks to change this and increase India's e-commerce exports by enabling vendors to access the international markets.
- **Key provisions related to e-commerce in FTP, 2023**
- » The new section on 'Promoting Cross Border Trade in Digital Economy' gives a fillip to e-commerce exports in the following ways:
    - Extending all FTP benefits to e-commerce exports
    - Increasing the value limit for exports through couriers to INR1,000,000 per consignment

- Promoting e-commerce through the **postal routes**: Government aims to operationalize '**Dak Niryat Kendras**' to "work on a hub and spoke model with Foreign Post Offices (FPOs) to facilitate cross border e-commerce and to enable artisans, craftsmen and MEMEs in the hinterland to reach international market.
- The policy also proposed to create E-Commerce Export Hubs (ECEHs), which would act as a centre for favourable business infrastructure and facilities for cross border e-commerce activities. These hubs would provide the necessary infrastructure for exports, and also connect to and leverage the services of the nearest logistics hubs.
- **Handholding and outreach schemes** to small players on how to use e-commerce platforms effectively.

- **Conclusion:**

- E-commerce platforms for exports can serve as a democratized marketplace that allows small vendors, MSMEs, and local artisans to access international market and retain higher profit margins. This will not only boost India's exports but will also lead to inclusive growth and development.

### 3) ECONOMY: FOREIGN TRADE POLICY, 2023 AND DISTRICTS AS HUB OF EXPORTS

**Ques:** Discuss the role of Foreign Trade Policy 2023 in galvanizing districts of the country to become export hubs [10 marks, 150 words]

- The Foreign Trade Policy, 2023 was launched with the goal of boosting exports to the USD 2 trillion by 2030. Towards achieving this goal, one of the sections of the FTP aims to galvanize districts of the country to become export hubs.
- It is being done in the following ways:
  - **Identifying products and services** with export potential in the district
  - The policy proposes to do so by creating District Export Promotion Committees (DEPC) and creating District Export Action Plans for each district.
  - The interventions at the district level can generate awareness and help small vendors to access bigger markets.
  - Further, steps such as promotion of exports through e-commerce and promotion of exports from MSME will also contribute to development of small towns and districts as export hubs.
  - Lastly, the FTP has declared four new 'Towns of Export Excellence' (TEE)[Faridabad-Apparel, Moradabad-Handicraft, Mirzapur - Handmade carpet and Dari, Varanasi - Handloom and handicraft] [in addition to existing 39 TEEs] with the objective of moving up the value chain and tapping into new markets.
- These initiatives are thus in sync with the spirit of '**Local goes Global**' and '**Vocal for Local**'. But to make these initiative successful, it is important to focus upon:
  - Improving export infrastructure and regulations in every district and town.
  - Studying global quality standards and bringing Indian standards in sync with global standards

- Take a few more points for way forward from the main FTP Article.

## 4) S&T: SPACE: NAVIC AND NVS-01

- Why in news recently?
  - ISRO's GSLV-F12 successfully places navigation satellite NVS-01 into intended orbit (May 2023)
- Example Questions
  - What do you understand by 'Standard Positioning Systems' and 'Precision Positioning Systems' in the GPS era? Discuss the advantages India perceives from its ambitious IRNSS program employing just seven satellites [Mains 2015, 12.5 marks, 200 words]
  - Why is Indian Regional Navigational Satellite System (IRNSS) needed? How does it help in navigation? [Mains 2018, 10 marks, 150 words]
  - What is satellite navigation? Discuss the key economic and social uses of Satellite navigation. [10 marks, 150 words]

### A) BASICS ABOUT SATNAV

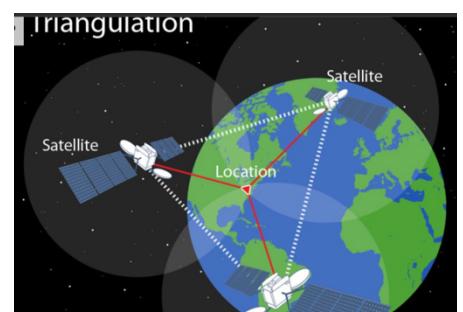
- A satellite navigation (SATNAV) system is a technology that allows users to determine their precise location, velocity, and time information anywhere on or near Earth's surface.
- It uses a network of satellite in space and provide accurate positioning data.
- Currently, there are four global satellite-based navigation system – the American GPS, the Russian GLOASS (GLObalnaya NAvgatsionnaya Sputnikovaya Sistema), the European Galileo and the Chinese BeiDou.
- India has a regional system called NavIC and Japan has Quasi Zenith.

#### - Methods used in SATNAV: Triangulation and Trilateration

**Triangulation:** Satnav systems use a technique called triangulation to determine the precise location of a receiver on the Earth's surface.

It is a geometric method that uses the angles formed by lines connecting the receiver to multiple satellites to determine the receiver's position.

By measuring the time it takes for signals to travel from multiple satellites to the receiver, the system can calculate the receiver's position based on the intersection of the satellite signals



**Trilateration:** GPS receiver use the method of trilateration. Trilateration involves measuring the distance between your GPS receiver (e.g. a smartphone) and multiple satellite in the network. Each GPS satellite broadcasts a signal that includes a timestamp and information about its location. Our GPS receiver picks up these signals and use the timestamp to calculate the distance between itself and each satellite.

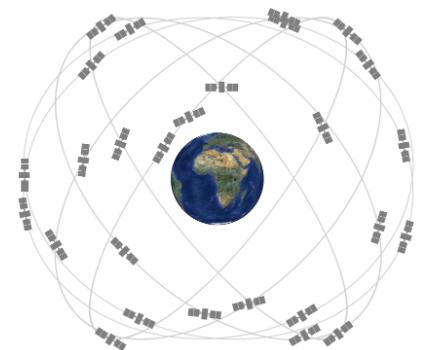
Using the distance from at least four satellites and their known positions, your GPS receiver performs calculations to determine your precise location on earth.

[Please note that GPS doesn't use triangulation (which measure angles), they really don't use angles at all].

- **Accuracy:** They generally provide high levels of positioning accuracy (within a few meters), depending on the quality of receiver and the number of satellites in view. However, various factors such as signal obstruction, atmospheric conditions, and receiver limitations can affect the accuracy.
- **Applications: Navigation purposes** -> helping users find their way while driving, hiking, or boating. It is also used in aviation, surveying, geolocation-based services, precision agriculture, and even in some outdoor recreational activities. It can be used for vehicle tracking, fleet management, precise timing etc.

## B) GLOBAL POSITIONING SYSTEM (GPS)

- The best-known satnav system, GPS, uses 24 active satellites (including backups). Day and night, 365 days a year, they whiz around earth once every 12 hours on orbital plane inclined 55 degrees to the equator.
- Wherever you are on earth, you are in sight of at least half a dozen of them, but **you need signals from 3 or 4 satellites** to determine your position with an accuracy of just a few meters.
- **How GPS Finds your location?**
  - It uses **Trilateration**
- **GPS Constellation arrangement**
  - » GPS constellation fly in medium earth orbit (MEO) at an altitude of approx. 20,200 kms. Each circle orbits the earth twice a day.
  - » The satellites are arranged in six equally placed orbital planes surrounding the earth. Each plain contains four slots occupied by baseline satellites. This 24-slot arrangement ensures users can view at least four satellites from virtually any point on the planet.



## C) BEIDOU

- **Details**
  - China initiated Beidou in 1994 with first BeiDou satellite launched in 2000.
    - **Second generation BeiDou (BDS-2)** provided coverage to Asia Pacific region starting in 2012.
    - **Third generation BeiDou** (BDS-3) satellite deployment started in 2015 and it started providing navigation services in 2018 to countries taking part in BRI. In 2020, the system has been completed and it can now provide global services. With this they have joined United States' GPS and Russia's GLONASS in providing global PNT services, with Europe's Galileo to follow. These are all compatible and interoperable, meaning users can draw services from all of those to improve accuracy.
- **Satellite Constellation**

- **24 satellites in Medium Earth Orbit** (around 21,500 kms above the earth) provide the positioning, navigation, and timing (PNT) services. These satellites use rubidium and hydrogen atomic clocks for highly-accurate timing that allows precise measurement of speed and location.
- **Satellites in geosynchronous Orbit** (including Geo-stationary orbit) help BeiDou provide short messaging service through which 120-character messages can be sent to other BeiDou receivers.
  
- **Plans of Expansion:**
  - In Nov 2022, China outlined plans to further expand the global reach of its home grown BeiDou satellite navigation system.
    - a. **Pakistan** in 2014 became the first foreign country to set up a BeiDou network.
    - b. **BeiDou** has set up a first of three Continuously Operating Reference Stations (CORS) for its network in Thailand in 2013, to serve as a hub for ASEAN.

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#### D) NAVIC (NAVIGATION USING INDIAN CONSTELLATION)

- Indian Regional Navigation Satellite System (IRNSS) (also called Navigation Using Indian Constellation (NAVIC)), is a regional satnav system developed by ISRO. It aims to provide reliable position, navigation and timing (PNT) services over India and its neighbourhood, upto 1500 km from its boundary. In addition it is also capable of broadcasting messages. This can be used for broadcasting safety-of-life alerts in areas with poor or no communication, particularly in Ocean.
  
- **Need of IRNSS** when services like GPS are easily available.
  - The access to foreign controlled global navigation satellite systems is not guaranteed in hostile situations, as happened to Indian military depending on American GPS during **Kargil War**.
  
- **NAVIC provides two types of services:**
  - » **Standard Positioning Service** (Open for Civilian Use)
  - » **Restricted Services** (Encrypted one, for authorized users (military))
  
- **Components of IRNSS System:**
  - » Space segments consists of **7 satellites, 3 satellites in GEO stationary orbit (GEO) and 4 satellites in GEO synchronous orbit(GSO)** with inclination of **29 degree** to the equatorial plane.
  - » All the satellites will always be visible in the Indian region.



- » **First of the 2<sup>nd</sup> generation satellite – NVS-01** was successfully launched in May 2023
  - ISRO's **GSLV F12** (GSLV-MK-II mission) successfully places navigation satellite NVS-01 into intended orbit.
  - **About GSLV F12:**
    - » It is the 15<sup>th</sup> flight of India's GSLV and the 9<sup>th</sup> flight with indigenous cryo stage.
- **About NVS-01:**
  - » **Heavier:** It weighs 2232 kg and has been placed in geosynchronous orbit (older IRNSS satellites weighed 1,425 kg)
  - » **Indigenous Atomic Clock:** For the first time, the satellite carries an indigenous atomic clock. The space qualified Rubidium atomic clock has been indigenously developed by Space Application Centre – Ahmedabad.
  - » **L1 signals for better use in wearable devices:** The second generation satellites have send signals in a third frequency, L1, besides the L5 and S frequency signals that the existing satellites provide. This will increase operability with other satellite based navigation systems. L1 frequency is the most commonly used in the GPS and will increase the use of NavIC in wearable devices which use low power signal frequency chip.
  - » **Longer Mission Life** of 12 years (earlier NavIC satellites have a mission life of 10 years).
- **Criticism of NaVIC:**
  - **Delay in developing user receiver:** A 2018 report by the CAG of India has said that even though the cabinet cleared funding of Rs 200 crore to develop user receivers in 2006, work on the project started only in March 2017, by which time seven launches of NavIC was already done.
- **Current Situation (June 2023)**
  - The receivers have now been deployed, and NavIC is in use for projects like public safety, power grid synchronization, real-time train information system, and fishermen's safety.

- Other upcoming initiatives (such as) common alert protocol based emergency warning, time dissemination, geodetic network, unmanned aerial vehicles are in the process of adopting NavIC system.
- Some cell phone chipsets build by Qualcomm, MediaTek integrated NavIC receivers in 2019. Some example phones which are NavIC enabled include Redmi Note 9, realme 6, the OnePlus Nord etc.

- **Way Forward:**

- **Promoting the Use of IRNSS:**
  - **NavIC** chip -> affordable
  - **Spreading awareness** -> Positional accuracy better than 20 m and timing accuracy better than 50 ns (20);
  - **Make compulsory for** phones marketing in India: Mobile phones haven't been made compatible to process its signals.
  - **Government apps** -> start using NavIC for various purpose.
  - HEIs -> Promote use in Labs, among students etc.
- **Fast track** the plans for making NavIC global
- The next generation NVS series of satellites will make the NavIC more versatile and promote ease of use.

### 3. PRELIMS FACTS

#### 1) PLACES IN NEWS: KAFUE NATIONAL PARK (ZAMBIA)

**Kafue National Park:** Lion and Leopard populations have begun rebounding in Africa's **third** largest national park - **Zambia's Kafue National Park (KNP)** -after fifty years of poaching, according to a new report from **Panthera**, the global wild cat conservation organizations, and partners.

##### Factors:

1. **Counter Poaching Operations:** Game changing conservation technologies like **SMART** (Spatial Monitoring and Reporting Tool) and **EarthRanger** were employed in these operations.
2. **Effective Prosecution**
3. Distribution of **synthetic 'heritage Furs'** replacing garments made of authentic leopard and lions skin

**Other details about KNP:** KNP sits within the **Kavango Zambezi Transfrontier Conservation Area (KAZA)**, the largest terrestrial conservation landscape in the world spanning five countries (**Angola, Botswana, Namibia, Zambia, and Zimbabwe**)



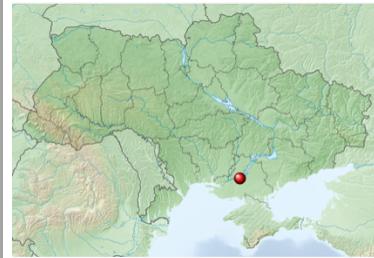
#### 2) PLACES IN NEWS: NOVA KAKHOVKA RESERVOIRS (DAM):

##### Nova Kakhovka Reservoir (DAM):

The Kakhovka Dam was a dam on the **Dnieper River** (also known as Dnipro) in **Kherson Oblast**, Ukraine. It is a **soviet era** dam and was **destroyed** in June 2023.

This breach has **unleashed flood water in the war zone**. Both, Ukraine and Russia have conflicting accounts on who destroyed it.

This Dam is part of **Kakhovka** hydro-electric power plant. It supplies water to **Crimean Peninsula**, which Russia annexed in 2014, and to the **Zaporizhzhia nuclear power plant**, which is also under Russia control.



Location of Kakhovka Dam in Ukraine

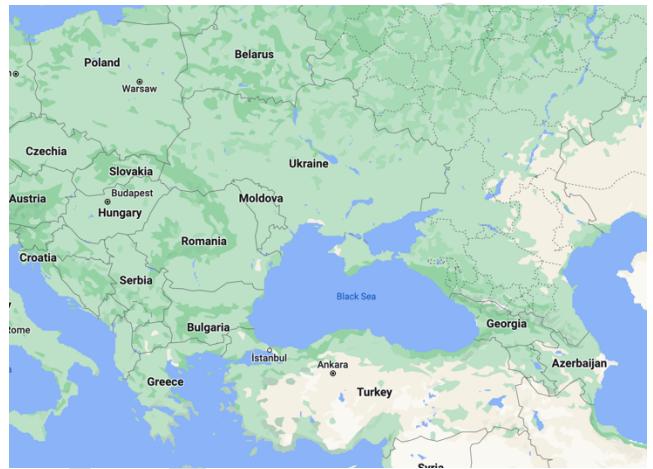


**The Zaporizhzhia Nuclear Power Plant** is the largest nuclear power plant of Europe. It gets its cooling water from Kakhovka Reservoir. It is located on the southern side, now under Russia control.

## A) UKRAINE

### Geographical Details

- Ukraine is a country in Eastern Europe. It is the second largest country in Europe after Russia.
- **Neighbours:** It shares its borders with Hungary, Slovakia, Poland to the West, Belarus to North, Russia to North, Northeast and East and Moldova and Romania to the South.
  - **Trick:** Hungry, Slow, Polar, Bear of Russia are Roaming in Moldova.
- **Coastline:** the country has coastline along the sea of Azov and Black Sea.



### Recent Political Events:

- Ukraine gained its independence in 1991 after dissolution of Soviet Union. Ukraine declared itself a neutral state, forming limited partnership with both Russia and NATO.
- In 2014, Kremlin leaning Ukrainian President Viktor Yanukovych rejected an association with the European Union (EU) in favor of close ties with Moscow. This resulted in a series of protests across Ukraine, ending with Yanukovych's removal from power the same year.
- Mass protests and demonstrations known as the Euromaidan erupted, escalating into the Revolution of Dignity that led to the establishment of new government. These events led to Russia annexing Crimea and a war in Donbas against Russian backed separatists, culminating in Russian invasion of Ukraine in 2022.

## Donbas Region

The Donetsk and Luhansk region of Ukraine is collectively called the Donbas.

**Strategic significance of Donbas region:** Donbas can act as a corridor between Russia and Crimea (and by extension, the strategically significant port of Sevastopol).

The population of this region is more Pro-Russia and thus a war has been going on since 2014 against Russia-backed separatists in the region.



**On 21<sup>st</sup> Feb 2022, Russia officially recognized the DPR (Donetsk People's Republic) and LPR (Luhansk People's Republic) and on 24<sup>th</sup> Feb launched a full-scale invasion of Ukraine.**

## Kherson

It is a port city of Ukraine that serves as the administrative centre of Kherson Oblast. It is located on the black sea and on the Dnieper River.

Kherson's administrative centre is Kherson City. It was occupied by Russia from March 2022 to Nov 2022, when the Ukrainian forces recaptured it. In June 2023, the city was flooded following the destruction of the nearby Kakhovka Dam.

## Mariupol

It is a city of the north coast of the Sea of Azov at the mouth of Kalmius river. While internationally recognized as in Ukraine, the city is under the de facto administration of the Donetsk People's Republic.

During the 2022 Russian invasion of Ukraine, the city was besieged and severely damaged in which it received the title of Hero City of Ukraine. On 16<sup>th</sup> May 2022, Ukrainian troops in Azovstal Steel Plant surrendered to Russian forces and were evacuated to Russian held territory in the Donetsk People's Republic, as Russia secured complete control of the city.



Mariupol shown within Ukraine

### 3) S&T: DEFENCE: 'FATTAH MISSILE'

#### Why in news?

- Iran has claimed that it has created a hypersonic missile capable of traveling at 15 times the speed of sound (June 2024)

Fattah is an Iranian hypersonic medium-range ballistic missile developed by the Islamic Revolutionary Guard Corps and unveiled in 2023.

It is Iran's first hypersonic ballistic missile. According to Iran, its high maneuverability and speed allows it to defeat all missile defence systems.



**Range:** 1,400 kms and **terminal speed** of Mach 13 to Mach 15.

#### Significance:

It is the first hypersonic missile of Iran and is also believed to be first such missile in the middle east.

Its capabilities could pose a challenge to regional and global missile defense system.

**Note:** Hypersonic weapons are the weapons which fly at speeds in excess of Mach 5, or five times the speed of sound.

### 4) BIODIVERSITY: BLACK VEINED BUTTERFLY

#### - Why in news?

- » Re-emergence of 'extinct' black veined butterfly in England likely due to unscientific release (June 2023: Source - DTE)

#### About the Black Veined White (*Aporia crataegi*):

It is a large butterfly that became extinct from British Isles in 1925. It was always considered a rarity in the British Isles but on the continent, it is often very common.

In June 2022, the butterfly was spotted in London. These sightings are the result of unofficial release and is unlikely that the butterfly will survive in the wild to breed. It is not known who did this or why.



## 5) BIODIVERSITY: MAHUA (MADHUCA INDICA)

- Mahua is a medium sized tropical deciduous tree found largely in central, southern and north Indian plains and forests. They are also found in Nepal, Myanmar, and Sri Lanka.
- **Uses:**
  - Mahua flowers, fruits, and leaves are edible and used as vegetables in India and other Southern Asian Countries.
    - » **The sweet, fleshy flower** are eaten fresh or dried, powdered and cooked with flour, used as a sweetener or fermented to make alcohol. This liquor is popular across India.
  - It is also an oil plant, whose seeds yield between 35 and 47% oil. This oil is used for making soaps and candles. It also has a potential use in bio diesel production. Though, it is used as edible oil by tribals, WHO recommends against it as it contains aflatoxin, a toxin component. The processing of oil can get rid of aflatoxin and makes it edible.
  - **Cocoa Butter Extender:** It is prepared from Mahua seed oil and is a prized product. It can be used for making chocolate and other confectionaries. Experts feel that this product has the scope of altering socio-economic conditions of tribals in India.
  - **Timber:** The tree is also used for its hard, strong, dense and reddish timber.
  - **Traditional Medicines** also use some mahua components.
- **Tribal women from Odisha's Kandhamal District** have been using mahua flowers to prepare various delicious varieties of food (Source: DTE, June 2023)
  - Around 120 tribal women members of the state's Van Dhan Vikas Kendras prepare laddus, cakes, jam, toffees, pickles, squash, pakodas, and biscuits using dry mahua flowers and supply them in local markets.
  - The women started preparing these items after attending a training held at the Krishi Vigyan Kendra, Nandurbar, Maharashtra, in Feb 2023





# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### JUNE 2023- BOOKLET-2

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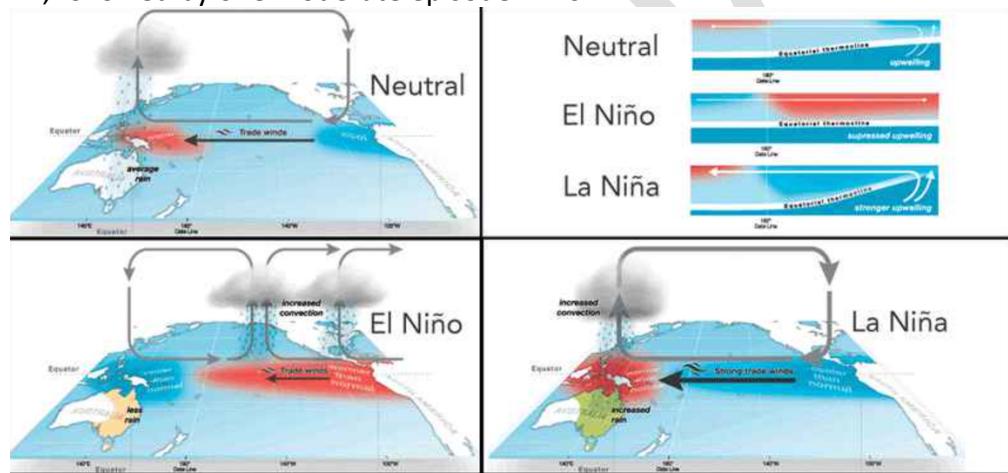
## 1. GENERAL STUDIES-1

### 1) GEOGRAPHY: EL-NINO AND MONSOON

- Why in news?
  - » According to the National Oceanic and Atmospheric Administration (NOAA), El-Nino has arrived (June 2023)
- Example Questions
  - » Discuss the mechanism behind occurrence of El-Nino and its counterpart La-Nina. How do they effect Monsoon season in India [15 marks 250 words]
  - » Discuss the different ways in which El-Nino situation is detected in the Pacific Ocean. How does the phenomenon of El-Nino Southern Oscillation impact Monsoon rains in India (10 marks 150 words)
- Understanding El-Nino Southern Oscillation (ENSO)
  - » EL-Nino Southern oscillation, also known as ENSO is a periodic fluctuation in the sea-surface temperature (El-Nino) and the air pressure of the overlying atmosphere (Southern Oscillation) across the **equatorial pacific ocean**. It is a recurring climatic pattern which has impact on temperature and precipitation across the globe.
  - » This scientific phenomenon occurs in **3 phases**: El-Nino Phase, the La Nina phase, and the Neutral Phase.
    - **The El-Nino Phase**
      - During El-Nino, the trade winds weaken or even reverse:
        - Instead of blowing from the east (South America) to West (Indonesia), they could turn into westerlies. As the wind blows from West to East, they cause the masses of warm water to move into the central and eastern equatorial pacific ocean. This leads to increased rainfall along the Western Latin America, the Caribbean and the US Gulf Coast, while depriving SE Asia, Australia and India of rainfall.
        - The strength of trade wind depletes and it is not able to take warm water to the Australian Coast.
        - This reduces the pressure difference between Eastern Pacific and Western Pacific.
        - This phase is characterized by severe drought in Indonesia, Australia (Western Pacific) and heavy rainfalls in the Eastern Pacific (i.e. the west coast of the Equatorial South America)
      - **The neutral phase (Normal Condition) of ENSO** involves sea surface temperature in the tropical pacific ocean that are closer to average.
        - The **trade winds** blow easterly across the surface near the equator.
        - **Warm water accumulates** in the Western Pacific (East Coast of Australia) creating low pressure there and high pressure in the Eastern Pacific (near the Peruvian Coast).
        - This phase is characterized by heavy rains on the East Coast of Australia and lack of rainfall on the Peruvian coast.

### » The La-Nina Phase

- It is opposing phase to El-Nino.
- It basically refers to abnormal cooling of the central and eastern pacific ocean waters off the coast of Ecuador and Peru. Such cooling (SSTs falling 0.5 degree Celsius or more below a 30-year average for at least five successive three months period) is a result of strong trade winds blowing west along the equator (strong easterly trade winds), taking warm water from South America towards Asia. The warming of western equatorial pacific, then, leads to increased evaporation and concentrated cloud formation activity around that region, whose affect percolate to India as well. It also leads to decreased rainfall in tropical pacific.
- For e.g. the bountiful rainfall during 2019-22 has been significantly attributed to La Nina.
  - The latest La-Nina event was one of the longest ever, lasting from July-September 2020 to Dec-Feb 2022-23. And it brought copious rainfall to India.
  - This was also the case with two previous strong La Ninas in 2007-08 and 2010-11, followed by one moderate episode in 2011-12.



### - Discovery of El-Nino and La-Nina

- » El Nino Phenomenon was first noticed by the scientists in the 1920s, though local population in Peru and Ecuador were aware of the periodic warming much earlier.
- » The La Niña phenomenon, on the other hand, was discovered only in the 1980s.

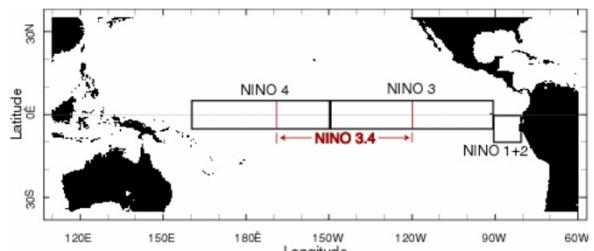
### - Reasons behind Oscillation (i.e. El-Nino and La-Nina)

- » **Not fully understood.**
- » But the two components of ENSO - Sea Surface Temperature (SST) and Atmospheric Pressure are strongly related.
  - The strengthening and weakening of the trade winds is a function of changes in the pressure gradient of the atmosphere over the tropical Pacific. Ironically, the warming of the sea surface works to decrease the atmospheric pressure above it by transferring more heat to the atmosphere and making it more buoyant. So, in summary, the pressure gradient affects the sea surface temperatures, and the sea surface temperatures affect the pressure gradient.

- How is El-Nino situation predicted?

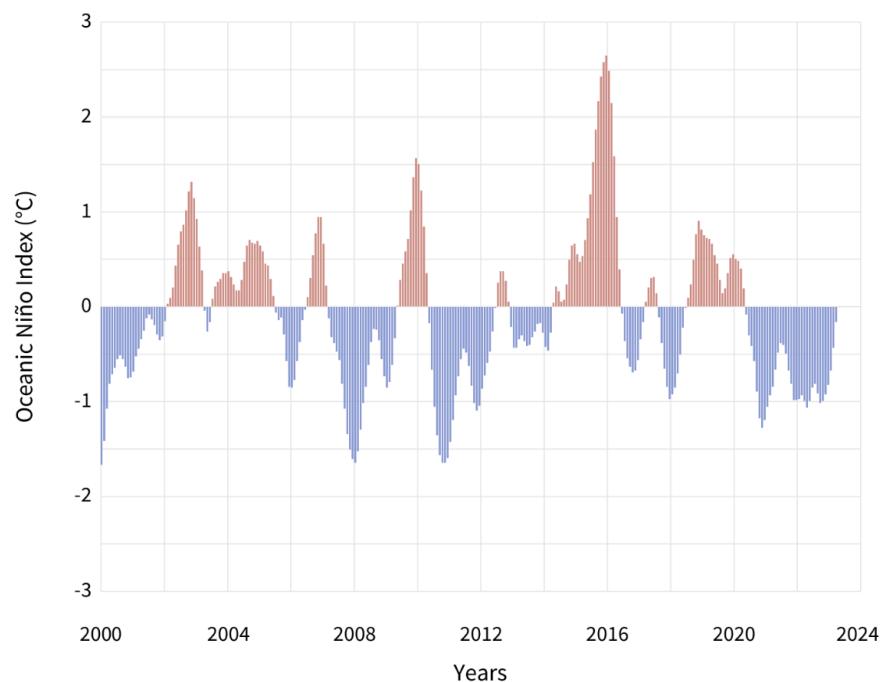
A. The Ocean Part of ENSO is measured by **Oceanic Nino Index (ONI)**.

- Monitoring of ENSO primarily focuses on Sea Surface Temperature (SST) anomalies in the 4 geographical regions of the equatorial pacific.
- The **Nino 3.4 region** refers to central and equatorial pacific while Nino 3 is the adjoining far-east pacific.
- During an **El-Nino**, the Nino 3.4 region gets relatively warmer (by atleast 0.5 degree Celsius)
- These are averaged over five, three-month sessions on a trot to arrive at the **Oceanic Nino Index (ONI)**.
- During a La-Nina it gets relatively cooler (by at least 0.5 degree Celsius)



Niño Regions

### OCEANIC NIÑO INDEX (ONI)



Fluctuations in sea-surface temperatures in the eastern equatorial Pacific Ocean, as represented by Oceanic Nino Index (ONI), since 2000. (Image Credit: NOAA, US)

- **Thermal expansion** of warming water in the eastern part of the basin measurably raises sea level in these regions, and this change in sea level can be measured by satellite sensors. Thereby, variations in sea level are good indicators of the presence of an El-Nino.

B. The Atmospheric part is monitored through **Southern Oscillation Index, or SOI**.

- Southern Oscillation Index (SOI) is calculated on the basis of the atmospheric pressure difference between Tahiti (Southern Pacific Ocean) and Darwin (Australia).

- **Negative phase of SOI** represents below-normal air pressure at Tahiti and above-normal air pressure at Darwin. It corresponds to warm waters across the eastern tropical pacific typical of **El-Nino**.
- **Positive phase of SOI** coincides with cold ocean waters across the eastern tropical pacific typical of **La Nina episodes**.

#### - ENSO and Climate

- » In general, El Nino has warming effect on the planet, while La Nina tends to cool it down. The warmest years in a decade are usually the El Nino years.
  - The warmest ever year on record, 2016, was part of one of the longest and strongest El Nino episodes ever, dubbed the Godzilla El Nino.

**All but one drought year in India was an El Nino year.**



	Drought Intensity	El Nino Intensity
1957-58	Major	Strong
1965-66	Major	Strong
1966-67	Major	No El Nino
1972-73	Major	Strong
1976-77	Moderate	Weak
1979-80	Major	Weak
1986-87	Moderate	Moderate
1987-88	Major	Strong
1991-92	Major	Moderate
2002-03	Moderate	Weak
2004-05	Moderate	Moderate
2014-15	Moderate	Weak
2015-16	Moderate	Very Strong
2018-19	Moderate	Weak

#### - Accurate Prediction of El-Nino provide valuable information for managing its impacts on vulnerable regions:

- Agriculture and Food Security: Based on the expected changes in rainfall due to El-Nino farmers can adjust their crop choices, planting schedule and irrigation options.
- Water Resource Management:** Early prediction of El-Nino enable water resource managers to optimize reservoir storage and allocations.
- Disaster Preparedness:** Steps can be taken to deal with disasters like drought or heatwaves in vulnerable regions.

#### - Impact of El-Nino in India

- » El-Nino has been generally known to **suppress monsoon rainfall** in India.
  - Practically, all drought years in India since Independence - marked by large declines in food grains production or monsoon failures - have witnessed El-Nino events of varying intensity. The sole exception was 1966-67, where drought took place without El-Nino.
  - Please note that this doesn't mean the all El-Nino years have been drought years.

#### - Conclusion1

- Though El-Nino and La-Nina are naturally occurring climate events, there **impacts in recent years have been exacerbated** by extreme weather events.
- With a good disaster management strategy, India needs to remain prepared for these adverse weather phenomena.

## 2. GENERAL STUDIES-2

### 1) SOCIAL JUSTICE: HOMOSEXUALITY

- Example Questions
  - » "The SC verdict in Navtej Singh Johar v. Union of India is a step in the right direction but will not be enough to ensure protection of fundamental rights for sexual minorities" Discuss [15 marks, 250 words]
  - » "In striking down section 377, the Supreme Court has recognized the Constitution's extraordinary transformative power" Elaborate [10 marks, 150 words]
- Introduction
  - » The sexual orientation characterized by romantic or sexual desire for, or sexual attraction towards member of the same sex is called Homosexuality (Homophilia).
    - The term 'gay' is used to refer to homosexual persons of either gender, although it is mostly used to refer to males.
    - In women, romantic sexual desire for other women is also called 'lesbianism'.
- Legal Provisions in India
  - » **Section 377 of IPC** punished voluntary carnal intercourse against the order of nature with any man, women or animal with imprisonment for life or for a term of upto 10 years.
    - Supreme Court in its 2018 judgment in **Navtej Singh Johar vs. Union of India** has said that section 377 insofar as it prohibits 'any consensual sexual relationship' is unconstitutional.
- History of important court ruling on the issue of Homosexuality:
  - » The issue of Section 377 being violative of fundamental rights was first raised by NGO, NAAZ Foundation, and AIDS Bedhhav Virodha Andolan (ABVA), in the Delhi High Court in 2001. But the petitions were dismissed by the court.
  - » Eight years, later in 2009, Delhi High Court in **Naz Foundation vs. Government of NCT of Delhi (2009)** declared that the Section (377), insofar as it criminalizes consensual sexual acts of adults in private, is violative of article 14, 15, 19 and 21 of the Constitution.
    - The court also held that "constitutional morality must outweigh the argument of public morality, even if it be the majoritarian view".
  - » However, the Naz Foundation judgment was overturned by Supreme Court in 2013 in **Suresh Kumar Koushal vs. Naz Foundation**
- Supreme Court Judgment in **Navtej Singh Johar vs Union of India** have reversed the Koushal judgment and has de-criminalized homosexuality. The key reasons given by the SC are:
  - a. **Sexual orientation is natural** and people have no control over it.
    - It is controlled by neurological and biological factors. CJI said that "what nature gives is natural and the natural identity of an individual should be treated to be absolutely essential to his being".

- Research shows that sexual orientation is decided very early, possibly even before birth, and that homosexuality is found in about 10% of the population, a figure that is largely constant across the cultures.
    - Justice Chandrachud also added that 'homosexuality has been documented in almost 15,00 species'.
  - b. Section 377 violates LGBTs' **Right to Equality** under article 14 of the constitution and **Prohibition of Discrimination** under article 15 of the constitution and is thus irrational, arbitrary and incomprehensible.
  - c. It also violates **Right to Freedom** by punishing freedom of choice of individuals.
  - d. **Violates Right to Life**
    - Right to Privacy as part of Right to Life applies fully to LGBT community.
    - Punishment under Section 377 made the LGBT a closeted community, destroyed the identity of members and breached their dignity - All part of Right to Life.
      - Self-determination lies at the core of the concept of identity.
  - e. **Section 377 leads to harassment of LGBT community**
    - Section 377 has become a weapon in the hands of the police and majority community to harass those who have alternative sex orientation. Therefore it assumes the character of unreasonableness.
    - After the 2013 judgment, a large number of cases have come up where gays were blackmailed by acquaintance and the police is in connivance with each other.
  - f. Benefit of **presumption of constitutionality of a statute can't be extended to a pre-constitutional law like 377** that was not enacted by popular legislature.
  - g. The court has rules that consensual sex between adults is neither harmful nor contagious in society.
  - h. **Constitutional morality is more important than Social Morality** (majoritarian consensus): Social morality or what the majority of society thinks cannot be used to violate the right of even one single individual.
    - CJI Mishra had made it clear by saying "We don't settle constitutional issues by referendum. We don't follow majoritarian morality, but follow constitutional morality".
    - The judges have unanimously said that freedom of choice can't be subjected to majoritarian perceptions. The constitution is not just for majority, the fundamental rights are guaranteed to "any person" and "any citizen" and the sustenance of these rights doesn't require majoritarian sanction.
  - i. Judiciary plays an important role in making constitution a "**living document**" through dynamic and purposive interpretations.
    - The constitution must transform society for better - at the heart of **transformative constitutionalism** lies a pledge to change the Indian society so as to embrace the ideals of justice, liberty, equality and fraternity.
- The Court also added that **society owes an apology to LGBTQ community**.
- **Other arguments Supporting Homosexuality / decriminalizing homosexuality.**
- i. **Homosexuality is not against India's tradition and culture.**
    - Our mythology refers to the existence of homosexuality.
      - There are reference to homosexuality in Valimiki's Ramayan.

- There are many instances of men turning into women and so on in Mahabharata too.(e.g. Shikhandi)
    - Erotic paintings and sculptures in ancient temples depict homosexual impulses of at least certain sections of Indian society.
  - ii. **Forced Heterosexuality Affects family life**
    - Homosexuals when forced to live life of a heterosexual have to get married and live with someone to whom they are not attracted. This ruins the life of not only the homosexual but the person with whom s/he got married.
  - iii. **Even Britishers have changed their law**
    - IPC which was drafted by Britishers criminalize homosexuality.
    - The English law was reformed in Britain by sexual offences Act, 1967, which decriminalized homosexuality and acts of sodomy between consenting adults.
  - iv. **Prevented raising awareness over the issue**
    - Homosexuality is already considered a social taboo and it being illegal further made it difficult to spread awareness about it and thus prevent harassment of homosexual people.
  - v. **International Image of a liberal, inclusive, democratic country**
    - Decriminalization of homosexuality has also enhanced India's international image of being a country of diversity, of inclusion and or equal protection for all.
- **Way Forward:** Supreme court judgement has merely decriminalized homosexuality but has not altered civil laws on it. Further court judgments or laws cannot remove social prejudice on their own. Discrimination still persists at workplace, in renting houses, and in the form of stigmatization which is more intense in rural areas. Therefore, we need to work towards:
- » **Bringing change in social attitude:** A change in social attitude and mentality needs to take place. This would require a lot of proactive efforts from government, civil society organizations, educational institutions etc. in the form of Information, Education and Communication Programs.
    - Homosexuals at leadership roles need to come up openly and confront the discriminatory attitude against them. This will help in changing the social perception
  - » **Ensuring Administrative Protection**
    - Government needs to ensure that homosexuals who are making their identity public are not harassed or discriminated in any way.
  - » **Legal Reforms:** Civil laws have to be brought in consonance with the SC verdict. The amendments need to provide for
    - Legalizing same sex marriage
    - Allowing same sex couples to adopt a child
    - **Ban Conversion Therapy**
  - » **Judiciary** also needs to proactively protect fundamental rights of homosexuals, at least, till the time when social attitude and legal protections are enhanced.
    - An example would be Kerala High Court's June 2022 judgment where it sanctioned a lesbian couple to live together after they were coercively separated by their parents.

- **Conclusion**
  - » The Navtej Singh Johar judgment widens the ambit of individual autonomy and decisional privacy. But the verdict is only the first step towards ensuring right to life, liberty and dignity of LGBT community. We still need to go a long way towards changing social attitude and ending all forms of discriminatory laws against the LGBT community.

## 2) SAME SEX MARRIAGE

- **Why in news?**
  - » The Constitutional Bench of the Supreme Court has reserved its verdict on the batch of petition seeking legal recognition of same-sex marriages after a hearing that lasted 10 days (May 2023)
- **Quote: "For the time they are a-changing": Bob Dylan**
- **Introduction:**
  - » In Navtej Singh Johar case, Supreme Court decriminalized homosexuality. But, gay marriages still don't have legal recognition in India. This may change soon. In a landmark case, a group of 18 same-sex Indian couples have petitioned the country's Supreme Court to legalize same-sex marriage.
- **Petitions**
  - » The petitions argued that marriage brings with it several rights, privileges, and obligations that are "bestowed and protected by law". The Delhi Commission for Protection of Child Rights (DCPCR) also advocated for recognition of marriage, filing an intervention application to assist the court on the impact of such marriages on children.
- **Respondents Opposing the petition:**
  - » The Central Government, the National Commission for the Protection of Child Rights, and a body of Islamic Scholars called the Jamiat-Ulama-i-Hind, opposed the petitions.
- **Argument Supporting Same Sex Marriage**
  - » The right to marry for non-heterosexual couple is implicit in Article 14 (Equality), 15 (Non-Discrimination), 16 (Equality of Opportunities in public employment), 19 (Freedom of Speech), and 21 (Right to Life). This is specially true after the SC ruling in 'Navtej Singh Johar vs. Union of India' and 'KS Puttaswamy verdict'.
  - » In Navtej Singh Johar verdict, Justice Chandrachud held that members of LGBT community are entitled, as all citizens, to a full range of constitutional rights, including liberties protected by the Constitution.
    - Being able to marry a partner would allow homosexuals to a host of rights currently reserved for heterosexual married couples - including right to jointly adopt children, own property together or nominate one another as a surrogate decision maker in a medical emergency, right to inheritance, maintenance and tax benefits.
  - » Since Navtej Singh Johar Judgment, several high court verdicts have ruled in favor of same sex couples having the right to live together.
    - In Madhu Bala vs State of Uttarakhand (2020), the high court of Uttarakhand held that right of a same sex couple to live together is a constitutional and human right.

- In **Vanitaben Damjibhai Solanki vs State of Gujarat** (2020), the Gujarat High Court ordered police protection for two women police constables in a relationship.
  - In **S Sushma v Commissioner of Police** (2021), the court protects the couple in relationship and makes sure that both sets of parents are taken along in this journey.
  - » **Supreme Court's recognition of same sex marriage will contribute to society's acceptance towards homosexuality.**
  - » A study titled '*The Anticipated Impact of LGBTQIA+ Marriage Equality Legislation on Indian Society and Mental Health*' among Indians has found that legalization of such unions will have a "positive impact on mental health of LGBTQIA+ individuals".
  - » There are 25 countries where same sex marriage is legalized. These countries have seen no harm to their culture and no deterioration of the legitimacy of traditional marriage in any place where same sex marriage is lawful.
- **How the law can be changed?**
- » Personal law can be interpreted by court to legalize same sex marriages.
  - » Government can add a provision defining LGBT culture in personal laws and allow for same sex marriages.
  - » Special Marriage Act, 1954 can be amended to bring in provisions for same sex marriage.
- **Arguments of people opposing same sex marriage:**
- » They argue that same sex marriage is afront to Indian customs and is an urban elitist concept.
  - » The government is also arguing that if Supreme court legalizes same sex marriage, it would mean a virtual judicial rewriting of an entire branch of law and court must refrain from passing such omnibus orders. Proper authority for this should be the legislature.
  - » Some don't consider it as normal because they can't replicate babies.
- **Conclusion:**
- » The LGBTQIA+ community is gazing upon the Supreme Court with a profound sense of optimism, anticipating the bestowal of their long-awaited constitutional rights, which have been withheld from them throughout the ages.

### 3. GENERAL STUDIES-3

#### 1) SYLLABUS: ISSUES RELATED TO DIRECT AND INDIRECT FARM SUBSIDIES AND MINIMUM SUPPORT PRICE (MSP)

##### A) GOVERNMENT'S SUBSIDY EXPENDITURE

- For FY23, government has spent Rs 5,32,446 crore on subsidy.
  - This includes Food Subsidy (Rs 2.8 lakh crores), Fertilizer Subsidy (Rs 2.1 lakh crores), and Petroleum subsidy (Rs 30,756 crore).
- It was the 2nd highest ever after the 7.06 lakh crores of FY 20-21.
- But, in 2020-21, the spike in subsidy was on account of the finance ministry making a one-time provision to clear all dues to the FCI and fertilizer companies.
  - The centre in previous years was not providing fully for subsidies, arising from these entities selling grain and fertilizers at below cost to PDS consumers and farmers respectively.
- **Key Reasons for Rise in Subsidy Burden:**
  - **Covid-19 Pandemic:** The lockdown led to launch of various initiatives like Pradhan Mantri Garib Kalyan Anna Yojana.
  - **Russia-Ukraine War:**
    - » This led to surge in global prices of petroleum and fertilizers.
      - Government had to keep farmers and consumer insulated from this price rise which led to rise in subsidy burden.

##### B) MSP

- **Why in news?**
  - » Government has announced the Minimum Support Price (MSP) for this year's summer (Kharif) season crops, hiking the prices between 5-10% from last season, to ensure remunerative prices to growers for their produce and to encourage crop diversification (June 2023)
    - **Reactions:**
      - A section of farmer representatives have expressed unhappiness over what they term as a 'meagre' hike in MSP, defeating the government's intent of securing a "remunerative price".
      - Agriculture domain experts believe that an increase in MSP may give a slight respite to growers, but argue that in the absence of any dependable or assured market mechanism of procurement-purchase for crop on the MSP in most parts of the country, Crop Diversification will not be encouraged.
- **Example Questions**
  - i. What do you mean by Minimum Support Price (MSP)? How will MSP rescue farmers from the low income trap? [Mains 2018, 10 marks, 150 words]
- **Introduction**

- » **What is MSP:** It is the minimum price set by the Government at which farmers can expect to sell their produce for the season. When market prices fall below the announced MSPs, procurement agencies step in to procure the crop and ‘support’ the prices.
- » **Beginning:** The Minimum Support Prices (MSP) were announced by the Government of India for the first time in 1966-67 for Wheat in the wake of the Green Revolution and extended harvest, to save the farmers from depleting profits.

Prelims	<b>How is MSP decided and Who takes final decision.</b>
	<ul style="list-style-type: none"> <li>▪ The <u>Cabinet Committee of Economic Affairs (CCEA)</u> announces <u>MSP</u> for various crops at the beginning of each sowing season based on the <u>recommendations of the Commission for Agricultural Costs and Prices (CACP)</u>.</li> <li>▪ The CACP takes into account <u>demand and supply</u>, the <b>cost of production (A2 + FL method)</b> and <u>price trends</u> in the market, inter-crop parity, implication for MSP on consumers, <u>a minimum of 50% as the margin over cost of production</u>; etc.</li> <li>▪ The CACP calculates <b>three types of costs — A2, A2+FL and C2</b> — for each mandated crop for different states. The lowest of these costs is A2, which is the <u>actual paid-out cost incurred by a farmer</u>. Next is <u>A2+FL</u>, the actual paid-out cost plus imputed value of family labour. The highest of the three costs is <b>C2</b>, <u>defined as ‘Comprehensive Cost including Rental Value of Own Land</u> (net of land revenue and interest on value of own fixed capital assets (excluding land))</li> </ul>

- » MSP is announced for 22 mandated crops and FRP is announced for sugarcane (**total 23 crops**)

Prelims	<b>Crops Covered under MSP:</b>
	<ul style="list-style-type: none"> <li>- MSP is announced for <b>22 mandated crops</b> and <b>FRP</b> for Sugarcane. (<b>Total 23 crops</b>) <ul style="list-style-type: none"> <li>▫ <b>Mandated Crops are:</b> 14 crops for Kharif season, 6 Rabi crops (except Toria) and 2 crash crops (Copra and Raw Jute).</li> <li>▫ In addition MSP for <u>Toria</u> and <u>De husked coconut</u> are fixed on the basis of MSP for <u>rapeseed/mustard</u> and <u>Copra</u>.</li> </ul> </li> <li>- <b>Note:</b> <u>Coffee, tea</u> etc are not covered under MSP.</li> <li>- <b>7 Cereals, 8 oilseeds</b>, 5 pulses, 5 cash crops - Copra, Raw cotton, Raw Jute, Virginia Flu cured (VFC) tobacco, Sugarcane.</li> <li>- <b>Note:</b> For Sugarcane <u>Fair and Remunerative Prices (FRP)</u> is announced that has to be paid by sugar mill owners.</li> </ul>

Kharif Crops	Rabi Crops
1. Paddy	15. Wheat
2. Jowar	16. Barley
3. Bajra	17. Gram
4. Maize	18. Masur/lentil

	5. Ragi	19. Rapeseed/mustard
	6. Arhar (Tur)	20. Safflower
	7. Moong	21. Toria (an oilseed similar to rapeseed)
	8. Urad	<b>Other Crops</b>
	9. Cotton	22. Copra / Dehusked Cotton
	10. Groundnut	23. VFC Tobacco
	11. Sunflower seed	24. Raw Jute
	12. Soyabean black	25. Sugarcane(FRP)
	13. Sesamum	
	14. Nigerseed	

- **Need of MSP/ Rationale Behind MSP**
  - » Protecting farmers from price volatility
  - » Incentivizing farmers to grow crops in short supply
  - » MSP also ensures easy procurement for food security schemes
- From FY19 the MSP has been **pegged at more than 50% of cost of production for most of the Kharif and Rabi crops**. This is another step towards ensuring **income inclusiveness**.
  - » Accordingly, the Government has been increasing the MSP for all 22 Kharif, Rabi and Commercial crops with a margin of at least 50% over the all-India weighted average cost of production since the agricultural year 2018-19.
- **Various Mechanisms under MSP to procure crops and ensure remunerative prices for farmers (Before PM-AASHA)**
  1. **For wheat and paddy** -> **Open Ended Procurement by FCI**
  2. **Coarse Grains** -> **Purchased by state government** with permission of central government, **upto the extent it is required** in their Target Public Distribution System (TPDS).
  3. **Price Support Scheme (PSS)** - for oil seeds, pulses and cotton - at the request of concerned states
  4. **Market Intervention Scheme (MIS)** for perishable horticulture commodities - at the request of states - when there is excess supply or low prices.
- **Some shortcomings in MSP Procurement Program**
  - » **Procurement is limited to few crops, few geographies and few farmers** -> only wheat and rice under open procurement -> Punjab, Haryana, Coastal Andhra benefitted a lot -> mostly big farmer benefitted
  - » There has been delays in establishment of procurement centre.
  - » Lack of awareness about MSP among large section of farmers. This leads to they getting exploited at the hands of commission agent.

- » **Inadequate MSP** (MSP calculation is not based on A2 + FL + C2 which was recommended by MS Swaminathan committee). It uses A2 + FL method.
- **Pradhan Mantri Annadata Aay Sanrakshan Abhiyan (PM-AASHA):**
  - » The scheme is aimed at increasing the MSP procurement of pulses, oilseeds, COPRA etc. This is expected to ensure remunerative price to farmers.
  - » **Three components of PM AASHA - Price Support Scheme; Price Deficiency and Payment Scheme; and Private Procurement & Stockist Scheme**
    - Note: For Oilseeds, the states will be allowed to choose between the PSS or two other schemes.
  - » **Note: AASHA is complementing (not replacing) complementing other schemes**
    - Other existing schemes of Department of Food and Public Distribution (DFPD) for procurement of paddy, wheat and nutri-cereals/coarse grains and of Ministry of Textile for Cotton and Jute will be continued for providing MSP to farmers to these crops.
  - » **What was expected out of PM-AASHA:**
    - Better remuneration for farmers; reduced storage and procurement requirement for government; increased private participation -> more investment in storage etc; improved food security
- **But, PM-AASHA has also not been able to increase MSP procurement a lot due to following reasons:**
  - **Budgetary support for PM-AASHA** has been too minimal (around Rs 15,000 crore in the first year)
  - **A number of factors preventing PM-AASHA to be inclusive:**
    - » **Agri-Marketing reforms** are incomplete: Poorly functioning APMCs with cartelization, lack of transparency which causes price distortion.
      - The three farm laws which were expected to reform agri-marketing in India had to be withdrawn due to farmers' protest.
    - » **Poor infrastructure:** This has led to farmers remaining out of MSP regime, remaining out of MSP regime.
      - To increase procurement of pulses, oilseeds etc., a large infrastructure improvement is required at state level. This infrastructure is absent or very poor at state level.
    - » Further, **ineffective supply chain management**, has rendered the whole scheme trivial.
      - For e.g. NAFED has a stock of 4 million tonnes of pulse and oilseeds, but their distribution policy is non-existent.
  - **State Financial condition** may not be strong enough for the program.
- **Other Criticism of MSP mechanism in general**
  - **MSPs causes market distortion** -> this negative impacts free market economy and investment in the sector.
  - **Cropping pattern** is affected and farmers tend to grow high MSP crops rather than the most suitable crop for the region.
    - **Excess fertilizer and water guzzling crops** makes agriculture unsustainable.
  - **Higher inflation due to higher MSP pressure** also has to be considered while announcing MSP for the food crops.
  - **Cost Plus Pricing** is risky as it ignores the demand side, i.e. demand-supply, domestic and international price trends, terms of trade, inter-crop price parity etc.

- Leads to less focus on non-price factors like technology, inputs, services, institutions and infrastructure
  - High fiscal burden on government
- Bigger stock exceeds the stock holding norms of FCI
- WTO' AOA issues (discussed with WTO issues separately)

#### - Way forward

- There is a need of **correction in the way MSP is provided.**
  - Land rentals and capital depreciation needs to be kept in mind.
- In order for our **procurement policy to be really inclusive**, government will need to focus upon improving the procurement infrastructure in rural, remote and backward areas. There is also a need to fast track the reform process of APMCs to end cartelization and promote transparency.
- Steps towards **wooing private investments** needs to be enhanced. Crop mandis can ensure more competition and thus better output for farmers.
- Further, FCI and NAFED will have to **strengthen the supply chain mechanism** to focus more on efficient distribution of the procured food items.
- At the same time we should remember that **procurement schemes can only be a temporary solution**. For lasting impact we need other structural changes. Farming has to be made profitable by reducing production cost and improving returns.

In summary, there has to be a **Comprehensive 'Production, process and market' approach** through higher investments on market infrastructure, processing, value addition and agri-business and diversification along with farmer's welfare initiative.

## 2) FERTILIZER SUBSIDY

- Why in news?
  - » CACP recommends Centre to bring urea under NBS regime to check overuse (June 2023)
- Introduction
  - » A fertilizer is any organic or inorganic, natural or synthetic material added to soil to supply one or more plant nutrients essentially to the growth of plants.
  - » These fertilizers provide **six macro nutrients** and **8 micro-nutrients** to plants for well balanced growth:
    - i. **6 macronutrients:** nitrogen(N), phosphorus(P), potassium(K), Calcium (Ca), magnesium (Mg), and sulphur(S). They are consumed by plants in larger quantities and make the bulk of fertilizers.
    - ii. **8 Micronutrients:** Boron (B), Chlorine (Cl), Copper (Cu), iron (Fe), manganese (Mn), Molybdenum(Mo), Zinc (Zn) and Nickel (Ni).
  - » Fertilizer are an important input for agriculture and have played a major role in increasing farm productivity since green revolution.
  - » But Indian farmers have often faced difficulties due to shortage of fertilizers in past. To ensure easy availability of fertilizers, government has **various subsidy schemes**. But not all fertilizers are sold at a controlled price.

- » In India, Urea is the only controlled fertilizer, which is sold at statutory notified uniform prize. The Phosphatic and Potash fertilizers are under a decontrolled regime and are sold at indicative maximum retail prices (MRPs).

#### A) NUTRIENT BASED SUBSIDY (NBS) SCHEME, 2010

- Key provisions of NBS
  - **Fixed subsidy based on nutrient:**
    - » Government provides a fixed amount of subsidy based on the nutrient content (both macro and micro (boron, zinc etc.)) (per kg) of fertilizers (unlike the earlier product-based subsidy scheme) to the fertilizer companies.
    - » For e.g. for RABI 2022 (from 01/10/2022 to 31/03/2023) - Subsidy rate was decided as follows:
      - N (Rs 98.02/kg) P (Rs 66.93/Kg), K (**Rs 23.65/Kg**) and S (Rs 6.12/kg)
  - **MRP to be fixed by fertilizer companies** on the basis of demand and supply but after incorporating the subsidy element.
  - Rate of subsidy is determined by various factors such as international prices, exchange rate, inventory levels etc.
  - The NBS scheme currently covers 21 grades of different phosphatic and potassic (P&K) fertilizers including DAP (diammonium phosphate), MOP (Murate of Potash) and other NPK complex fertilizers.
  - **UREA has been kept outside the coverage of the NBS scheme.**
- **Key Aim** -> Reduced Subsidy Burden; New specialized variety of fertilizers; Balanced application; Improved farm output; promote indigenous fertilizer industry.
- **Hasn't been as affective** -> Government's subsidy burden still very high -> UREA kept out of NBS, so farmers shifted to UREA -> Balanced Nutrient Goal also missed.
- **Subsidy burden** has also kept on going up.

#### B) UREA BASED SUBSIDY

- **Introduction:**
  - To ensure affordable access to fertilizers to farmers, UREA is made available at statutorily **controlled price**, which at present is Rs 5378 per MT (exclusive of Central/State Tax and other charges towards neem coating).
  - The difference between the delivered cost of fertilizers at farm gate and MRP payable by farmers is given as subsidy to the fertilizer manufacturer/importer by GoI.
- **Issue of Diversion**
  - Being super-subsidized, urea is always prone to diversion for non-agricultural use - as a binder by plywood/particle board makers, cheap protein source for animal feed manufacturers or adulterant by milk vendors - apart from being smuggled to Nepal and Bangladesh.
- From 2018, the government announced the **implementation of DBT** for disbursement of fertilizer subsidy.

- Now the subsidy transfer only happens after the actual sales to farmers by retailers. Retailers have a point of sale (PoS) machine linked to e-Urvark DBT Portal. Fertilizer buyers (farmers) are required to furnish Aadhar or KCC number.
- **Advantages**
  - Prevents diversion and plug the leakages (because Aadhar is used)
  - Timely payment of Urea subsidy to urea manufacturing companies.
  - Adequate availability of UREA to farmers at adequate prices.
- But the diversion still continues at the retail level.
- Various steps being proposed to deal with this problem:
  - **Plans for Direct Cash Transfer to Farmers:**
    - Ceiling might be put on farmers based on the size of their land.
    - The subsidy may be directly transferred to farmer's e-wallet which could be made available along with farmer's Rupay Kisan Card.
  - In a study by NITI Aayog in 2019, farmers prefer DBT to fertilizer companies, rather than Direct Cash Transfer to Farmers as they are worried that buying fertilizers at market price would be an extra burden.
  - Government is trying to resolve this concern by developing a DCT mechanism where fertilizer subsidy will be paid in advance.
- **Plans to cap the total number of subsidized fertilizer bags that any person can buy during an entire Kharif and Rabi Cropping season:**
  - This is expected to end even retail-level diversion and purchases by large buyers masquerading as farmers.

### C) IMPACT OF FERTILIZER SUBSIDY POLICIES IN INDIA

- **Positive Impact:** Fertilizer subsidy policies have had positive impact in terms of increasing fertilizer consumption and hence leading to an increase in overall Agri-production.
- **But it has failed in the goals of increasing domestic production** (and has thus increased import dependency) and promoting balanced use of nutrients by farmers. It has also led to diversion of UREA for other industries and exports to neighboring countries.
- **Why domestic industry couldn't be promoted:**
  - **Lack of raw material for potassic and phosphatic fertilizers:** India completely lacks any commercially exploitable source of Potash and the entire demand for MOP is met through import. In the Phosphatic sector (for DAP etc.), there is limited availability of raw material like Sulphur and rock phosphates and hence, a bulk of raw material is imported. Even the **Urea sector** is dependent on imported fuel sources like crude oil and now, even gas.
  - **Low investment in fertilizer sector** over the years.
  - **Inefficient Fertilizer manufacturer companies** - Since they get subsidy based on the cost of production (rather than fixed subsidy for all manufacturers on the basis of per unit production).
- **Increased dependency on Urea has been harmful**
  - In India, the ideal ratio of NPK fertilizers use is considered as **4:2:1**. However, in most regions it is skewed against the ratio with a propensity to use larger quantities of N (urea) as it is cheaper.

- It has caused serious problems:
  - i. Widespread deficiency of secondary and micro-nutrients.
    - Among these, the deficiency of zinc has to be specifically mentioned as zinc deficiency in food causes problems like stunting.
  - ii. **Fertilizer response and efficiency** has continuously declined over decades mainly due to imbalanced use of nutrients.
  - iii. Environmental damages
    - Part of over-used Nitrogen is lost as NH<sub>3</sub>, N<sub>2</sub>, NO<sub>x</sub> gases which adversely affect environment.
    - Part of Nitrogen leaches down as NO<sub>3</sub> and contaminates the ground water resources. It has been found to cause methemoglobinemia or the Blue baby syndrome.
  - iv. **Limits diversification of crops**
    - Specialized fruits, vegetables require special non-UREA fertilizers, which are not easily available at affordable prices. This prevents diversification of agriculture.
- **Diversion of UREA** -> smuggling to neighboring Nepal, Diversion to Industries
- **Huge Fiscal Burden on Government**
  - A burden of more than Rs 2 Lakh crore only because of fertilizer subsidy.

#### **D) SOME STEPS THAT HAVE BEEN TAKEN TO MAKE UREA SECTOR EFFICIENT.**

- i. **GAS Price Pooling**
  - Earlier, different urea plants got gas at different prices, so their cost of production differed.
  - Therefore, in 2015 government has approved a major policy intervention. Under this policy the **domestic gas is pooled with imported LNG gas** to provide uniform natural gas to all the Urea manufacturing plants for the production of Urea.
    - **Cost of UREA at pooled price will be less than the price of imported urea.** This will help in increasing the production. This will augment indigenous production capacity.
- ii. **Neem Coating of UREA**
  - Reduces rate of dissolution in soil -> slowly absorbed by plants
  - Reduces diversion to industry
  - Neem has other advantages for crops -> insecticidal and pesticidal properties
  - UREA can't be used in synthetic milk now
- iii. **New Urea Policy** to increase the productivity, efficiency and indigenous production
- iv. **Introduction of 45 kg Urea Bag** (from earlier 50 kg) -> aimed at cutting demand
- vi. **Nano Urea**
  - Government has notified the **specification of Nano nitrogen** under Fertilizer Control Order, 1985.
- vii. **One Nation One Fertilizer Scheme**

- It aims to ensure timely supply of fertilizers as well as eliminate the dilemma of farmers in choosing one of the many brands available in the market.

viii. **Pradhan Mantri Krishi Samriddhi Kendra (PMKSK)**

- It has been decided to convert the existing village/block/sub-district/taluk and district level fertilizer retail shop into Model Fertilizer Retail Shops. These shops will act as "**One Stop Shop**" for all the agriculture related inputs and services.

ix. **PM PRANAM (Proposed)**

- Aimed at reducing the use of chemical fertilizers and thus reducing the subsidy burden.

**E) STEPS THAT FURTHER NEEDS TO BE TAKEN/WAY FORWARD**

i. **Work towards self-reliance and reducing dependency on imports.**

- Tie-up with gulf countries to set up plants
  - Gas prices for UREA plants in India is 3 times higher than in gulf countries. So we should set up joint ventures in countries where these prices are low.

ii. **Correcting Price Signals and Decontrolling the Fertilizer sector -> More investment and more competition.**

- The Commission on Agriculture costs and Prices (CACP) has recommended the centre to bring urea under NBS regime.

iii. **Direct Cash Transfer to Farmers and ensure progressive subsidies.**

iv. **Improve fertilizer efficiency -> Expand the soil health testing facilities and Issue of soil health cards**

v. **Digitization of land records**

- The process of was launched in 2008 but has not gathered momentum.
- Without setting right the land records, it will be impossible to transfer the subsidy to beneficiaries or to issue soil health cards.

vi. **Ensuring timely reach of subsidy to farmers**

- Last, but not the least, in the drive for increased efficiency and productivity, we should not forget the question of equity and inclusiveness, for 85% of our operational holdings belong to small and marginal farmers and smaller farmers tend to use fertilizers more intensely.

vii. **Develop Alternative sources of nutrition for agriculture** - Shift towards non-chemical form of fertilizers -> scope to use large biomass of plants which is wasted today;

- **Conclusion:**

- These steps will go a long way in enhancing the productivity of agriculture, mitigating climate change, providing an alternative to chemical fertilizers and balancing the fiscal impact of fertilizer subsidy on the Union Budgets in the years to come.

**3) NANO-FERTILIZERS**

- **Why in news?**

- Union Home Minister Amit Shah launched IFFCO's liquid nano Di-Ammonia Phosphate (DAP) (April 2023)

- Nano Urea fast-tracked for approval despite incomplete trials (Sep 2022)
- **Question:**
- “The Nano-Fertilizer technology can change the contours of not just Indian agriculture but also the economy” Critically analyze [10 marks, 150 words]
- **Introduction:**
- India has become the first country in the world to have developed and roll out nano-fertilizers.
    - » So far, it has launched nano-versions of two fertilizers – Urea and Diammonium Phosphate (DAMP).
    - » While nano-Urea has been made available to farmers since late 2021, nano-DAP was launched in April 2023.
  - The Indian Farmers Fertilizer Cooperative Limited (IFFCO), which had developed the variants using propriety technology, claims that Nano-UREA and Nano-DAP have several advantages over their conventional granular counterparts.
- **More Details:**
- Both Nano-Urea and Nano-DAP come in liquid form.
  - IFFCO claims that a 500 ml bottle of nano-urea can replace at least a 45 kg bag of granular urea and a bottle of 500 ml nano-DAP can replace a 500 kg bag of granular DAP.
- **Advantages:** The Parliamentary Standing Committee on Chemicals and Fertilizers (2022-23), headed by Shashi Tharoor have enumerated several advantages of nano-fertilizers in its March 2023 report:
- **Soil Health:** Nano-UREA can address the imbalanced and excessive used of conventional urea in the country, which accounts for around 82% of nitrogenous fertilizers applied to majority of the crops.
  - It costs lesser than subsidized conventional fertilizer thus reducing the cost for farmers.
  - They also result in better productivity and higher income for farmers.
    - » The PSC report notes that it has average 8% higher crop yield.
  - Experts also believe that these nano-fertilizers will lead to reduced import dependency of fertilizers and save forex reserves.
  - It will also contribute to reduced fiscal burden of government because of reduced fertilizer subsidy cost.
- **Limitations:**
- **Doubts about Yield gain:** DTE has reported interviews of several farmers who had to resort back to traditional fertilizers after, nano-fertilizers didn't give good results.
  - **Labour cost for spraying fertilizer** is increasing the overall input cost for farmers.
  - **Complaints** about farmers being forced to buy Nano-Urea.
  - **Issue of Evaluation/Trial:** ICAR has given results of field trial based on a year (two seasons) of experiments in its affiliated labs. This was an exception as ICAR normally tests a new fertilizer for 2 years (or three seasons) before giving go ahead to a new fertilizer.
- **Conclusions:** Nanotechnology could play a crucial role in promoting sustainable agriculture in India and nano-urea is an example of that. At the same time, it should be ensured that any new technology-based product is properly evaluated in its efficacy, environmental impact and economic impact on farmers.

## 4. PRELIMS FACTS

### 1) PLACES IN NEWS: SVALBARD

#### SVALBARD (also known as Spitsbergen)

- It is a Norwegian archipelago in the Arctic Ocean. North of mainland Europe, it is about midway between the northern coast of Norway and the North Pole. The islands of the group range from 74 degree to 81-degree N.
- The largest island is Spitsbergen.
- **Flora and Fauna:** The flora has adapted to take advantage of the long period of midnight sun to compensate polar nights. Many seabirds use Svalbard as a breeding ground, and it is home to polar bears, reindeer, the Arctic fox.
- **Svalbard Global Seed Vault** is a seedbank to store seeds from as many of the world's crop varieties and their botanical wild relatives as possible. It is a cooperation between the government of Norway and the Global Crop Diversity Trust, the vault is cut into rock near Longyearbyen, keeping it at a natural – 6 degree C and refrigerating the seeds to -18 degree C. It is also referred as Earth's dooms day vault.
- **IndARC:** It is India's first underwater moored observatory in the Arctic region. It was deployed in 2014 at Kongsfjorden fjord, Svalbard, Norway. It is focused on studying arctic climate



### 2) S&T: SPACE

- **Why in news?**
  - Norwegian Ambassador Han Jacob Frydenlund's visit to ISRO's headquarters (June 2023)
- In June 2023, Norwegian Ambassador Frydenlund, accompanied by officials of Kongsberg Satellite service (KSAT), called on ISRO Chairman S. Somanath in Bengaluru, ISRO. The meeting concluded with a mutual agreement on the importance of maintaining a continued partnership and fostering increased engagements between India and Norway.

- It also offered an occasion to recall the 'Svalbard mission' of 1997.

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#### A) SVALBARD MISSION OF 1997

- On Nov 20, 1997, a Rohini RH-300 Mk-II sounding rocket rose to the skies from Svalbard, Norway, operationalizing a new rocket launching range.
- ISRO bagged the Norway mission after its commercial arm Antrix Corporation won a global tender floated by the Norwegian space agency.
- The RH-300 MK-II was given a new name by the NSC (Norwegian Space Centre): **Ibjorn-1**, which translates literally as 'Polar Bear-1'.



# CURRENT AFFAIRS PROGRAM

## PRE-CUM-MAINS 2024

### JUNE 2023- BOOKLET-3

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LevelupIAS

### 1) GEOGRAPHY: HEAT WAVES

- **Why in news?**
  - Many Heat wave deaths in Uttar Pradesh and Bihar (June 2023)
  - Earlier in April 2023, **13 people died from apparent heatstroke** while attending a government award function in an open space in Navi Mumbai. This is possibly the **biggest ever heatwave-related death toll from a single event in the country** and brings back to spotlight on potential risks from heatwaves, whose intensity and frequency is expected to rise because of climate change.
- **Example Questions**
  - What are heat waves? Suggest a strategy to reduce India's vulnerability to heatwaves. [15 marks, 250 words]
  - With a focus on the Oct 2019 guidelines from the National Disaster Management Authority (NDMA), discuss the mechanisms for preparedness to deal with Heat Waves in India. [15 marks, 250 words]
  - Heatwaves can pose economic challenges to various sectors. Evaluate the economic consequences of heatwaves on industries such as agriculture, tourism, and energy, and suggest some measures to minimize their adverse effects [15 marks, 250 words]
- **Definition**
  - A heat wave is a **period of abnormally high temperatures, more than the normal maximum temperature** that occurs during the **summer season** usually in the north-western parts of India. In India, heat waves **typically occur between March and June**, and in some rare cases extend till July.
  - **Indian Meteorological Department (IMD)** has given following criteria for heat waves.
    - **Maximum Temperature of at least 40 degree Celsius for Plains, 37 degrees Celsius for coastal regions** and atleast **30 degree Celsius for hilly regions**.
  - Following conditions are used declare heat waves:
    - a. **Based on Departure from Normal**
      - **Heat Wave:** Departure from normal is 4.5 degree to 6.4 degree.
      - **Severe Heat Wave:** Departure from normal is > 6.4 degree.
    - b. **Based on Actual Maximum Temperature (for plains only)**
      - **Heat Wave:** When actual maximum temperature  $\geq$  45 degree Celsius
      - **Severe Heat Wave:** When actual maximum temperature  $\geq$  47 degree Celsius.
- **Increasing cases of Heat Waves in India:** According to Lancet Report, India faced **60 million heatwave exposure events** in 2016, a rise from 40 million exposures in 2012. Similarly, the **average length of heat waves** in India ranged from **3-4 days**, which is more than double of **global average of 0.8 - 1.8 days**. The key factors responsible for this are:
  - **Climate change -> higher temperatures**
    - According to a report by UNICEF "*The Coldest year of the Rest of Their Lives*" - **nearly every child will face frequent heatwaves by 2050**.
  - **Sparser Pre-Monsoon shower and Delayed Monsoon**
    - This weather pattern coupled with **El-Nino effect**, which often increases temperature in Asia, combine to create the record high temperatures.

- The **Loo (hot and dry winds)** originating from **Pakistan and Northwest India**, has also contributed to increasing temperature in India.
  - **Urbanization and its problems like Urban Heat Island (UHI) Effect** exacerbates the problem of heat wave in many parts of our country.
  - **Decreasing Tree Covers** -> concrete jungles, land heats up more.
  
- **Impact of Heatwaves**
  - **Health Impacts**
    - The heat waves are associated with increased rate of heat stress and heat stroke, worsening heart failures and acute kidney injury from dehydration.
    - Children, elderlyies and those with pre-existing morbidities are particularly vulnerable.
    - According the NDMA, more than 24,000 people have died in India due to heat waves between 1992-2015.
  
  - **Economic Loss**
    - According to Lancet, the output of workforce in India declined by 7%, equivalent to 75 billion labor hours every year.
  
  - **Worsening of air pollution problems** -> increased electricity use -> more fuel burned.
  
- **Steps Taken So Far**
  - The **IMD** has regularly issued heat wave warnings in different parts of the country to make people aware of the worsening situation.
  
  - The **NDMA** has suggested things like covering of head, cross-ventilating rooms and sleeping under a slightly wet sheet.
  
- **NDMA's revised guidelines for prevention and management of Heat Waves in India (Oct 2019)**
  - **Aim/Objective**
    - The guideline aims to provide framework for developing Heat Action Plans for implementation, inter-agency coordination and impact evaluation of heat wave response activities in cities/towns.
  
  - **Developing a Heat-wave Plans**
    - Generating heat wave risk and vulnerability map and mapping hotspots for developing a strategic mitigation action plan.
    - Identifying **Vulnerable Population** - elderlyes, pregnant women, chronic disease patient, resident of a particular type of housing, certain type of occupations etc.
    - Identification and Evaluation of factors leading to disproportionate increase in temperature in the city.
  
    - Reducing Temperature in the cities through vertical gardens, small parks with water fountains etc.
    - Coordinate with Research institutions for better built environment.
      - Government budget should allocate funds for R&D in this field
    - Curb Future UHI manifestation by incorporating findings from the built environment assessment
    - Adhere to city building codes.
    - Preparedness at the local level for health eventualities.
    - Health care system capacity building
    - Collaboration with private and Non-Government and Civil Society

- Establish Early Warning System and Communication Systems
  - Developing inter-agency response plan and coordination in the field.
  
- **Other Steps that can be taken:**
  - **Preparedness:** Already discussed with NDMA guidelines
  - **Response:**
    - Ensuring quick advanced communication and guidelines during heatwave condition.
    - Drinking water supply should be increased along the roadside during heatwave conditions
    - Health facilities should respond with all the relevant facilities.
  - **Other steps:**
    - **Reviewing the existing occupational health standards, labor laws, and sector regulation** for worker's safety.
      - **Special focus on farm laborers** as the agricultural sector was more vulnerable compared to the industrial and service sectors because workers there were more likely to be exposed to heat.
    - Increased work on amenities like increased access to drinking water, indoor ventilation, healthcare, regular work breaks, and protection against wage loss.
    - **Promoting more greenery throughout the city** especially on both sides of the roads to ensure cooler roads.
    - **Making communities more aware and resilient** to after effects of the heatwaves.
    - Internationally, the **global community** should work towards achieving the climate change mitigation goals by working towards Paris Climate targets and making the NDCs more ambitious.

#### **A) PRELIMS UNDERSTANDING: WHAT IS HEAT STROKE?**

- A heat stroke happens when the ambient temperature is so high that the body's cooling mechanism (sweating) is not able to bring down the temperature of the core. The body temperature may shoot upto 40-degree C. In these situations there is severe imbalance of salts such as sodium and potassium in the body.
- The high core temperature coupled with salt imbalances disrupts the organs, leading to host of symptoms.
  - It can affect the brain, making a person foggy, drowsy, and in severe cases may also lead to a person going into a coma.
  - It can also lead to kidney and liver damage as well.
- A cascade of such symptoms may also lead to death due to heat stroke.
- **What should be done during such situations:**
  - In severe cases, the aim is to bring down the core temperature of the body fast. This can be done by pouring cold water over the person, making them drink cold drinks, and giving them electrolytes to balance salt levels.
  - **Visit hospitals quickly** if they are exhibiting symptoms like high body temperature, but no sweat, feeling drowsy, vomiting, not passing urine, and not breathing properly.
- **How to prevent heat stroke?**
  - Don't go out between 12 noon - 3 pm. Avoid strenuous activities during this period.
  - If you have stepped out, ensure that you are drinking water even if you don't feel thirsty. Drink other hydrating fluids, like Lassi, lemon water, buttermilk, or ORS that can maintain electrolytes levels.
  - Don't consume coffee, tea, and carbonated drinks as they by dehydrate you further.
  - Wear light weight, light-colored, loose, and porous cotton clothes.

#### **2) GEOGRAPHY: URBAN HEAT ISLAND (UHI) EFFECT**

- **Probable Questions?**
  - i. What is Urban Heat Island? What are the key factors responsible for the phenomena. [150 words, 10 marks]
  - ii. "Urban Heat Island effect is accentuated by rapid urbanization". Elaborate. Suggest some measures to deal with the phenomena. [200 words, 12.5 marks]
- **Introduction**
  - UHI is an urban area which is significantly warmer than the surrounding rural areas.
  - The temperature difference is more stark during the day hours and night. Weak winds reduces the heat transfer and makes this phenomena more apparent.
- **Causes**
  - The main cause of UHI effect is the modification of land surfaces.
    - Extensive concrete and asphalt surfaces, which absorb and retain heat from sun. These materials have low albedo (reflectivity) and high heat capacity, leading to absorption and storage of solar radiation.
    - Unscientific Urban Planning and Layout may also be responsible for UHI effect. Density of buildings, street patterns, and the arrangements of tall structures may affect the air flow and restrict the dissipation of heat.
    - Decreased vegetation cover and reduction in agri fields: Vegetation help in regulating temperature by a process of evatranspiration. In the absence of vegetation, this cooling effect reduces.
    - Decrease in water bodies (like lakes and ponds) over the years reduce the cooling effect during summers.
    - Increasing population also increase the human generated heat through refrigerators, ACs etc.
- **Harmful Impacts**
  - UHI increases the probability of long duration heat waves and it also exacerbates the impact of heat waves.
  - It leads to increased energy consumption. This is due to greater demand for cooling in hot weather conditions
  - Elevated Emissions of Air Pollutants and Greenhouse Gases
    - Increased energy consumption leads to more greenhouse gas emissions as more fossils will be burned for the energy.
      - Fossil fuels also produce other harmful pollutants such as Sulphur dioxide, Nitrogen oxides, Particulate Matter, Carbon monoxide etc.
      - The pollutants further result in formation of ground level ozone, acid rains etc.
      - Ozone is formed when NO<sub>x</sub> reacts with Volatile Organic Compounds in presence of sunlight. If environment becomes hotter, more ground level ozone will be formed.
    - It also decreases water quality as warmer waters put stress on the ecosystem.
      - Storm water which gets warm will affect the nearby ponds, lakes and rivers too.
    - **Infrastructure Damage:** The excessive heat in urban areas can cause damage to infrastructure, particularly roads, pavements and buildings.
    - Some experts believe that it may be contributing to global warming.
- **Some positive impacts**
  - Lengthening the plant growing season in very cold regions.
- **How Urban Heat Island effect can be mitigated?**
  - **Proper Urban Planning** - keep UHI effect in mind, while planning urban development.

- Lower building height, aligning streets against the sun's path (i.e. in north-south direction) could prevent new layouts from heating up.
  - Focus on energy efficient buildings which will ensure insulation, high-performance windows etc.
  - Create monitoring systems to automatically identify UHIs.
  - **Green Infrastructure**
    - It includes Green Roofs (Roof partially or completely covered by vegetation)
    - Painting house in light colors
    - Promoting urban forestry (For e.g. use Miyawaki method)
  - **Protect Water Bodies and Permeable Surface:**
    - This will ensure high soil moisture and proper cooling of cities.
  - **Community Engagement and Education**
    - Promoting behavioral changes like reducing energy consumption, planting more trees, etc.
  - **Collaborative governance:**
    - Promote collaboration between various stakeholders like state government, local bodies, NGOs etc.
- **Conclusion:**
- These measures can not only help mitigate UHI effect, but can also improve urban resilience, enhance public health and create sustainable and livable cities.

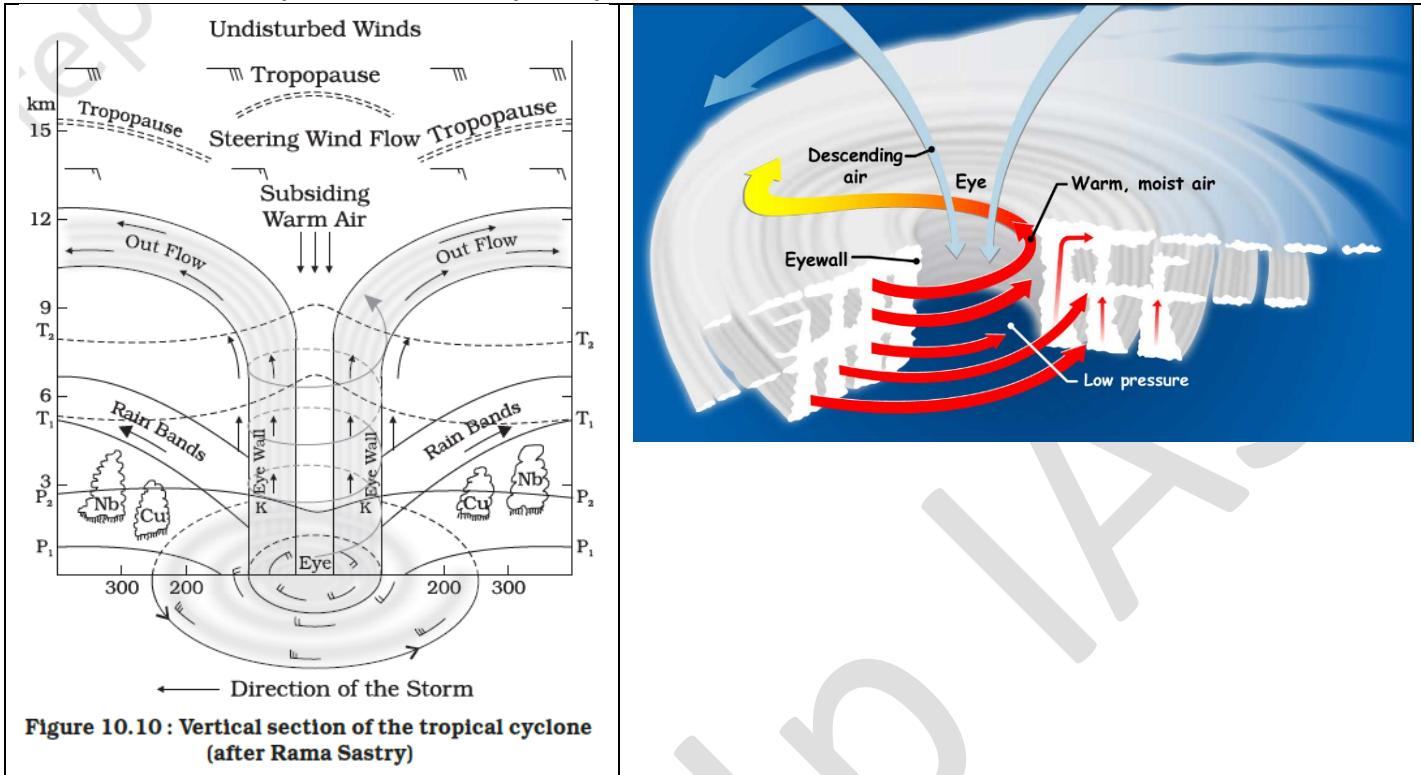
### 3) GEOGRAPHY: CYCLONES

- **Syllabus:** Important Geophysical phenomena such as earthquakes, Tsunami, Volcanic activity, **cyclone** etc., geographical features and their location - changes in critical geographical features (including waterbodies and icecaps) and in flora and fauna and the effects of such changes
- **Why in news?**
  - **Cyclone Biparjoy** (June 2023)
- **Example Questions**
  - Tropical Cyclones are largely confined to South China Sea, Bay of Bengal and Gulf of Mexico. Why? [12.5 marks, 200 words] [Mains 2014]
  - The recent Cyclone on the coast of India was called "Phailin". How are the tropical cyclones named across the world? [Mains 2013] [10 marks, 150 words]
  - Why is east coast of India more prone to tropical cyclones compared to west coast of India? [10 marks, 150 words]
  - Discuss the conditions required for the formation of a tropical cyclone [10 marks, 150 words]
- **Introduction**
  - Tropical cyclone is a violent storm system characterized by a low pressure centre, strong winds and heavy rainfall. They originate over oceans in tropical areas and move to coastal areas bringing about large scale destruction. It is one of the most devastating natural calamities.

<b>Prelims</b>	<b>Different names</b>
	<ul style="list-style-type: none"> <li>▪ Cyclones - Indian Ocean region</li> <li>▪ Hurricane - Atlantic / East pacific</li> <li>▪ Typhoons - West Pacific and South China Sea</li> </ul>

- **How does a cyclone originate and intensify?**
  - Tropical cyclones originate over warm tropical oceans.
  - **The condition favorable for the formation and intensification of tropical storms are**
    - a. Large Sea surface with temperature higher than 26.5 degree celsius to a depth of atleast 50 meters below the surface.
    - b. Presence of the Coriolis force (A distance of atleast 500 km from equator) (as Coriolis force is zero at equator)
    - c. Small variation in the vertical wind speed (low wind shear i.e. there is not too much change in wind direction and strength at different levels)
    - d. Pre-existing weak low-pressure area or low-level cyclonic circulation
    - e. Upper divergence above the sea level system
    - f. If ITCZ is away from Equator, the tropical cyclone are intensified because of warm air masses converging at ITCZ.
- **Process of formation of a tropical cyclone**
  - Warmer ocean surface (generally late summers) -> Low pressure center on water bodies -> winds from surrounding region are attracted towards this region -> while rising up they release the latent heat which acts as an energy for tropical cyclone.
- **Process of intensification of storm**
  - The energy that intensifies the storm, comes from the condensation process in the towering cumulonimbus clouds, surrounding the center of the storm. With the continuous supply of moisture from the sea, the storm is further strengthened.
- **Various stages in formation of a tropical cyclone**
  - **Tropical Depression** (wind speed < 62km/h) -> **Tropical Storm** (wind speed > 62 km/h) -> **Cyclone** (Wind speed >= 119 km/h) -> **Super Cyclone** (wind speed >= 320 km/h)
- **Tropical Cyclone Structure**
  - Because the converging wind spiral inward towards the central low pressure area, the wind rotate in a counterclockwise direction around the central low in the northern hemisphere (clockwise in the southern hemisphere). As these winds spiral inward they draw in the thunderclouds around the storm, creating the spiral rain bands that are clearly visible on satellite images of the storm.
  - As the winds converge toward the central core, they spiral upwards, sending warm moist air upwards. As this air rises, it cools and releases its latent heat into the atmosphere to add further energy to the storm.
  - The winds spiraling around this central core create the eye of the tropical cyclone and eventually spread out at high altitudes. Eventually, cool air above the eye begins to sink into the central core. This dry descending air within the eye gives the core a clear, cloud free sky, with little to no wind. The wind is coming inwards towards the center from all direction. This convergence causes the air to sink in the eye. This sinking creates a warmer environment and the clouds evaporate leaving a clear area in the centre.
- **Dissipation**
  - Since the main source of energy for the storm is the heat contained in the warm tropical and subtropical oceans, if the storm moves over the land, it is cut off from its source of heat and will rapidly dissipate.
- **Other terms**
  - **Land fall:** It refers to the centre of a storm - or its eye - moving over land from the sea.

- A Schematic representation of tropical Cyclone



- Useful Video:

- <https://youtu.be/UKL9NIxLIIE> (Formation of a Tropical Cyclone)

#### A) WHY TROPICAL CYCLONES DON'T ORIGINATE ON WESTERN COAST OF S AMERICA, AFRICA AND AUSTRALIA

- Cold Ocean Currents -> don't let shifting of ITCZ -> warm air don't converge here.

#### B) HOW ARE CYCLONES ORIGINATING IN INDIAN OCEAN NAMED?

- The system of naming of Atlantic cyclones (hurricanes), is a fairly old practice, but giving names to cyclones that originate in the northern Indian Ocean and affect South Asian countries began only at the turn of this century.
- Currently, the Cyclones worldwide are named by 9 regions - North Atlantic, Eastern North Pacific, Central North Pacific, Western North Pacific, North Indian Ocean, South West Indian Ocean, Australian, South Pacific, and South Atlantic.
- The system of naming cyclones was finalized at a meeting of World Meteorological Organization (WMO) and the United Nation Economic and Social Commission for Asia and the Pacific (ESCAP) in 2000, and the first cyclone was named in 2004.

- Eight north Indian ocean countries, namely Thailand, Myanmar, Bangladesh, India, SriLanka, Pakistan, Maldives, and Oman were asked to contribute names so that a combined list could be compiled. Each country gave 8 names and a combined list of 64 names were prepared by the Regional Tropical Cyclone Committee.
  - One name from each country is picked in an order to name the cyclones.
  - The Cyclones in North Indian Ocean basin are named by Indian Meteorological Department and the first tropical cyclone was named in 2004 as Onil (given by Bangladesh).
  - This list exhausted with Cyclone Amphan in 2020.

The latest list of tropical cyclone names was adopted by the WMO/ United Nations Economic and Social Commission for Asia and the Pacific (WMO/ESCAP) panel countries in April 2020 for naming of tropical cyclones over north-Indian ocean, including Bay of Bengal and Arabian Sea.

- The 13 panel countries - Thailand, Myanmar, Bangladesh, India, Sri Lanka, Maldives, Pakistan, Iran, Yemen, Oman, UAE, Qatar and Saudi Arabia - have submitted a list of 13 names each [total 169]
- Why Name a Cyclone: Ease of Communication
  - Remembering cyclones or discussing their impacts, or warning people about them, becomes easier with a name.
  - Giving a name to a cyclone makes it easier to spread the word.

### C) CYCLONE COLOR CODING

- IMD has its own color-coding system for warning and information regarding cyclones. It is used to signify the intensity of the situation and the warning associated with it. The main objective of the color coded system is to alert people of hazardous weather conditions which have potential to damage properties and lives.
  - Green: All is well - no adverse weather conditions
  - Yellow: It asks the 'guards to be updated' to handle the bad weather that can last for days, with a warning of affecting daily activities.
  - Orange: "Be Prepared" - It can be warning for extreme damage to communication disruptions that can lead to power cuts, road and railway blockade.
  - Red: It is the highest level of warming that notifies the authorities to take action. This is a case in which there is a threat to life with the worst weather conditions.

### D) CYCLONE BIPARJOY (JUNE 2023)

- Some unique aspects about Biparjoy:
  - It was a slow cyclone. It developed into a cyclonic storm on 6th June 2023 and made a landfall on June 15. The 10 day life period, during which it developed into a very severe cyclonic storm and then an extremely severe cyclonic storm, was longer than the average but not the longest. One of the reasons for its longer stay on the sea was its relatively slow speed.
  - Cyclones in the Arabian Sea typically progress with a speed of 12-14 km per hour. Biparjoy, through most of its life, moved at a speed of 5-7 km an hour while covering a distance of nearly 1200 km to Gujarat.
    - Reason: Biparjoy was sandwiched between two anti-cyclonic systems. One of them had the effect of aiding its northwards movement, while the other was sort of pulling it back. The combined effect was that it moved relatively slow.

- **Impact:** The slow speed meant that even after reaching land, the cyclone remained close enough to the sea to draw moisture and sustain itself. This allowed it to penetrate much deeper in land (till Ajmer, Rajasthan)
- It was a **recurring tracks cyclone**.
  - The influence of these anticyclonic systems also made its trajectory wobble. We call it recurring tracks cyclone. The trajectory of such cyclones tends to change directions frequently.
  - Therefore, it was only from 11th June, it was concluded that cyclone is hitting Gujarat coast (earlier it was presumed to be hitting Karachi)

## E) EXCELLENT WORK OF DISASTER MANAGEMENT:

- **Excellent Forecasting:** Management of recent Cyclone Biparjoy indicates that India has successfully planned and executed integrated forecast systems and computational infrastructure to reduce cyclone mortality by nearly 90% (when compared to the first decade of 21st century).
  - **Early warning** (4 days in advance before landfall) gave enough time for administration to prepare.
  - **Note:** A cyclone in 1998, that stuck Gujarat, reportedly killed nearly, 3,000 people, and it can be safely said that India has moved beyond that era.

## F) WHY ARE TROPICAL CYCLONES BECOMING MORE DANGEROUS?

- **Climate Change -> Marine Heatwaves**
  - Ocean absorbs most of the access heat in the atmosphere, it is leading to oceans warming up globally causing marine heatwaves.
- **Warming of oceans** is leading to other challenges like increased intensity of cyclones, rising sea levels, and changing weather patterns globally.
  - For e.g., a new study has suggested that warm subsurface waters in the Bay of Bengal has likely helped fuel the 2020 Amphan super cyclone.

## G) WAY FORWARD:

- With climate change, be prepared for stronger cyclones.
- Coastal Regulation Zone Rules should be followed in letter and spirit.
  - Further, it should also specify that only those structures, which are capable of withstanding these cyclones are built in these regions.
- The dwelling of rural, coastal inhabitants must be strengthened.
- Increase green cover like Mangroves which act as natural shield and improve resilience of coastal areas.
- Forecasting should continue to improve.
  - There should also be focus on maximizing skills of the forecasts of cyclone intensities, lifespans, speeds, and tracks.
  - India's academic climate community should build teams to work with IMD to advance understanding of cyclone processes and to improve cyclone predictions.

### 1) SOCIAL JUSTICE: LGBTQIA+

- **Example Questions**
  - "Legal provisions alone will not be able ensure equal rights for Transgenders, social attitude towards them needs to change" Discuss [15 marks, 250 words]
- **Introduction**
  - **LGBTQIA++** is an inclusive term that includes people of all genders and sexualities, such as lesbian, gay, bisexual, transgender, questioning, queer, intersex, asexual, pansexual, and allies.
  - **LGB** (Lesbian, Gay, Bisexual)
  - **Who are Transgenders?**
    - People who have a gender identity or expression that differs/doesn't conform to the social expectations for their assigned sex. They are sometimes called transsexual if they desire medical assistance to transition from one sex to another.
    - Transgenders also include people who are not exclusively masculine or feminine (people who are genderqueer/non-binary).
  - **Intersex** - Individuals who don't fit into specific gender norms of woman or man; can also be used for those with reproductive anatomy that isn't biologically typical.
  - **Questioning** - when a person is exploring their sexuality, gender identity and gender expression
  - **Queer** - An inclusive term or as a unique celebration of not molding to social norms
  - **Asexual** - used for those who don't feel sexual attraction to either sex or that don't feel romantic attraction in the typical way.
- **Population:** Estimated transgender population > 4,90,000 (2011 census)
  - But the transgender activists estimate the population to be 5-6 times more.
  - In the United States 0.3% people identify themselves as transgender indicating that our census numbers are big under-estimation.
  - It further shows that people in India still have to hide their identity as transgender.
  - **Nodal Ministry :** Ministry of Social Justice and Empowerment.
- **Problems faced by Transgenders:**
  - Discrimination in Family
    - Family gives up the child; higher rate of domestic violence; Orthodox mindset considers birth of transsexual as ill omen.
    - social stigma.
    - discrimination in all walks of life (Education, Health, Work, Access to Public Facilities; Denial of residence);
    - lack of self-determination (mis categorization as males or females);
    - police harassment.
    - insensitive laws (provisions for transgenders missing);
      - For e.g.
        - personal marriage laws don't legalize homosexual marriages.
        - Laws related to adoptions (The Hindu Adoption and Maintenance Act, 1956 (HAMA), and Juvenile Justice Act (JJA) - both laws - don't mention anything about adoption by homosexual couples.

- sexual harassment;
  - Lack of understanding in society -> makes them feel isolated, lonely and may cause mental health issues.
- **Important steps taken for their welfare so far**
  - i. **Supreme Court Judgment in 2014: National Legal Service Authority vs. Union of India**
    - Declared Transgender people to be a 'third gender'.
    - Affirmed that fundamental rights granted under Constitution of India will be equally applicable to transgender people
    - Gave them right to self-identification of their gender as male, female or third gender.
    - The court also recognized transgender people as **socially and economically backward classes** and hence should be granted reservation in educational institutions and jobs.
  - i. **Steps taken by various state governments**
    - Some states like Bihar have already provided them reservations as OBCs.
    - The state of Kerala had become the first state to announce the policy for transgenders in 2015. It has recently announced reservation in Higher educational institutions for transgenders.
    - States like **TN, Rajasthan, and Chhattisgarh** have also allowed hiring of transgenders in police forces.
  - iii. **Transgender Persons (Protection of Rights) Act, 2019**
  - iv. **Transgenders Persons (Protection of Rights) Rules, 2020**
  - v. **National Council for Transgender Persons constituted (Aug 2020)**
  - vi. **National Medical Commission declared conversion therapy a 'professional misconduct'** and empowered the State Medical Councils to take disciplinary action if the guideline is breached.
    - Earlier, Madras High Court had directed NMC to issue an official notification listing conversion therapy as a wrong, under the Indian Medical Council (Professional Conduct, Etiquettes and Ethics).
  - vii. **Shelter Homes - 'Garima Greha' (July 2021)**
    - Shelter Homes - 'Garima Greha' for Transgenders: MoSJ&E has initiated 12 pilot shelter homes and provided financial assistance to community based organizations (CBOs) for setting up of shelter homes 'Garima Greha' for Transgender Persons. (July 2021)
      - These pilot shelter homes are in States of Maharashtra, Delhi, West Bengal, Rajasthan, Bihar, Chhattisgarh, Tamil Nadu and Odisha.
      - The main aim of these shelter homes is to provide safe and secure shelter to Transgender persons in need. These shelter homes would provide basic amenities like food, medical care, recreational facilities and also conduct capacity-building/skill development programmes for Transgender persons.
  - viii. **National Portal for Transgender Persons**
    - The portal provides for the **procedure for identification certificates issued by the District Magistrate**. It is functional in all districts of the country.
    - The portal was launched in Nov 2020.
    - As of June 2021, i.e. within 6 months of its launch, the portal has issued 1,557 certificates.
  - x. **IWEI - India Workplace Equality Index (Dec 2020)**
    - It is touted as the country's first comprehensive benchmarking tool for employers to measure their progress on LGBT+ inclusion at the workplace.

- It was launched in Dec 2020 by **non-profit Keshav Suri Foundation** (founder Hotelier-activist Keshav Suri) partnered with **Pride Circle, Stonewall UK** and **FICCI**, to bring the IWEI to India Inc.
  - The index **measures 9 areas**: policies and benefits, employee lifecycle, employee network group, allies and role models, senior leadership, monitoring, procurement, community engagement and additional work.
  - **Standard Chartered Bank** has been named as a 'Gold Employer' in the Indian Workplace Equality Index 2021 for its LGBT+ inclusion.
- **Steps that further needs to be taken**
  - i. **Proper estimation**
  - ii. **Sensitization and Awareness to deal with stigmatization**
    - Inclusion of third gender in school books
    - Information, Education and Communication Programs
  - iii. **Ending all forms of discrimination, coming up with welfare schemes etc.**
    - Effectively enforce the 2019 act
  - iv. **Reservation in educational institutions and jobs**
    - This will help in dealing with poor literacy rate and employment situation
  - v. **Special focus on their health needs**
    - Community had been demanding mental health counselling support and free gender transition surgery facilities in government hospitals.
  - vi. **Rehabilitation**
    - A large number of them are involved in flesh trade. There should be a plan to rehabilitate them in various other sectors
  - vii. **Transgender Welfare board in all states** should be made mandatory.
    - This will provide an institutional set up to look after the welfare of the transgender community.
  - viii. **Reforming Personal Laws** to make them more inclusive.

## 2) THE TRANSGENDER PERSONS (PROTECTION OF RIGHTS) ACT, 2019

- **Main Provisions**
  - i. **Definition of Transgenders:**
    - A person whose gender doesn't match the gender assigned at birth. It includes trans-men and trans-women, persons with inter-sex variations, gender queers, and persons with social cultural identities such as Kinnar and Hijra.
    - **Intersex variations** is defined to mean a person who at birth shows variations in his or her primary sexual characteristics, external genitalia, chromosomes, or hormones from the normative standard of male or female body.
  - ii. **Prohibition Against Discrimination:** The act prohibits the discrimination against a transgender person, including denial of services or unfair treatment in relation to, Education, Health, Employment, access to or enjoyment of goods, facilities, opportunities available to public; Right to movement Right to reside, rent, own or otherwise occupy property, Opportunity to hold public or private office;
  - iii. Every transgender person shall have **right to reside** and be included in the household.
    - If the immediate family is unable to care for transgender persons, the person may be placed in a rehabilitation centre, on the orders of a competent court.

- iv. **Health Care:**
  - The government must take steps to provide health facilities to transgender person including separate HIV surveillance center, sex reassignment surgeries, etc.
  - The government shall review medical curriculum to address health issues of transgender persons, and provide comprehensive medical insurance scheme for them.
- v. **Certificate of identity:** A transgender person may make an application to the District Magistrate for a certificate of identity, indicating the **gender as 'transgender'**. A revised certificate may be obtained only if individual undergoes surgery to change their gender either to male or a female.
- vi. **Welfare measures by government**
  - The act directs central and state governments to take measures to ensure the full participation of transgender persons in society.
  - Government must also take steps for their rescue and rehabilitation, vocational training and self-employment, create schemes which are transgender sensitive, and promote participation in cultural activities.
- vii. **Offences and penalties:** -> Forced labour; denial of public space; removal from household, village; physical, sexual, verbal abuse etc.; These offences will attract imprisonment between six months and two years, and a fine.
- viii. **National Council for Transgenders persons (NCT)**
  - The National Council of Transgender persons will consist of
    1. Union Minister for Social Justice (Chairperson)
    2. Minister of State for Social Justice (Vice-Chairperson)
    3. Secretary of Ministry of Social Justice
    4. One representative from ministries including health, home affairs and human resource development
    5. Representatives from other ministries, NITI Aayog and the NHRC.
    6. Five members from transgender community and five experts from NGOs.
  - The council will advise the central government on the formulation and monitoring or policies, legislation and projects with respect to trans gender person.

#### - Analysis

- **Positives**
  - The act is in spirit with International Conventions, particularly the Universal Declaration of Human Rights, 1948, the International Covenant on Civil and Political Rights, 1966, and the Yogyakarta Principles 2006.
  - It recognizes gender identity as non-binary. Through this act the government has evolved a mechanism for social, economic and educational empowerment of the transgenders.
  - The act will benefit a large number of transgenders persons, mitigate the stigma, discrimination and abuse against this marginalized section and bring them into mainstream of society.
  - It will lead to greater inclusiveness and would make transgender persons as productive member of society.
  - The bill will bring greater accountability on the part of the central government and state government/ union territories administrators for issues concerning transgender persons.
- **Negatives/Limitations/Shortcomings**
  - i. **Principle of Self Determination/ Self Identification missing**
    - NALSA verdict had suggested that anyone who didn't identify with the gender assigned to them by birth could choose to identify as transgender without needing a physical

- examination and certification, the new bill undoes this possibility both in spirit and in practice.
- In fact, the parliamentary standing committee on the bill, which submitted its report in July 2017 have called for many modifications including the change in definition to ensure conformity with the international definition and providing right to self-identification.
  - In the current act, there are no avenues open either for appeal in the event a magistrate refuses to hand out such a certificate.
- ii. **Doesn't suggest changes in other laws**
    - Certain criminal and personal laws currently only recognize the genders of 'man' and 'women'. It has not been defined how such laws will be applicable to transgender persons.
  - iii. **National or State Commissions: No provision** for national or state commission for transgenders
    - NCT, lack the power of commission, which is statutory in nature
  - iv. **Transgender Rights Court: No provision for transgender right courts**
  - v. **Reservation: Silent on any kind of reservation** for transgender persons in education system
  - vi. **Lack of clear grievance redressal mechanism and insufficient punishment**
    - The act is ambiguous about the methods individuals must follow to seek justice, limits the jail sentences that the offender may receive to just two years.
  - vii. **Only covers transgender** (protection may be needed by Intersex, Queer, lesbians, gays, bisexuals etc. as well)
- **Parliamentary standing committee on the bill submitted its report in July 2017 and suggested following changes.**
    - a. Self-identification to bring conformity to international definition
    - b. Providing transgender persons with medical benefits
    - c. Providing quotas in government college and jobs
    - d. Recognize the rights of transgenders person to partnerships and marriages
      - **This has become more crucial after decriminalization of homosexuality by Supreme Court.**
  - **Conclusion1**
    - With various judicial and legal efforts, NALSA Judgment, Transgender Persons (Protection of Rights) Act, 2019 etc., the environment for transgender persons is changing in the country. But, still we need to go a long way in creating a society completely inclusive of LGBTI++ community.
  - **Conclusion2**
    - We need to emulate Kerala Model throughout the country. This state, in last 12 years have turned from a society which was very discriminatory against transgenders to a society which is very inclusive towards transgenders. All this is a result of strong political will where politicians and administrators have acted to reform social attitudes.

### 3) PRELIMS: INTERSEX INCLUSIVE PROGRESS PRIDE FLAG

#### - Why in news?

The month of June is recognized as the Pride Month all across the world. While many organization still use the older rainbow pride flag (a simple red to violet rainbow) in their events, the new variation is increasingly accepted as a more inclusive representation of the LGBTQIA+ community (June 2023)

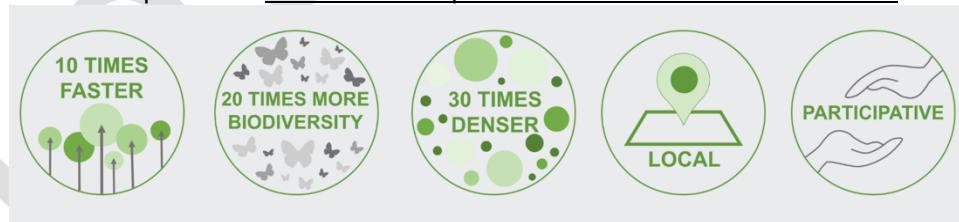


- A Pride flag essentially represents the pride associated with LGBTQIA+ social movement. For centuries people belonging to the community have had to fight for basic rights in countries across the world. The struggle continues in many countries. Uganda, for instance, recently passed a law criminalizing the LGBTQIA+ community.
- History of Pride Flag:
  - The simple rainbow pride flag, designed by Baker, made its debut in 1978 at the San Francisco Gay Freedom Parade. The new flag is based on this very flag.
  - In 2018, American Graphic Designer Daniel Quasar redesigned the flag to include the colors of the transgender flag, blue, light pink, and white. Quasar added the transgender colors along with black and brown color (representing the people in color) in a chevron shape to represent forward movement.
  - The most recent version of the flag is designed by Valentino Vecchietti in 2021 as an inter-sex inclusive Pride flag. A purple circle over a yellow triangle was included in the chevron part of the pride flag. This is a reference to the Intersex pride flag.
    - Why is it called inter-sex inclusive Progress Pride Flag:
      - The intersex has been largely been under-represented within broader queer narratives.
      - According to UN, intersex people are born with sex characteristics (including genitals, gonads, and chromosome pattern) that don't fit typical binary notions of the male or female bodies.
    - In 2021, Intersex Equality Rights (UK) decided to adapt the Pride Progress flag design to incorporate intersex flag, creating the new inter-sex pride flag. Intersex equality rights activists did the redesigning. The colors yellow and purple are used in the intersex flag as a counterpoint to blue and pink which are traditionally seen as gendered colors.

- What do colors of the new flag signify?
  - Red - Life
  - Orange - Healing
  - Yellow - New Ideas
  - Green - Prosperity
  - Blue - Serenity
  - Violet - Spirit
  - Chevron Part:
    - Black and Brown = People of color
    - White, blue and pink = Trans people
    - Yellow with purple circle = Intersex People

## 1) ENVIRONMENT: MIYAWAKI FORESTS

- **Why in news?**
  - PM Modi talks Miyawaki forests in Mann ki Baat (June 2023: Source - IE)
- **Practice Questions:**
  - Discuss the Miyawaki method of afforestation and its significance in the context of ecological restoration and climate mitigation [10 marks, 150 words]
  - Critically analyze the advantages and limitations of the Miyawaki method compared to traditional afforestation approach. Discuss its potential application and suitability in different regions of India. [15 marks, 250 words]
- **What is Miyawaki Forest?**
  - Miyawaki Forests (also known as Miyawaki method or Miyawaki technique), refer to a unique approach to afforestation and ecological restoration developed by Japanese Botanist Dr Akira Miyawaki. He is a recipient of the 2006 Blue Planet Prize, which is the equivalent of a Nobel prize in ecology.
  - This method aims to create dense, fast growing forests in a short period of time, typically 20-30 years, by emulating the natural growth process of the forests.
- **Details of the method and its advantages:**
  - The method take its inspiration directly from process and diversity in nature: 15 to 30 different species of trees and shrubs are planted together. This plant community works very well together, and is perfectly adapted to local weather conditions.
  - The habitat thus created get more complex over time and attract much more biodiversity. Vegetation becomes much denser than conventional plantations, and it has the structure of a mature natural forest.
    - For e.g. a Kerala based teacher, Raafi Ramnath, has used this method to transform a barren land into a mini forest called Vidyavanam by planting more than a 100 varieties of trees.
  - It is a multistorey structure, where different levels of vegetation appear. The forest thus structured delivers many benefits in the form of ecosystem services.
  - **Faster Recovery:** It would take 200 years to let a forest recover on its own. But with the Miyawaki method a similar result is achieved in 20 years.
  - The technique works worldwide irrespective of soil and climatic conditions.



- **Some challenges and limitations**
  - **Regular Maintenance** requirement: Regular watering, weeding, and pest control can be labor intensive and time consuming
  - **Seed availability** for various kinds of diverse seed is a challenge.
  - **High Initial investment** - Cost of acquiring and preparing land, procuring diverse range of seeds/saplings, and ongoing maintenance expense.
  - **Lack of Long term Data**: Since Miyawaki method is only a few decades old, how sustainable these trees would be over longer period is not very well known.

- **Conclusion:**

- It is important to consider these advantages and limitations when assessing the suitability and feasibility of the Miyawaki method in different contexts. The specific ecological, social, and economic factors of an area should be taken into account for successful implementation and effective decision-making

#### 4. PRELIMS FACTS

##### 1) PLACES IN NEWS: LAKE VICTORIA

###### - Why in news?

- More robust measures needed to minimize disaster impact in Lake Victoria Basin: Study (June 2023: Source - DTE)

It is the 2nd largest fresh water lake in the world in terms of surface area (after Lake Superior).

It has its boundaries in 3 east African countries (Uganda(45%), Kenya (6%) and Tanzania (49%)). It occupies a shallow depression in Africa.

It is largest lake of Africa.

**Source of water for lake Victoria:** Mostly rainfall (80%) and thousands of small streams. The Kagera river is the largest river flowing into the lake, with a mouth on lake's western shore.

Lake Victoria is drained solely by the Nile River near Jinja, Uganda, on the lake's northern shore

###### Mingingo Island

It is a very small island (barely 1/4th of an hectare large) in Lake Victoria.

It is claimed by both Uganda and Kenya and the dispute has continued for a decade now.

The island is a rounded, rocky outcrop which has become densely populated over the last 1 decade.

The surroundings of the island is very rich in fishes and is a fisherman's paradise.

###### **Climate Change threatening Lake Victoria Basin (June 2023)**

- A new scientific report published in the journal Nature shows significant precipitation changes and increasing extreme climate events in the near future of the already sensitive region, affecting both its large human populations as well as endemic biodiversity.

**Note:** Country's forming part of Lake Victoria Basin:

1. Uganda
2. Kenya



###### **Note:**

Lake Superior is the world's largest fresh water lake by surface area, third largest by volume, and the deepest, largest and coldest of the Great Lakes of North America.

Lake Baikal (located in Russia in the southern region of Siberia), is the largest freshwater lake by both volume and depth (1741 m). It contains 20% of the world's fresh water. It hides its vast waters under a relatively small surface area.

3. Tanzania
4. Rwanda
5. Burundi

Each of this country contributes water to the lake through various rivers, streams, and direct rainfall.

## 2) PLACES: VENETIAN GRAND CANAL

**Venice:** It is a city in north-eastern Italy and is the capital of Veneto region. It is built of 118 small islands. That are separated by expanses of open water and by canals.

### Venetian Grand Canal:

It is a channel in Venice, Italy. It forms one of the major water traffic corridors in the city.

One end of the canal leads into lagoon near the Santa Lucia Railway Station and the other end leads into the basin at **San Marco**; in between, it makes a large reverse-S shape through the central districts of Venice.

### Why in news?

Venetian canal had turned green. Initially known one was able to give a reason. But in June 2023, authorities found that the test samples of the water confirmed the canal's bright new hue was caused by **fluorescein**, a chemical often used to find leaks during underwater construction. The official are investigating how the chemical got into the canal.



## 3) CULTURE: GANDHI PEACE PRIZE, 2021

- Gandhi peace price is an annual award instituted by Gol in 1995, on the occasion of 125th Birth Anniversary of Mahatma Gandhi as a tribute to the ideals espoused by Mahatma Gandhi.
- Who can get this award?
  - This award is open to all persons, irrespective of nationality, race, language, caste, creed, or gender.
  - The award carries an amount of Rs 1 crore, a citation, a plaque, and an exquisite traditional handicraft/handloom item.
- Past Awardees include ISRO, RK Mission, Grameen Bank of Bangladesh, Vivekananda Kendra, Akshay Patra, Sulabh International.
  - It has also been awarded to luminaries like Nelson Mandela, Dr Julius Nyerere (Former President of Tanzania) etc.
  - Recent awardees include Sultan Qaboos Bin Said Al Said, Oman (2019) and Bangabandhu Sheikh Mujibur Rehman (2020), Bangladesh.

- The Jury headed by the PM Modi, after due deliberation on 18th June 2023 unanimously decided to select **Gita Press**, Gorakhpur as the recipient of the Gandhi Peace Prize for the year 2021, in recognition of its outstanding contribution towards social, economic, and political transformation through non-violent and other Gandhian methods.
- **More About Geeta Press:**
  - Established in 1923, it is one of the world's largest publishers, having published 41.7 crore books in 14 languages, including 16.21 crore Shrimad Bhagvad Gita. The institution has never relied on advertisement in its publications, for revenue generations.

## 4) SCIENCE: COCAINE

- **Why in news?**
  - "Black Cocaine" worth Rs 32 crores seized at Ahmedabad International Airport (June 2023: Source - PIB)
- **About Cocaine:**
  - It is powerfully **addictive stimulant drug** made from the leaves of the coca plant native to South America. Although healthcare providers may use it for valid medical purpose, such as local anesthesia for some surgeries, recreational cocaine is illegal.
  - As a **street drug**, it looks like a fine, white, crystal powder.
  - **How does cocaine affect the brain?**
    - It increases levels of the natural chemical messenger dopamine in brain circuits related to the control of movement and reward.
    - **Short term effects:**
      - Extreme happiness/ mental alertness/ hypersensitivity to sight, sound, and touch/ Irritability/ Paranoia - extreme and unreasonable distrust of others.
- **About Black Cocaine:**
  - It is a designer drug wherein cocaine is mixed with charcoal and other chemicals to give it black rubbery appearance to camouflage and to evade detection by Canines and field testing kit. This modus operandi to smuggle cocaine is unique and this is the first instance of seizure of "Black Cocaine" by Directorate of Revenue Intelligence (DRI)

## 5) SCIENCE: SPACE AND ASTRONOMY: STAR BETELGEUSE

- It is one of the brightest and largest known stars in the Milky Way Galaxy. It is located 700 light years away from Earth. It is part of the Orion constellation and is visible to the naked eye in the night sky.
- **Some Key features:**
  - It is a **Red Supergiant** – Thus it is in the last stage in the life cycle of star.
  - **Very Large:** If placed at the center of our solar system, it would extend out to asteroid belt.
  - **Future Supernova:** It is expected to explode as a supernova within the next 100,000 years – a blink of an eye on a cosmic time scale. This explosion will be a spectacular event, potentially visible from Earth even during the day, and the star will outshine the entire galaxy for weeks of months.
- In late 2019, astronomers around the world grew giddy with excitement, because they saw the **Betelgeuse star get fainter than ever before**. There was some speculation that this might be death rattle before the end.

- It was understood that in 2019, Betelgeuse likely underwent an enormous surface mass ejection (SME). An SME happens when a star expels large amount of plasma and magnetic flux into the surrounding space. It is suspected that Betelgeuse lost a large part of its surface material.
- What is remarkable is that Betelgeuse ejected 400 billion times more mass than a typical event on other stars. This is multiple times the mass of Moon, pushed out at incredible speed.

#### **Understanding lifecycle of a star:**

- 1) Small or Medium Star (mass less than 8 times the mass of sun):
  - Star -> Red Giant -> White Dwarf (with planetary supernova) -> Black Dwarf
- 2) **Large Stars** (mass more than 8 times the mass of sun)
  - Star -> dying stage (iron core) -> supernova explosion -> Neutron Star -> Black Hole (not all neutron stars will become black hole)

## **6) ANTHROPOLOGY: DID HOMO NALEDI MADE ROCK ART AND BURIED THEIR DEAD?**

### **A) EVOLUTION OF HUMANS**

- The earliest known hominids (man-like species) were members of the ***Australopithecus genus***. They lived roughly between 4.4 and 1.8 MYA and perhaps lived only in Africa (remains have not been found anywhere else so far).
  - ***Ardipithecus*** (or *Australopithecus ramidus*) is the earliest sample of this genus and seems to have evolved from some common ancestor of the hominid and pongid apelines in sub-Saharan Africa about 4.4 MYA.
  - So far, we don't have any evidence to show if *Australopithecus* made any tools. They may have used naturally available material as tools.
- **About Homo Genus:** This is the genus to which humans belong. Like modern humans, other species in the group had large brains and used tools.
- **Homo Habilis:**
  - The earliest known (from fossil evidence so far) representative of '***Homo***' genus is ***Homo habilis*** (hand using man) who was found in Kenya and Tanzania about **2.8 MYA**.
  - The **earliest stone** tool have been found at **Hadar in Ethiopia** and have been dated about 2.5 MYA.
  - These tools were used to scrape flesh from carcasses of animals killed by carnivores, and crack open long bones for their marrow content.
  - These 'first humans', thus became scavengers on animal left-overs. The most probably exploited a time window around mid-day when the carnivores were resting (hyenas arrived nocturnally to devour the leftovers). Walking upright freed their arms to carry bones away to be processed in safe sites to augment the plant-based dietary staples.
  - **Losing of body hairs:** To facilitate mid-day movements -> fur-covered animals will soon overheat.
- **Homo Erectus** (fully erect posture) appeared in east Africa around 1.7 MYA. From here, the species spread to various parts of Africa, Asia and Europe.
  - They are the earliest known humans to have possessed modern human like body proportion with relatively elongated legs and shorter arms.
  - These early humans were efficient hunters.
  - A division of labor came about. Men Hunted; women gathered plants.

- **Homo Neanderthalis** (lived between 400,000 - 40,000 years ago) in Europe and Southwestern to Central Asia.
  - The Neanderthals, *Homo neanderthalensis* or *Homo Sapiens Neanderthalensis*, is an extinct species or subspecies of archaic humans that lived until about 40,000 years ago.
  - They are known from many fossils. The species was first located in 1856 in the Neander Valley of the present day Germany, identified from fossils which were 1,30,00 years old.
  - Whether Neanderthals got merged into *Homo Sapiens* or whether they became extinct remains a mystery. They are the closest extinct human relatives
- **Homo Denisovans:**
  - The **Denisovans** shared a common ancestor with Neanderthals until their population diverged 380,000 to 470,000 years ago. This was much later than the split between modern humans and Neanderthals/Denisovans, which occurred between 5,50,000 and 7,60,000 years ago.
  - ‘**Hominin Denisova**’ was discovered by Swedish Paleo geneticist Svante Paabo, the winner of 2022 Nobel Prize in Medicine.
  - In 2012, Paabo and his team sequenced the DNA of a well-preserved fragment of the bone that was 40,000 years old and found in 2008 in the Denisova Cave in southern Siberia. The result was astounding they had come across an entirely novel hominin, distinct from Neanderthals and even more from modern humans.
  - In the same cave, palaeontologists later discovered the fossil of a girl who was part Neanderthal and part Denisovan, proving that these two species interbred.
  - Little is known about what the Denisovans looked like because they have left few fossilized traces of their time on Earth other than fragments found in Siberia and a jawbone discovered on the Tibetan Plateau in 2019.
- **Homo Sapiens** appeared for the first time around 5,00,000 years ago.
  - From around 130,000 years ago, there is evidence of Homo Sapiens neanderthalis (Neanderthals) in various parts of western and central Asia and in Europe. Whether Neanderthals got merged into Homo Sapiens or whether they became extinct remains a mystery.
- **Anatomically modern humans**, known as *Homo sapiens*, seem to have appeared in Africa between 1,95,000 and 1,50,000 and eventually replaced all other Homo Sapiens.
- **Note:** Evolution is not a neat unilinear process. There are overlap and co-existence of species

## B) HOMO NALEDI

**Major new research claims smaller brained Homo naledi made rock art and buried the dead. But the evidence is lacking (June 2023: Source - TH)**

- Homo Naledi were the short stature, small-brained, ancient cousins who are thought to have lived in Southern Africa between 335,000 and 241,000 years ago.
- They were first discovered in 2013 in South Africa's rising star cave system.
- Rising Star cave system is an exceptional resource for exploring the origins of our species.
- New studies claim that Homo Naledi intentionally buried their dead (a sophisticated practice we generally associate with homo sapiens) and made rock art, which suggests advanced cognitive abilities.
- But these findings have been challenged by several archaeologists

## 7) BIODIVERSITY: HIMALAYAN BROWN BEAR (URSUS ARCTOS ISABELLINUS)

- **Why in news?**
  - An Himalayan brown bear (*Ursus arctos isabellinus*) as captured by J&K Wildlife Department on May 13, 2023, at Rajwara in the North Kashmir district of Handwara, days after it was found wrecking graveyards, reportedly in search of human cadavers to eat (June 2023: Source - DTE)

It is the largest animal in Himalayas and is usually reddish brown in color. They inhabit altitudes ranging from 2,000 to 2,500 metres, predominantly above the tree line.

It also shows sexual dimorphism (Males (1.5 - 2.2m), Females (1.37 - 1.83m)).

**Distribution:** Nepal, Pakistan, and Northern India. In Hemis National Park, Great Himalayan National Park, Nanda Devi Park -> this may be seen as the giant mammal walking upright.

**IUCN Status:** CR

Please note that IUCN status of Brown bear is LC (due to its wide distribution). But the Himalayan subspecies is CR.

#### **Updates:**

Human encroachment in wildlife has led to bears straying more often into human-dominated areas. Several incidents from various villages of J&K such as Behnipora, Budshungi, and Shatiam have been reported, where more than one bear may have entered.

**Key reasons:** Insufficient food in their habitats;



## 8) BIODIVERSITY: ORCHIDS OF DARJEELING HILLS AND DOAB ARE FACING THREATS

- **What are orchids?**
  - They are a diverse and widespread group of flowering plants, with blooms that are often colorful and often fragrant commonly known as the **Orchid** family. They belong to the family **Orchidaceae**, which is one of the largest family of flowering plants with possibly over 27,000 species and more than 800 genera.
  - **Habitats:** Orchids can be found in nearly every habitat, but most orchid species are tropical.
- **The Botanical survey of India**, in 2019 came up with the first comprehensive census of orchids in India putting the total number of orchid species to 1256.
  - **Orchids can be classified** in three types:

- » **Epiphytic:** (Plants growing on another plants including those growing on rock boulders and often termed lithophyte).
- » **Terrestrial:** (Plants growing on land and climbers)
- » **Mycoheterotrophy:** (Plants that derive nutrients from mycorrhizal fungi that are attached to the roots of a vascular plants).
- » In India, of all orchids 757 are epiphytic, 447 are terrestrial, and 43 are mycoheterotrophy.
- **State wise distribution:**
  - » **Arunachal Pradesh** (612 species); Sikkim (560 species) and West Bengal (with Darjeeling Himalayas having high species concentration) with 479 species.

#### - Orchids of North Bengal are facing threats (June 2023)

- The wild orchids of Darjeeling Hills and Dooars are facing threats due to habitat loss (mostly due to deforestation).
- **The most endangered** are the epiphytic orchids - the type that grows on another plant/tree merely for physical support. Please note that they are not parasitic and use trees only for support.
- Orchids are also natural gauges of air quality because they don't grow in polluted air
- **Applications:**
- The Oraon and Kharia tribal communities use wild orchids to treat range of diseases - cut and fractures, skin diseases, aches and pains.



#### Some Important species of Orchids:

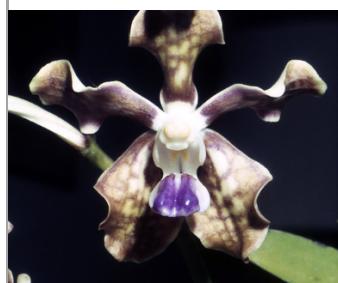
**The Dendrobium aphyllum** carries pinkish violet, fragrant flowers;



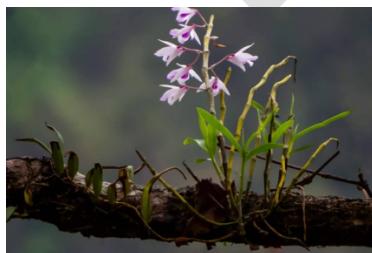
**The Bulbophyllum leopardinum**, with its pale green and spotted red flowers simulate a leopard's spots;



**Vanda Tessellate** is greenish with a striking blue purple lip



**Dendrobium transparens**



**Aerides Maculosa** - Foxrush Orchid



## 9) DEFENCE: INS KIRPAN

- **Why in news?**
  - India gifts missile Corvette INS Kirpan to Vietnam (June 2023)
- **Details:**
  - INS Kirpan is a Khukri class missile corvette displacing 1,350 tonnes and was commissioned into the navy on Jan 12, 1991.
    - The ship is fitted with a medium range gun, 30 mm close range guns, chaff launchers, and surface to surface missiles, enabling it to perform a wide variety of roles, including coastal and offshore patrol, coastal security, anti-piracy, HADR operations etc.
- **Gift to Vietnam**
  - India gifted indigenously built in service missile corvette INS Kirpan to Vietnam to enhance that country's Naval capabilities.



# TARGET PRELIMS 2024

## CURRENT AFFAIRS PROGRAM

### BOOKLET-1, S&T-1

### SPACE AND ASTRONOMY

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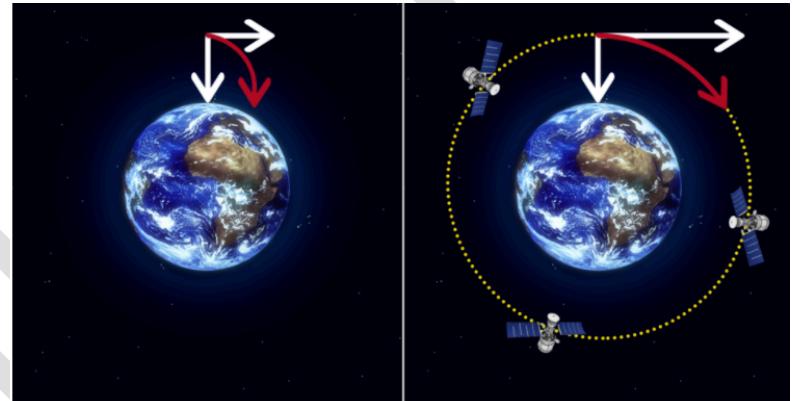
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## 1. SOME BASICS ABOUT SATELLITE ORBITS

### 1) ORBIT:

- An orbit is the curved path that an object in space (such as a planet, moon, star etc.) takes around another object due to gravity.
  - Objects of similar mass orbit each other with neither object at the centre, whilst small objects orbit around large objects. In our Solar system, earth revolves around sun, Moon revolves around earth.
- **Satellite Orbits:** The path that satellite takes to revolve around a planet due to force of gravity is called satellite orbit.

- **Gravity and Speed of Satellite in an orbit**



- **How are satellites placed in Orbit – Circular vs Elliptical Orbit** - Detailed Class Discussion

- **Orbital Velocity – Circular vs Elliptical**

- For a circular orbit, it is always the same.
- However, in the case of an elliptical one this is not the case as the speed changes dependent upon the position in the orbit. It reaches the maximum when it is closest to the earth and it has to combat the greatest gravitational pull, and it is at its lowest speed when it is furthest away.

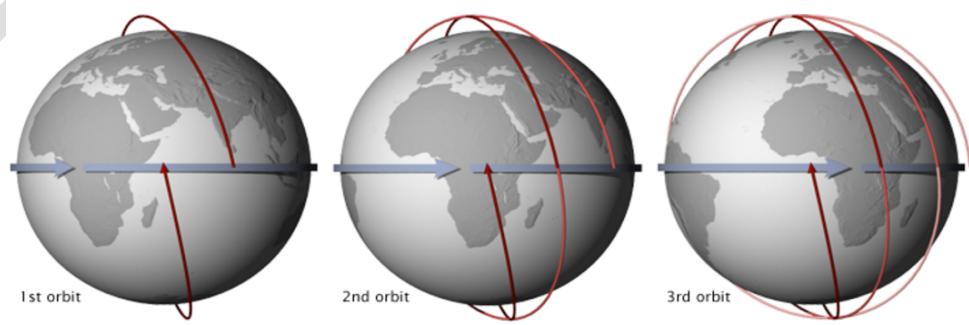
## 2) TYPES OF ORBITS: 1. CIRCULAR (LEO, MEO, GSO) 2. ELLIPTICAL ORBITS

### A) LOW EARTH ORBIT (CIRCULAR ORBIT)

- A low earth orbit is an orbit around earth with an altitude between 160 kilometers and 2000 Kilometers. Objects below approximately 160 Kilometers will experience very rapid orbit decay and altitude loss.
- It is used for vast majority of satellites.
  - Most satellites
  - All human space flights (except manner lunar flight of the Apollo program);
  - All space stations.
- **Main Characteristics**
  - **Low orbital period**
  - **Satellites closer to earth** -> better visibility -> earth observation/remote sensing satellites.
  - **Easier placement of satellite in orbit**
  - **Lower latency in communication** -> less round-trip time.
  - **Satellites face lower radiations** when compared to satellites at higher altitudes.
- **Applications**
  - **Earth Monitoring Satellites**
    - As they are able to see the surface of the earth more clearly
  - **Communication satellites**
    - Especially the satellite phones
  - **International Space Station** is at a height of 400 km.

### SUN SYNCHRONOUS ORBIT (CIRCULAR OR ALMOST CIRCULAR) (POLAR ORBIT)

- **Satellites in Polar Orbit** usually travel past Earth from north to south rather than from west to east, passing roughly over Earth's pole. They don't have to pass the north pole or south pole precisely. Even a deviation within 20 to 30 degrees is still classed as polar orbit.
- **Sun Synchronous Orbit** is a kind of Polar Orbit. In this orbit, satellites are synchronized to always be in the same fixed position relative to the Sun. This means that the satellite always visits the same spot at the same local time. In this orbit, whenever and wherever the satellite crosses the equator, the local solar time on the ground is always the same.



- A sun synchronous combines altitude and inclination in such a way that an object on that orbit will appear to orbit in the same position, from the perspective of the sun, during its orbit around the earth. In other words, it orbits in such a way that **it precesses once a year**. The surface illumination angle will nearly be same every time.
- Typical sun-synchronous orbits are about 600-800 Km in altitude, with periods in the 96-100-minute range, and inclination of around 98 degrees.
- Possible only around oblate planets like Earth, Mars etc. The extra mass around the equator makes the precess possible. But Venus is too spherical to have a Sun Synchronous Satellite orbit.

**□ Significance of Sun-Synchronous Orbit**

- SSPO keeps the angle of sunlight on the surface of the earth as consistent as possible, though the angle will change from season to season. This consistency allows scientists to compare images from the same season over several years without worrying about too much extreme changes.
- **Kinds of satellite put in Sun-Synchronous orbit:** Imaging, Spy and weather satellites (e.g. Cartosat-2 series)

---

## B) MEDIUM EARTH ORBIT

- **Height:** 2000 km to 3,5786 kms
- Satellite speed is lower (compared to LEO)
- **Orbital Period** range from 2 to 24 hours.
- **Most common use** of satellite in this orbit is for navigation, communication, and geodetic/space environment science.
- **Most common altitude** is approximately 20,200 km, which yields an orbital period of 12 hours as used for examples by GPS.
- **E.g:**
  - GPS Satellites Fly in Medium earth orbit at an altitude of approximately 20,200 km.
  - Galileo (the satnav system of Europe) is also located in MEO.

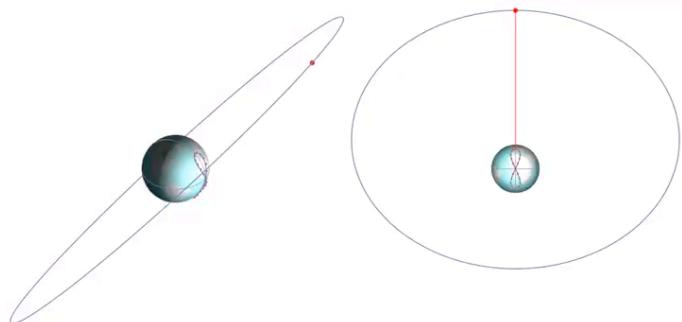
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## C) GEOSYNCHRONOUS ORBIT AND GEOSTATIONARY ORBIT

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### GEO-SYNCHRONOUS ORBIT

- It is a satellite orbit around the earth with an **orbital period that matches Earth's rotation period on its axis** (i.e., orbital period is 23 hours 56 minutes and 4 seconds), irrespective of inclination.
  - » A person on a point on Earth, will see a satellite in this orbit in the same place in the sky at the same time of the day, every day.



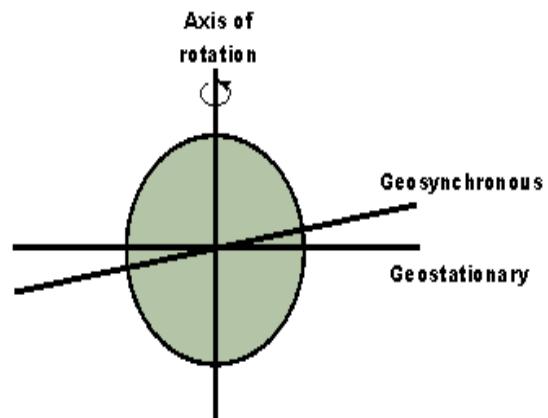
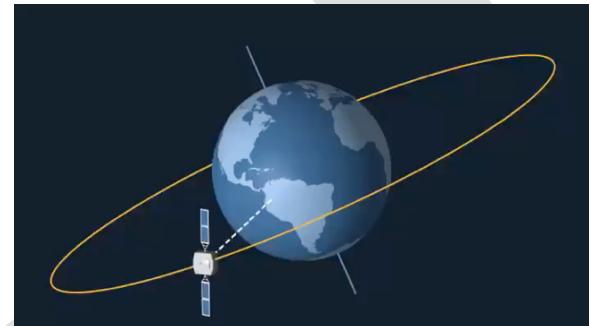
- » Over the course of a day, the object's position in the sky traces out a path, typically in a figure-8 form, whose precise characteristics depend on the orbit's inclination and eccentricity.

- Requirements:

- » **Circular Orbit of Height 35786 km**. At this height an orbital period of satellite is equal to earth's rotation period.
- » **Direction of revolution** of satellite should be same as direction of rotation of earth.

### GEO-STATIONARY - A SPECIAL CASE OF GEOSYNCHRONOUS

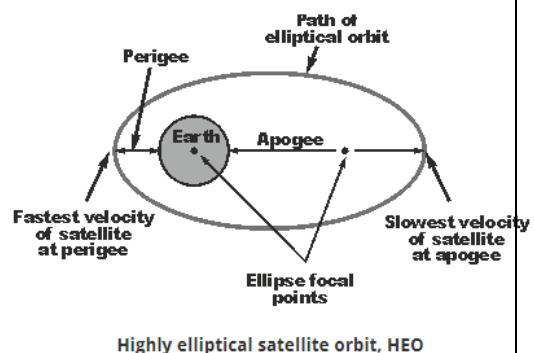
- A Geostationary Orbit is a particular type of Geosynchronous orbit, the distinction being that while an object in Geosynchronous orbit returns to the same point in the sky at the same time each day, an object in geostationary orbit never leaves that position.
- **Requirements for a satellite to be geostationary?**
  - Geosynchronous requirements
  - The equatorial plane of earth must be coplanar with the orbital plane of the satellite revolution (i.e., angle of inclination of orbit to equator is 0 degrees)
- Communication satellites and weather satellites are often placed in Geostationary orbits, so that satellite antenna which communicate with them don't have to rotate to track them but can be pointed permanently at the position in the sky where they stay.
- **Advantages**
  - Geo systems have significantly greater available bandwidth than the Low Earth Orbit
  - LEO and Medium Earth Orbit
  - Covers 1/3rd of Earth's surface.
  - Less expenses on tracking activities
  - Higher life span of satellites
- **Limitations**
  - Would require line of sight communication paths between terrestrial antenna and the satellites.
  - Long path length, and hence losses when compared to LEO, or MEO.
    - Long path length introduces delays.
    - Satellite costlier to install in GEO in view of the greater altitude
    - Geostationary Orbit (GEO) can only be above equator and therefore poles can't be covered.



Geostationary orbit can only be over the Equator

### 3) HIGHLY ELLIPTICAL SATELLITE ORBITS

- Elliptical Orbits are often called Highly Elliptical orbits or HEO.
- Key Features
  - Follows the curve of an ellipse.
    - Moves much faster when it is near earth and slower when it is away from earth.
  - There are two focal points and one of these is the geocentre of the earth.
  - **Apogee:** Point where the satellite is furthest from Earth - gravitation pull is lowest - satellite moves the slowest
  - **Perigee:** Point where the satellite is nearest from earth - gravitation pull is highest - satellite moves the fastest
  - **How permanent coverage can be achieved?**
- Applications
  - Provide coverage at any point on the globe
    - It may provide high latitude and polar coverage.
      - Countries such as Russia which needs coverage over polar and near polar areas make significant use of highly elliptical orbits.

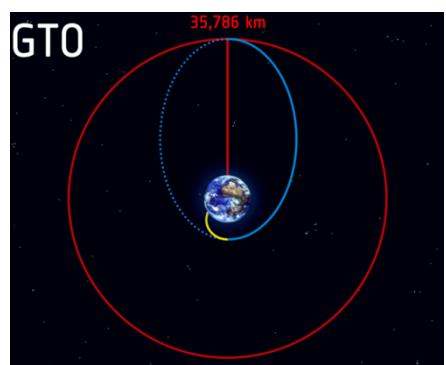


### 4) TRANSFER ORBITS

- These are special kind of orbits used to transfer satellites/spaceships from one orbit to another. These orbits are elliptical, with its perigee closer to earth. Satellites are taken to Perigee with the help of a rocket. After reaching this orbit, satellites by using relatively little energy from built in motors, can move to another larger orbit.
- This allows a satellite to reach a very high orbit, without needing the rocket to go to that height. **Geostationary Transfer Orbit (GTO)** is the most common type of transfer orbit.

#### A) GEOSTATIONARY TRANSFER ORBIT

- It is a Hohmann transfer orbit used to reach, geosynchronous or geostationary orbit. It is highly elliptical earth orbit with an apogee of 42,164 km, or 35786 km above sea level. Perigee can be anywhere above atmosphere, but it is generally restricted to few hundred Kms above the earth's surface.
- **Hohmann transfer orbit:** It is an elliptical orbit used to transfer between two circular orbits of different radii in the same plane.



### 5) SOME OTHER BASICS (CLASS DISCUSSION)

**Why are satellites generally launched in west to east direction?**

**Why are satellites generally launched from the east coast?**

**Why are satellites launched from near the equator?**



## 2. TIMELINE: INDIA IN SPACE, THROUGH THE YEARS

- 1) **1962:** The Indian National Committee for Space Research is formed under the leadership of Vikram Sarabhai and physicist Kalpathi Ramakrishna Ramanathan
- 2) **21 Nov 1963:** India's space program takes off with launch of a sounding rocket from Thumba Equatorial Rocket Launching Station in Kerala. It was for probing upper atmosphere.
- 3) **Aug 15, 1969:** ISRO is formed.
- 4) **Aug 19, 1975:** Aryabhata – India's first satellite is launched from a Soviet Kosmos-3M rocket from Kapustin Yar in the Soviet Union. It was designed and built in India.
- 5) **1979:** Bhaskara-1, the first experimental remote sensing satellite built in India, is launched. Images taken by its camera were used in hydrology, forestry and oceanography.
- 6) **1980:** Satellite Launch Vehicle (SLV)-3, India's first experimental satellite launch vehicle, takes off with Rohini Satellite RS-D2. Camera had the ability to use data for classifying ground features like water, vegetation, bare land, clouds and snow.
- 7) **1982:** INSAT 1-A is launched. Abandoned in 1983 where its altitude control propellant was exhausted.

- 8) **1984:** Rakesh Sharma, former IAF pilot, becomes the first Indian in space. In a joint India-Soviet Union Mission, Sharma boards the Soyuz T-11 spacecraft to the Salyut 7 orbital station.
- 9) **2008:** Launch of Chandrayaan-1. It orbits the Moon but doesn't land. It performs high resolution remote sensing aiming, among various missions, to prepare a 3D atlas of both the near and far sides of the moon.
- 10) **2013:** Launch of Mangalyaan, the Mars Orbiter Mission. Orbiting and studying Mars since Sep 24, 2014.
- 11) **2016:** All 7 satellites of IRNSS system placed in Orbit
- 12) **2019:** Chandrayaan-2 launched using GSLV MK-III
- 13) **2023:** Chandrayaan-3 succeeded in landing on the surface of the moon.

### 3. ISRO LAUNCHERS (OPERATIONAL)

**PSLV, GSLV, Sounding Rockets** are three broad categories of rockets (launchers) that ISRO has developed over the years.

Both PSLV (Polar Satellite Launch Vehicle) and GSLV (Geosynchronous Satellite Launch Vehicle) are the satellite launch vehicles (rockets) developed by ISRO.

#### 1) PSLV (POLAR SATELLITE LAUNCH VEHICLE)

- The PSLV is the third-generation satellite launch vehicle of India. It is an expandable system and was the first Indian Launch Vehicle to be equipped with Liquid Stage.
  - **Note:** ISRO has over the years realized **5 generations of rockets** – SLV, ASLV, PSLV, GSLV, and GSLV-MK-III.
- **Where is PSLV used?**
  - It was developed to allow India to launch its Indian Remote Sensing (IRS) satellite into **Sun synchronous orbit**, a service that was, until the advent of the PSLV, commercially available only from Russia.
  - PSLV can also launch small size satellites into **Geostationary Transfer Orbit**.
- It is one of the world's most reliable launch vehicles.

PSLV was developed for Low Earth Orbit satellites into Polar and Sun Synchronous Orbits, and GSLV for heavier INSAT class of Geosynchronous satellites into orbit.

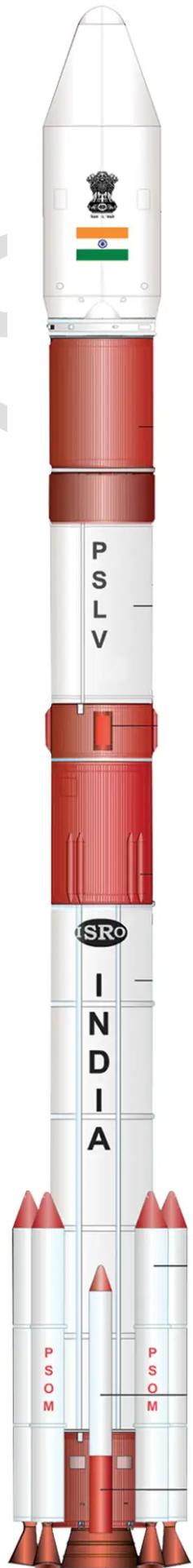


	SLV-3	ASLV	PSLV-XL	GSLV MK-II	GSLV MK-III
Height	22.7 m	23.5 m	44 m	49 m	43.43 m
Liftoff weight	17 t	39 t	320 t	414 t	640 t
Propulsion	All solid	All solid	Solid and liquid	Solid, liquid, and cryogenic	Solid, liquid, and cryogenic
Payload mass	40 kg	150 kg	1860 kg	2200 kg	4000 kg
Orbit	Low Earth Orbit	Low Earth Orbit	475 km Sun Synchronous Polar Orbit*	Geosynchronous Transfer Orbit	Geosynchronous Transfer Orbit

- **Launches So Far**
  - Developed in early 1990s, its first launch in 1993 was a failure.
  - First successful launch of PSLV took place in 1994 and till Jan 2023 (i.e., PSLV C-58), PSLV has had 60 launches with only two failures.

#### - Technical Specifications of PSLV

- **Payload Capacity:** SSPO (1,860 Kg); GTO (1,425 Kg)



- **Key features of PSLV Engines:** PSLV has four stages using solid and liquid propulsion alternatively.
- **Expansion of capabilities: Strap on Motors**
  - PSLV uses 6 solid rocket strap-on motors to augment the thrust provided by the first stage in its PSLV-G (1678 kg in SSPO) and PSLV-XL (1750 kg to SSPO) variants. PSLV-DL, PSLV-QL versions use 2 and 4 straps on motors respectively. PSLV-CA (1100 kg in LEO) uses no strap on motors.

» **Key Significance and Achievements of PSLV**

- **Reliability:** Only 2 failures in almost 3 decades of service and 60 launches.
- **Commercial use:** PSLV has launched **more than 350 foreign satellites** from 34 different countries so far.
- It has played significant role in various major ISRO missions (including Chandrayaan-1, MOM, IRNSS system etc.)
- **Strengthen India's Soft Power**
- Many **learnings** from the development of PSLV has helped scientists develop several non-space applications like fire resistant tiles, better engines for missiles etc.

**A) SOLID FUEL ENGINE VS LIQUID FUEL ENGINE (EXTRA GYAN)**

- » **A solid rocket fuel** has its fuel and oxidant mixed together as fine powders and then pressed into solid cake.
  - **Key characteristics**
    - **Higher Thrust** -> Higher force to launch the vehicle.
    - **Less volume**
    - **One time burn** -> all fuel burns at the same time, i.e., once it has been lit it will carry on burning until it is used up.
    - **Produces a lot of smoke** -> **large particles** when fired
- » **A liquid fuel engine** uses liquid fuel which can have following advantages
  - **Controlling Thrust**
  - **Engine can be shut down and restarted**
  - **Higher energy density** (joules per kg of propellant) is higher.
  - **Higher Specific Impulse** (impulse (in Newton second) per kg of propellant)
  - E.g., a modern solid fuel rocket has specific impulse of around 2500 N s Kg<sup>-1</sup>, while a good liquid fuel rocket produces an impulse of about 4500 N s Kg<sup>-1</sup>.
  - **Disadvantage: More complicated Engine requirements and thus more expensive and heavier engine** -> pumps, piping, separate storage for the fuel and oxidant means that extra mass has to be carried by the launch vehicle.

» **Why Hybrid Engines**

- Vastly reduce overall system weight and cost. It increases reliability (a smaller number of components which can fail)

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## B) PSLV C-58

- ISRO's PSLV C-58 has launched **XPOSAT Satellite** into an eastward low inclination orbit on 1<sup>st</sup> Jan 2024.
- After injection of XPOSAT, the PS4 stage was restarted twice to reduce the orbit into 350 km circular orbit for orbital platform (OP) experiments. The PSLV Orbital Experiment Module-3 (POEM-3) experiment was executed to meet the objective of 10 identified payloads, supplied by ISRO and IN-SPACe.
  - » These 10 payloads are developed by start-ups, education institutions and ISRO Centres.
  - » They are:
    - The Radiation Shielding Experimental Module (RSEM) by TakeMe2Space;
    - Women Engineered Satellite (WESAT) by LBS Institute of Technology for Women;
    - BeliefSa-t0 Amateur radio satellite by K.J. Somaiya Institute of Technology;
    - Green Impulse TrAnsmitter (GITA) by Inspecty Space Labs Private Limited;
    - Launching Expeditions for Aspiring Technologies -Technology Demonstrator (LEAP-TD) by Dhruva Space Private Limited
    - RUDRA 0.3 HPGP by Bellatrix Aerospace Private Limited;
    - ARKA-200 by Bellatrix Aerospace Private Limited;
    - Dust Experiment (DEX) by PRL;
    - ISRO Fuel cell Power System (FCPS) by VSSC, ISRO and;
    - FCPS payload is significant as it has potential applications in India's space station which is proposed to come up by 2035.
    - Si-based High Energy cell by VSSC, ISRO
- **Note:** This is the third time ISRO has operated the PSLV fourth stage in this way.
- **Thus**, it can be said that the PSLV-C58 mission represents a union of the aspirations of professional scientists, aspiring students of science, and India's private spaceflight sector.

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## ISRO SUCCESSFULLY TESTS POLYMER ELECTROLYTE MEMBRANE FUEL CELL ON PSLV'S-C58'S ORBITAL PLATFORM POEM3 (JAN 2024)

- ISRO successfully tested a 100 W class Polymer Electrolyte Membrane Fuel Cell based power system in its orbital platform, **POEM-3** which was launched onboard PSLV-C58 on 1<sup>st</sup> Jan 2024.
- The objective of the experiment was to assess Polymer Electrolyte Membrane Fuel Cell operation in space and to collect data to facilitate the design systems for future mission.
- **Outcome of the test:**
  - » During the short duration test onboard POEM, 180 W power was generated from Hydrogen and Oxygen gases stored onboard in high pressure vessels. It provided a wealth of data on performance of various static and dynamic systems.

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### C) PSLV C-57/ ADITYA-L1 MISSION (SEP 2023)

### D) PSLV-C56 / DS-SAR MISSION (JULY 2023)

- The launch of PSLV C-56 carrying DS-SAR satellite, along with 6 co-passengers [all 7 Singaporean satellites] was accomplished successfully on July 30, 2023.
- PSLV C-56 was configured in **core alone model**, similar to C-55.
- **DS-SAR** is a 360 kg satellite into a Near-equatorial Orbit (NEO) at 5 degrees inclination and 535 km altitude.
  - DS-SAR satellite is used for satellite imagery requirements of various agencies within the government of Singapore.
  - It carries a Synthetic Aperture Radar (SAR) payload developed by Israel Aerospace Industries (IAI). This allows DS-SAR to provide all weather day and night coverage, and capable of imaging at 1m-resolution at full polarimetry.
- After the launcher placed all the seven satellites into a 535 km circular orbit, **PS4 stage was brought back to a lower orbit of 295 km X 300 orbit**. This has been done so that the stage spends less time in space, reducing its duration from over two decades to less than two months, before re-entering into the earth's orbit.

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### E) PSLV C-55/TELEOS-2 MISSION (APRIL 2023)

- **PSLV C-55/ TeLEOS-2** was launched successfully on April 22, 2023, from SDSC-SHAR, Sriharikota.
- This is a dedicated commercial mission through NSIL with **TeLEOS-2** as primary satellite and **Lumelite-4** as a co-passenger satellite.
- The satellite weigh about 741 kg and 16 kg respectively. Both belong to Singapore.

**POEM-2:** The mission has the PSLV Orbital Experiment Module (**POEM**), where the spent PS4 stage of the launch vehicle would be utilized as an orbital platform to carryout scientific experiment through non-separating payloads. The payloads belong to ISRO, Bellatrix, Dhruva Space, and Indian Institute of Astrophysics.

## 2) GSLV (GEOSYNCHRONOUS SATELLITE LAUNCH VEHICLE)

- **Background of GSLV**
  - » GSLV is an expandable launch system operated by ISRO.
  - » First launch in 2001. First successful flight in 2003: successfully placed GSAT-2 in 2003.
  - » **Main Purpose:** GSLV was primarily developed to launch INSAT class of satellites into Geosynchronous Transfer Orbits. GSLV is being used for launching GSAT series of satellites.
  - » **Payload to GTO:** Presently GSLV-mk-II can inject 2.5 ton (GSLV Mk-2) of communication satellite into Geosynchronous Transfer Orbit.
  - » **Payload to LEO:** GSLV's capability of placing up to **5 tonnes** in LEO broadens the scope of payloads from heavy satellite to multiple smaller satellites.
- **Three Stage Launcher (GSLV-Mk-2) (one solid motor stage (expandable with four liquid engine strap ons), one earth Storable Liquid stage, and one cryogenic stage)**
- **Third Stage: CUS**
  - Developed under Cryogenic Upper Stage Project (CUSP), the CE7.5 is India's first cryogenic engine, developed by Liquid Propulsion Systems Centre in Mahendragarh, Tamil Nadu. CE-7.5 has a staged combustion operating cycle.
    - Fuel: LOX + LH<sub>2</sub> (Liquid Oxygen + Liquid Hydrogen)
    - Max Thrust: 75 KN
- **Variants**
  - **GSLV Mk 1(a,b,c)** - Not important
  - **GSLV Mk 2 (Operational)**
    - This variant uses an Indian cryogenic engine, the CE-7.5, and is capable of launching 2500 Kg into Geostationary transfer orbit. Previous GSLV vehicles (GSLV Mk1) have used Russian cryogenic engines.

### A) LAUNCH VEHICLE MARK 3 (LMV3 OR GSLV MARK 3)

- LVM3 is a **3-stage** heavy lift launch vehicle developed by ISRO.
- 1) **Solid Rocket Boosters: S200** – GSLV MK III uses two S200 solid rockets boosters to provide the huge amount of thrust required for lift off. Fuel: **HTPB**.
- 2) **A liquid Propellant core stage (L110):** The L110 liquid stage is powered by 2 Vikas engines.
- 3) **A Cryogenic Stage (C25):** The C25 is an improvement on CE-20 Cryogenic engine, India's largest cryogenic engine, designed and developed by the Liquid Propulsion System Center
  - a. Fuel: LOx + LH<sub>2</sub>
- **Capability:** GSLV-Mk III can launch 4 tons class of satellites to Geosynchronous Transfer orbit (GTO) or about 8-10 tons to LEO, which is twice the capability of GSLV Mk II.
- **GSLV MK-III Flights so far:**
  - » GSLV-Mk III – D1 (2017): GSAT-19 to GTO

- » GSLV-MK III – D2 (2018): GSAT-29 to GTO
- » GSLV-MK III – M1 (2019): Chandrayaan-2
- » GSLV-MK III – M2 (2022): OneWeb India-1 Mission
- » GSLV MK III – M3 (2023): OneWeb India-2 Mission
- » GSLV MK III – M4 (2023): Chandrayaan-3

▫ **GSLV MK-III – M2/ OneWeb India-1 Mission (Oct 2022)**

- It was only the second operational flight of LVM3 (after Chandrayaan-2 mission). It was a dedicated commercial satellite mission of NewSpace India Limited (NSIL). This mission was undertaken as part of the commercial arrangement between NSIL and m/s Network Access Associates Limited (m/s OneWeb Ltd), a UK based company. A total of **36 OneWeb Gen-1** satellites of about 150 Kg each totaling about **5,796 Kg** were launched to a circular LEO of about 601 km with a 87.4 degree inclination.
- This was one of the biggest commercial orders executed by ISRO.
- **Note: Some Unique features of the Mission**
  - First Commercial Mission of LVM3
  - First multi-satellite mission with 36 OneWeb Satellites onboard
  - First launch of LVM3 to LEO
  - First Indian rocket with six-ton payload
  - First NSIL Mission with LVM3
  - First OneWeb Mission with NSIL/DoS

**LVM3 M3/ OneWeb India-2 Mission Accomplished Successfully (March 2023)**

- In its sixth consecutive successfully flight of LVM3, the vehicle placed 36 satellites belonging to the OneWeb Group company in their intended 450 km circular orbit with an inclination of 87.4 degrees.
- The total weight of the payload was 5,805 kg.

**LVM3 M4/ Chandrayaan 3.0** Mission was accomplished in July 2023

**B) INDIA'S JOURNEY TOWARDS DEVELOPING ITS OWN CRYOGENIC ENGINE**

- **Basics about Cryogenic Engine**
  - **Cryogenic engine** is a rocket engine that uses cryogenic fuel or oxidizer, i.e. its fuel or oxidizer (or both) are gases liquified and stored at very low temperatures.
  - **Note:** All Cryogenic engines are also, liquid propellant rocket engines or hybrid rocket engines.
  - **Fuel:** Combination of Liquid hydrogen and Liquid Oxygen is the most commonly used propellant in cryogenic engine. The fuel provides very high specific impulse.
- **Difficulties in developing Cryogenic engine:** Burning super cooled fuel at extremely high temperature; Developing material that can withstand high temperature and pressure during combustion.
  - **Advantages**
    - More efficient and provides more thrust for every kg of propellant it burns.

- **Current status**
  - CE-7.5 being used in GSLV MK-II.
  - CE-20 is being used in GSLV MK-III. It is indigenously developed for LVM-3.
- **Further upgradation:**
  - In Nov 2022, ISRO has successfully conducted a hot test of CE20 cryogenic engine. This successful hot test was at an uprated thrust level of 21.8 tonne for the first time.
  - This will enhance the LVM3 payload capability upto 450 Kg with additional propellant loading. The major modification carried out on this test article compared to previous engines was introduction of Thrust Control valve (TCV) for thrust control.
  - In addition to the hot test, a 3D printed LOX and LH2 turbine exhaust casings were also inducted in the engine for the first time.

#### 4) SOUNDING ROCKETS

- Sounding rockets are one or two stage solid propellant rockets used for probing the upper atmospheric regions and for space research.
- They also serve as easily affordable platforms to test or prove prototypes of new components or subsystems intended for use in launch vehicles and satellites.
  - With the establishment of the Thumba Equatorial Rocket Launching Station (TERLS) in 1963 at Thumba, a location close to the magnetic equator, there was a quantum jump in the scope for aeronomy and atmospheric sciences in India.
    - The launch of the first sounding rocket from Thumba near Thiruvananthapuram, Kerala on 21 November 1963, marked the beginning of the Indian Space Programme. The rocket was US Nike Apache.
- **Operational Sounding Rockets**
  - Currently **3 versions** are offered as operational sounding rockets, which cover a payload range of 8-100 Kg and an apogee range of 80-475 Km.

Vehicle	RH-200	RH-300-Mk-II	RH-560-MK-II
Payload (in kg)	10	60	100
Altitude (in km)	80	160	470
Purpose	Meteorology	Aeronomy	Aeronomy
Launch Pad	Thumba, Kerala	SDSC-SHAR	SDSC-SHAR

- **Rohini (Rocket Family)** is a series of sounding rockets developed by ISRO for meteorological and atmospheric study.
- ISRO's RH-200 sounding rocket records **200<sup>th</sup> consecutive successful flight** (Nov 2022)

- The small rocket lifted off from the launchpad at the **Thumba Equatorial Rocket Launching Station (TERLS)** at the Vikram Sarabhai Space Centre (VSSC).
- **Example of Experiment: Air Breathing Propulsion Experiment** using RH-560 rocket fitted with a supersonic combustion (Scramjet) engine on Aug 28 from Sriharikota. (Aug 2016)

## 4. OTHER ENGINES AND RELATED PROJECTS IN NEWS

### 1) ISRO'S NEXT-GEN LAUNCH VEHICLE (NGLV) MAY ASSUME PSLV'S ROLE

- ISRO is developing a Next-Gen Launch Vehicle (NGLV), which will one day replace operational systems like PSLV. Here ISRO is planning a three stage to orbit, reusable heavy lift vehicle with payload capacity of 10 tons to GTO.
- It will feature semi-cryogenic propulsion; simple and robust design (allowing bulk manufacturing, modularity and minimal turnaround time)

### 2) SEMI-CRYOGENIC ENGINE (UNDER DEVELOPMENT)

- Semi-Cryogenic Engine is an Indian Liquid fuel rocket engine using a combination of liquid oxygen (LOX) and refined kerosene (Isrosene) as propellants. It is being developed for future heavy lift launch vehicles and reusable launch vehicles.
- It is being developed by Liquid Propulsion System Centre, a subsidiary of ISRO.
  - Project Codename: SCE-200
- **Where will it be used?**
  - Immediate Application: One of the immediate applications will be to replace the liquid core (L110) engine of GSLV Mark-3 with the SCE-200 to boost the payload capacity of the rocket from 4 to six tonnes.
- **SCE-200: Other Details**
  - Cost of project: 1800 crore (Cabinet cleared the project in 2008).
  - Currently, only US and Russia have this technology.
  - In 2015, ISRO signed an MoU with Russian Space Agency to boost its plan for Semi-Cryogenic Launch Vehicle

### 3) DIFFERENCES BETWEEN CRYOGENIC ENGINE AND SEMI-CRYOGENIC ENGINE

	Cryogenic	Semi-Cryogenic
Fuel	Liquid Hydrogen + Liquid Oxygen	Isrosene + Liquid Oxygen
Temperature	Liquid hydrogen required to be stored at -253-degree celsius	Kerosene can be stored at normal temperatures
Weight	LH <sub>2</sub> + LO <sub>2</sub> is <u>heavier</u> than Kerosene and has to be stored	Lighter than liquid fuel and can be stored at normal temperature.

	at freezing temperature of - 253 degree celsius.	Therefore, <b>kerosene occupies less space, and more propellant can be packed</b> in the semi-cryogenic engine's fuel compartment.
<b>Specific Impulse</b>	Cryogenic engine offers <u>higher specific impulse</u> than SCE	
<b>Thrust to weight Ratio</b>		It offers <u>better thrust to weight ratio</u> upto 180. Higher density of the exhaust gas in case of the SCE contribute to high mass flow rates making it <u>easier to develop high thrust engines</u> .
<b>Stage</b>	Higher specific impulse is valuable for upper stage, where mass comes at a premium price. So Cryogenic is used at upper stage.	<ul style="list-style-type: none"> <li>SCE have been preferred in lower stages when <u>high thrust is must-have over specific impulse</u>.</li> </ul>

#### 4) REUSABLE ROCKETS: REVOLUTIONIZING ACCESS TO OUTER SPACE

- **Details**
  - Reusable launch system is a launch system that includes the recovery of some or all of the component stages and reuse of these components in another launch.
  - Till now, several **fully reusable sub-orbital system** and **partially reusable orbital systems** have been flown. During 21<sup>st</sup> century, the interest in reusable launch system has grown considerably, with several active launchers.
    - SpaceX's Falcon 9 rocket has a reusable first stage and expendable second stage. Plans for the second stage of the Falcon 9 to be made reusable, creating a fully reusable system, have been cancelled, with the SpaceX starship being planned as a fully reusable launch vehicle.
    - If ISRO is able to develop this technology, it will reduce the cost of launch by 70-80% and increase the competitiveness of ISRO in satellite launch market.

- **Steps taken by ISRO to develop RLV.**

- In May 2016, ISRO successfully test fired its first indigenous winged reusable satellite launch vehicle.
  - In this experimental mission, the HS9 solid rocket booster carrying RLV-TD lifted off from the First Launch Pad at Satish Dhawan Centre, Sriharikota.
  - The RLV-TD re-entered the earth after reaching a height of 70 km.
  - It was a baby step towards developing reusable launch vehicle.
  - Ultimate Aim:** Ultimate aim of the project is to put satellite into orbit around earth and then reenter the atmosphere.
- The final version would take another 10-15 years to get ready.

#### 5) LOW-COST SMALL SATELLITE LAUNCHER (SSLV)

## - Introduction

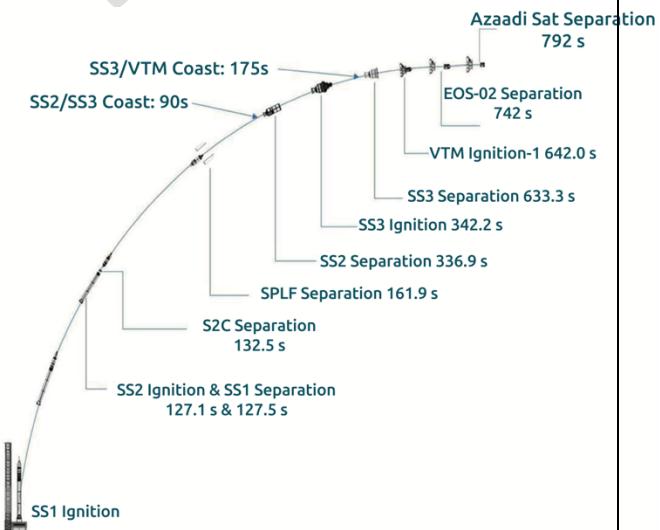
- The Indian SSLV (Small Satellite Launch Vehicle) is a small launch vehicle which serves small satellite launches.
- It is the smallest vehicle at 110-ton mass at ISRO.
- **Low turnaround time:** It takes only 72 hours to assemble (unlike around 70 days needed for PSLV).
- **Low Human Resource requirement:** Only 6 people are required to do assembly (unlike 60 people for the PSLV).
- **Cost Effective:** The overall cost of building the SSLV will only be Rs 30 crores.
- **Capability:** Payload capacity of 500 Kg to 500 km planar orbit or 300 kg to SSPO. Using PSLV for these small satellites was an overkill.
- It uses three solid fuel-based stages and a liquid fuel-based velocity trimming module (VTM) to place the satellite in orbit.
- It is ideal for on-demand, quick turn-around launch of small satellites.
- **Major technologies** developed as part of SSLV are flexible nozzle control with electro-mechanical actuators for all stages, miniaturized avionics, and a velocity trimming module in the upper stage for precise satellite injections.

## - Need

- The **global demand** for launch of small satellite is increasing. It is being demanded by businesses, government agencies, universities, and various research labs.

## - First Developmental Flight

- » The maiden flight of SSLV in Aug 2022 can be considered a partial success.
  - When it came to the stage when the satellite had to be set in orbit, there was a glitch which resulted in the satellite being lost forever. ISRO announced that there was a malfunction of a sensor which resulted in placing the satellites in an elliptical orbit, rather than a circular orbit.
  - It placed the satellites into 356 km X 76 km elliptical orbit instead of 356 km circular orbit.



## - 2nd Developmental Flight: SSLV-D2 / EOS-07 Mission (Feb 2023)

- » The 2<sup>nd</sup> developmental flight of SSLV-D2 was successfully launched on Feb 10, 2023.
- » It intended to inject EOS-07, Janus-1 and AzaadiSAT-2 satellite into 450 km circular orbit, in its 15 minutes flight.
  - **EOS-07** is 156.3 kg satellite designed, developed and realized by ISRO. New experiments include mm-wave Humidity Sounder and Spectrum Monitoring payload.

- Janus-1, a 10.2 kg satellite belongs to Antaris, USA.
- **AzaadiSAT-2** is a combined effort of about 750 girl students across India guided by SpaceKids India, Chennai.

## 5. ISRO SATELLITES

### 1) BASICS

#### What is a satellite?

- Satellite means a smaller, space-based object moving in a loop (an orbit) around a larger object.
  - The Moon is a natural satellite of earth because gravity locks it in orbit around our planet.

### 2) COMMUNICATION SATELLITES

- **Introduction**
  - A communication satellite is an artificial satellite that is placed in earth's orbit for the purpose of sending and receiving communication data between a source and destination. They are basically "space mirrors" that can help us bounce radio, TV, Internet data, and other kinds of information from one side of earth to another.
  - It is used to provide data communication and relaying services for televisions, radio, telecommunication, weather and internet.
  - Communication satellites essentially overcome the problem of sending radio waves, which travel in straight lines, around our curved planet.
  - They commonly move in geo-stationary orbit.
    - Why?
  - Communication satellites can also move in highly elliptical orbit.
- **Two types of Communication Satellites – Passive and Active**

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#### A) COMMUNICATION SATELLITES OF INDIA / ISRO

- **The Indian National Satellite System (INSAT) System** is one of the largest domestic communication satellite systems in Asia-Pacific region.
  - It was established in 1983 with the launch of INSAT 1B, it initiated a major revolution in India's communications sector and sustained the same later.
  - The system presently consists of the constellation of INSAT system consisting of around 20 operational satellites, namely INSAT-3A, 3C, 4A, 4B, 4CR, GSAT 6,7,8,9,10, 12, 14, 15, 16, 18, 19, 17, 6A, 29, 11 (largest 5850 Kg, Dec 2018), 7A (Mostly for serving air force, Dec 2018) and 31 (Feb 2019).
- INSAT system with more than 200 transponders in the C, extended C and Ku-bands provides services to telecommunication, television broadcasting, satellite newsgathering, societal application, weather forecasting, disaster warning and search and rescue operations.

## B) RECENT EXAMPLES OF COMMUNICATION SATELLITES

### GSAT-20

- **Why in news?**
  - ISRO's commercial arm to launch GSAT-20 Satellite on SpaceX's Falcon-9 in 2024 (Jan 2024)
- **Details about GSAT**
  - The GSAT-20 is a high throughput Ka-band satellite which will be fully owned, operated and funded by NSIL.
  - a. It will offer Ka-Ka band HTS capacity with 32 beams having Pan-India coverage including A&N and Lakshadweep.
  - b. The satellite weighs 4,700 kg and offers HTS capacity of nearly 48 Gbps and has been specifically designed to meet the demanding service needs of remote and unconnected areas.

## 3) EARTH OBSERVATION SATELLITES (PHOTOGRAPHY, IMAGING AND SCIENTIFIC SURVEYING)

- Earth Observation Satellites are specifically designed for Earth Observation from Orbit and are used for environmental monitoring, meteorology, map making etc. Most earth observation satellites carry instruments that should be operated at a relatively low altitude.
- **Earth Observation Satellites of India**
  - » Starting with IRS-1A in 1988, ISRO has launched many operational remote sensing satellites.
  - » Today, India has one of the largest constellations of remote sensing satellites in operation. Currently, earth observation satellites which are in **Sun-synchronous orbit** include
    - EOS-01, EOS-02, EOS-06 (Oceansat-3)
    - RESOURCESAT-1, 2, 2A
    - CARTOSAT-1, 2, 2A, 2B etc
    - CARTOSAT-3 (Launched in Nov 2019)
    - RISAT-1, RISAT-2, RISAT-2B (launched in May 2019 – PSLV C46), RISAT-2BR1 (launched in Dec 2019 – PSLV C-48)
    - OCEANSAT-2
    - Megha-Tropiques, SARAL and SCATSAT-1
    - **HySIS**
  - Earth Observation satellites in **Geostationary Orbit** include:
    - EOS-03 (couldn't be put in orbit due to failure of GSLV-F10)
    - INSAT-3D, INSAT 3DR
    - Kalpana & INSAT 3A
- » Varieties of instruments have been flown onboard these satellites to provide necessary data in a diversified spatial, spectral and temporal resolutions to cater to different user requirements in the country and for global usage. The data from these satellites are used for several applications covering

agriculture, water resources, urban planning, rural development, mineral prospecting, environment, forestry, ocean resources and disaster management

#### 4) SATELLITE NAVIGATION (SAT – NAV)

- Why in news recently?
  - ISRO's GSLV-F12 successfully places navigation satellite NVS-01 into intended orbit (May 2023)

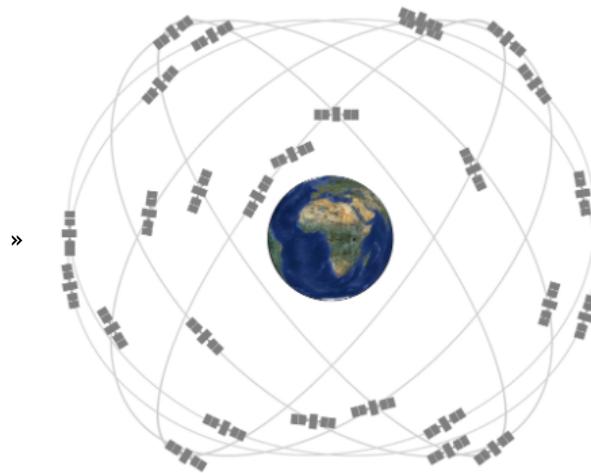
##### A) BASICS ABOUT SATNAV

- A satellite navigation (SATNAV) system is a technology that allows users to determine their precise location, velocity, and time information anywhere on or near Earth's surface.
- It uses a network of satellite in space and provide accurate positioning data.
- Currently, there are four global satellite-based navigation system – the American GPS, the Russian GLONASS (GLObalnaya NAvgatsionnaya Sputnikovaya Sistema), the European Galileo and the Chinese BeiDou.
- India has a regional system called NavIC and Japan has Quasi Zenith.
- **Methods used in SATNAV: Triangulation and Trilateration:**
- **Accuracy:** They generally provide high levels of positioning accuracy (within a few meters), depending on the quality of receiver and the number of satellites in view. However, various factors such as signal obstruction, atmospheric conditions, and receiver limitations can affect the accuracy.
- **Applications: Navigation purposes** -> helping users find their way while driving, hiking, or boating. It is also used in aviation, surveying, geolocation-based services, precision agriculture, and even in some outdoor recreational activities. It can be used for vehicle tracking, fleet management, precise timing etc.

##### B) GLOBAL POSITIONING SYSTEM (GPS)

- The best-known satnav system, GPS, uses 24 active satellites (including backups). Day and night, 365 days a year, they whiz around earth once every 12 hours on orbital plane inclined 55 degrees to the equator.
- Wherever you are on earth, you are in sight of at least half a dozen of them, but **you need signals from 3 or 4 satellites** to determine your position with an accuracy of just a few meters.
- **How GPS Finds your location?**
  - It uses **Trilateration**
- **GPS Constellation arrangement**
  - » GPS constellation fly in medium earth orbit (MEO) at an altitude of approx. 20,200 kms. Each circle orbits the earth twice a day.

- » The satellites are arranged in six equally placed orbital planes surrounding the earth. Each plain contains four slots occupied by baseline satellites. This 24-slot arrangement ensures users can view at least four satellites from virtually any point on the planet.



### C) BEIDOU

- **Details**
  - China initiated BeiDou in 1994 with first BeiDou satellite launched in 2000.
  - **Second generation BeiDou (BDS-2)** provided coverage to Asia Pacific region starting in 2012.
  - **Third generation BeiDou (BDS-3)** satellite deployment started in 2015. In 2020, the system has been completed and it can now provide global services. With this they have joined United States' GPS and Russia's GLONASS in providing global PNT services, with Europe's Galileo to follow. These are all compatible and interoperable, meaning users can draw services from all of those to improve accuracy.
- **Satellite Constellation**
  - **24 satellites in Medium Earth Orbit** (around 21,500 kms above the earth) provide the positioning, navigation, and timing (PNT) services. These satellites use rubidium and hydrogen atomic clocks for highly-accurate timing that allows precise measurement of speed and location.
  - **Satellites in geosynchronous Orbit** (including Geo-stationary orbit) help BeiDou provide short messaging service through which 120-character messages can be sent to other BeiDou receivers.
- **Plans of Expansion:**
  - In Nov 2022, China outlined plans to further expand the global reach of its home grown BeiDou satellite navigation system.
    - a. **Pakistan** in 2014 became the first foreign country to set up a BeiDou network.
    - b. **BeiDou** has set up a first of three Continuously Operating Reference Stations (CORS) for its network in Thailand in 2013, to serve as a hub for ASEAN.

## D) GAGAN AND GEMINI (CLASS DISCUSSION)

## E) NAVIC (NAVIGATION USING INDIAN CONSTELLATION)

- Indian Regional Navigation Satellite System (IRNSS) (also called Navigation Using Indian Constellation (NAVIC)), is a regional satnav system developed by ISRO. It aims to provide reliable position, navigation and timing (PNT) services over India and its neighbourhood, upto 1500 km from its boundary. In addition it is also capable of broadcasting messages. This can be used for broadcasting safety-of-life alerts in areas with poor or no communication, particularly in Ocean.

- **Need of IRNSS** when services like GPS are easily available.

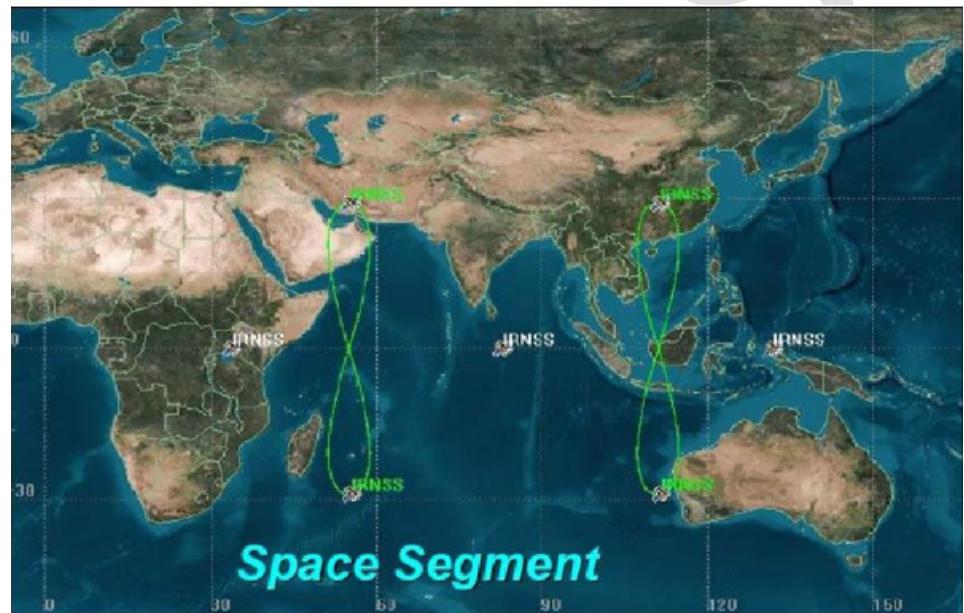
- The access to foreign controlled global navigation satellite systems is not guaranteed in hostile situations, as happened to Indian military depending on American GPS during **Kargil War**.

- **NAVIC provides two types of services:**

- » **Standard Positioning Service** (Open for Civilian Use)
  - » **Restricted Services** (Encrypted one, for authorized users (military))

- **Components of IRNSS System:**

- » Space segments consists of **7 satellites, 3 satellites in GEO stationary orbit (GEO) and 4 satellites in GEO synchronous orbit(GSO)** with inclination of **29 degree** to the equatorial plane.
  - » All the satellites will always be visible in the Indian region.
  - » **First of the 2<sup>nd</sup> generation satellite – NVS-01** was successfully launched in May 2023
    - ISRO's **GSLV F12** (GSLV-MK-II mission)successfully places navigation satellite NVS-01 into intended orbit.
    - **About GSLV F12:**
      - » It is the **15<sup>th</sup>** flight of India's GSLV and the **9<sup>th</sup>** flight with indigenous cryo stage.
  - **About NVS-01:**
    - » **Heavier:** It weighs **2232 kg** and has been placed in **geosynchronous orbit** (older IRNSS satellites weighed 1,425 kg)



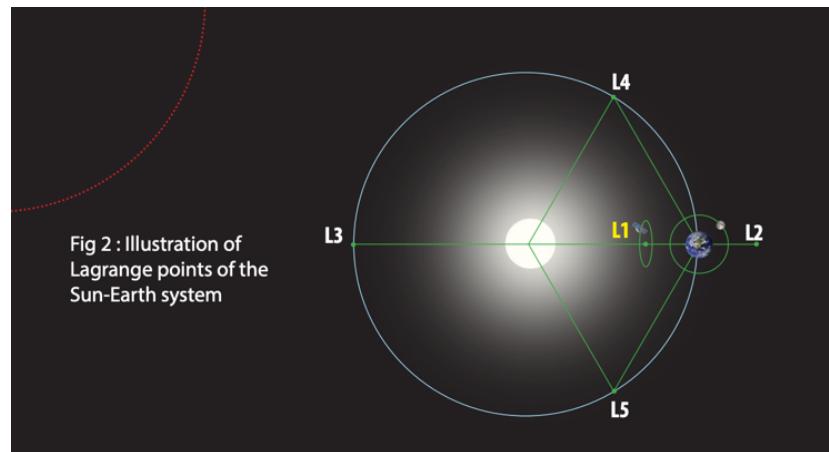
- » **Indigenous Atomic Clock:** For the first time, the satellite carries an indigenous atomic clock. The space qualified Rubidium atomic clock has been indigenously developed by Space Application Centre – Ahmedabad.
- » **L1 signals for better use in wearable devices:** The second generation satellites have send signals in a third frequency, L1, besides the L5 and S frequency signals that the existing satellites provide. This will increase operability with other satellite based navigation systems. L1 frequency is the most commonly used in the GPS and will increase the use of NavIC in wearable devices which use low power signal frequency chip.
- » **Longer Mission Life** of 12 years (earlier NavIC satellites have a mission life of 10 years).

- **Current Situation** (June 2023)
  - The receivers have now been deployed, and NavIC is in use for projects like public safety, power grid synchronization, real-time train information system, and fishermen's safety.
  - Other upcoming initiatives (such as) common alert protocol based emergency warning, time dissemination, geodetic network, unmanned aerial vehicles are in the process of adopting NavIC system.

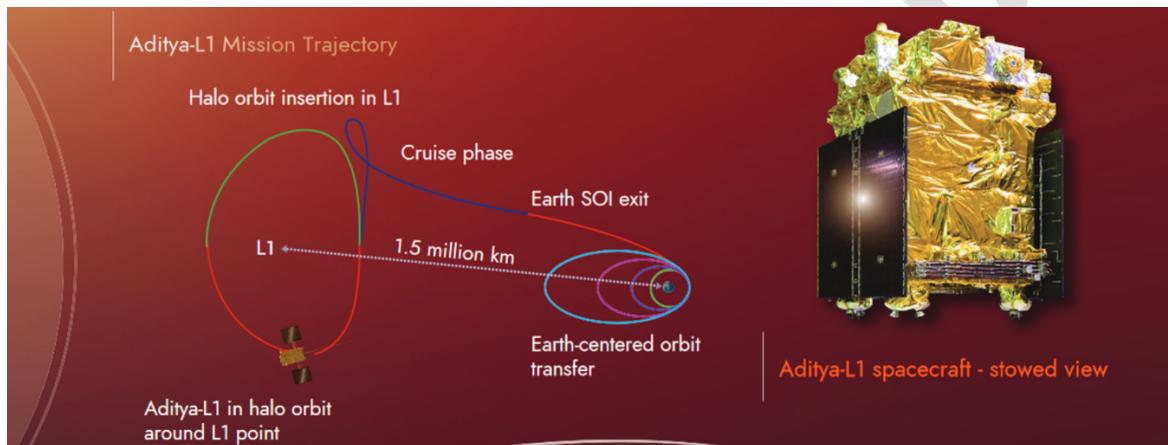
Some cell phone chipsets build by Qualcomm, MediaTek integrated NavIC receivers in 2019. Some example phones which are NavIC enabled include Redmi Note 9, realme 6, the OnePlus Nord etc.

## 5) SATELLITES TO STUDY THE SUN: ADITYA L1

- It is India's first observatory class space based solar mission.
- It was launched into space on 2<sup>nd</sup> Sep 2023 onboard PSLV-C57 and reached the L1 point on 6<sup>th</sup> Jan 2024, 127 days after its launch.
- It has a mission life of 5 years during which its payloads will study various aspects of sun. It serves as a space weather station and the data from the spacecraft will aid in making models and predicting storms in advance.
- The orbit of Aditya-L1 spacecraft is a periodic Halo Orbit with an orbital period of about 178 earth days. This halo orbit is a periodic, three dimensional orbit at L1 involving sun, earth and spacecraft.
- **Why study sun from space and specifically from Lagrangian point 1?**
  - **Why study sun from Space?**
    - Various types of radiations from sun are not able to reach earth due to atmosphere of the earth and earth's magnetic field making their study difficult from earth.
  - **Why from Lagrangian Point-1 (L1)?**
    - A Satellite placed in the halo orbit around the Lagrangian point 1 (L1) of the Sun-Earth system has the major advantage of continuously viewing the Sun without any occultation/ eclipses.



**What Trajectory ADITYA-L1 followed to reach Lagrangian Point-1:** Through various orbit raising manoeuvres and cruise phase, it was placed in a halo orbit around the Lagrangian Point-1 (L1) of the Sun Earth System, which is about 1.5 million km from the Earth.



The path Aditya-L1 will take to get to L1. | Photo Credit: ISRO

- **Major Science Objectives:**
  - Understand the coronal heating and solar wind acceleration; understand the initiation of Coronal mass ejection (CME), flares, and near earth space weather; understand the coupling and dynamics of the solar atmosphere; understand solar wind distribution and temperature anisotropy.
- **Aditya-L1 went with 7 Payloads:**

**Remote Sensing Payload:**

  - a. **Visible Emission Line Coronagraph (VELC):** It can peek as close as **1.05 solar radii**, a region never imaged by any solar telescope. It can thus give us more information about **coronal mass ejection**.
  - b. **Solar Ultraviolet Imaging Telescope (SUIT):** It will observe UV radiations from different zones of the solar atmosphere. It will help us to better understand the climate variation on earth.
  - c. **Solar Low Energy X-Ray Spectrometer (SoLEXS)**
  - d. **High Energy L1 Orbiting X-Ray Spectrometer (HEL1OS)**

### In-Situ Payloads:

- a. Aditya Solar Particle Experiment (ASPEX): In-situ measurements of solar particles and ions.
- b. Plasma Analyzer Package for Aditya (PAPA)
- c. Advanced Tri-axial High Resolution Digital Magnetometers

With the help of e,f, and g scientists can predict probable geomagnetic storms and better understand space weather dynamics.

### Understanding Lagrangian Points

- These are position in an orbital configuration of two large bodies where a small object affected only by gravity can maintain a stable position relative to two large bodies. The Lagrange points mark positions where the combined gravitational pull of two large masses provides precisely the centripetal force required to orbit with them.
- The interaction of the forces creates a point of equilibrium where a spacecraft may be "parked" to make observation.
- These points are named after Joseph-Louis Lagrange, an 18th-century mathematician.
- There are five such points, labeled L1 to L5 all in the orbital plane of two large bodies.
  - Three of these Lagrangian points – L1, L2, and L3 – are unstable positions that lie along an imaginary straight line connecting the two larger bodies.
    - Because of this instability, an object positioned at one of the three unstable Lagrange points L1, L2, and L3 – can be easily de-orbited by even weak force and they will then drift into space. Therefore, spacecraft here will need to frequently burn fuel via its thrusters, at the various moments of displacement to adjust to orbital movement frequently.
  - The other two – L4 and L5 – are stable locations that from the apexes of two imaginary equilateral triangles with the two large celestial bodies at the vertices of each triangle. Objects stay undisturbed at L4 and L5 because of a restoring force – a force acting against any displacement – that prevents them from being nudged away from the stable point. Because of this stability, this point tends to accumulate a lot of interstellar dust and asteroids called Trojans that zip around the points. Scientists have detected various Trojans at L4 and L5 of Sun-Jupiter System, Sun-Mars System, Sun-Neptune system etc.
    - They are also potential Site for Space Colonies
- Are there other space explorers at L1?
  - Yes, it is already home to four robotic explorers – NASA's Solar and Heliospheric Observatory Satellite, Deep Space Climate Observatory, Advanced Composition Explorer, and the Global Geospace Science Wind Satellite.
  - In next few years, some more observatories by USA and EU will be reaching here.

**About HALO Orbits:** A halo orbit is a, three dimensional orbit near the L1, L2, or L3 Lagrangian point in the three body problem of orbital mechanics. Although the Lagrange point is just a point in empty space, its peculiar characteristics is that it can be orbited.

## 6. OTHER IMPORTANT PROJECTS OF ISRO

### 1) PROJECT NETRA

- It is an EWS in space to detect debris and other hazards to satellite. It will also provide warning against missile and space attack against India's assets.
- It will consist of many observational facilities, connected radars, telescopes, data processing units, control centers etc.
- Initially, it will be launched for **LEO satellites** which inhabits remote sensing satellites. Eventually, NETRA will also have the capability to capture **GEO**, where communication satellites mostly reside.
  - **Does India not have any collision avoidance detection mechanism now?**
- Even now, India does collision avoidance maneuvers on our satellites. But for this it depends on data from **NORAD** (North American Aerospace Defense Command) and others available in the public domain.
- **NOTE:** NORAD is an initiative of USA and Canada and shares selective debris data with many countries

### 2) MISSION SHAKTI

- An ASAT tested by India.

### 3) GAGANYAAN

### 4) XPOSAT (X-RAY POLARIMETER SATELLITE)

- **Why in news?**
  - ISRO launched the XPoSat, in a two-part mission, onboard a PSLV C58 flight on 1<sup>st</sup> Jan 2024.
- **More Details**
  - XPoSat is a specialized science mission that will study the **polarization of X-Rays** in space.
    - The mechanization of polarization of radiation gives away the nature of its source, including the strength and distribution of the magnetic field and the nature of radiation around it.
  - XPoSAT carries two scientific payloads in a **low earth orbit**:
    - The Primary Payload (POLIX) (Polarimeter Instrument of X-Rays) will measure the polarimetry parameters (degree and angle of polarization) in medium X-ray range of 8-30 Kilo electron volt (KeV) photons of astronomical origin.

- The **POLIX** payload is developed by the Raman Research Institute (RRI), Bangalore, with support from ISRO centres.
- The **XSPEC** (X-Ray Spectroscopy and Timing): It will study X-rays of energy 0.8-15 KeV and changes in continuous X-Ray emissions.
  - The **XSPEC** payload is developed by the UR Rao Satellite Centre (URSC), ISRO.
- Together (POLIX and XSPEC), they are expected to shed light on intense X-ray sources such as pulsars and blackholes.
  
- **Need:**
  - **Better understanding of the universe:**
    - So far, astronomers have largely used and depended on spectroscopic, imaging and timing-based data obtained from either ground-based telescopes or satellite based missions. **Polarization** based study was done either in the optical or radio bands.
    - **XPOSAT** will be game changer and will facilitate X-Ray polarization measurement possible from bright source, that too in the medium energy band (8-30 KeV) – which has never been attempted before.
    - It is thus an excellent diagnostic tool to understand the emission processes from astronomical sources.
    - In space, X-Rays get polarized by multiple factors - for e.g. when X-rays are subjected to strong magnetic field or due to interactions with material present around black holes. So, by studying this polarization, scientists can understand the key characteristics of the source.
  
- **International Trend in Space-Based X-Ray Polarimetry**
  - Internationally, space-based x-ray polarimetry is gaining importance.
    - The **Imaging X-Ray Polarimetry Explorer (IXPE)** mission, launched in 2021, represents NASA's inaugural space-based endeavor, focused on scrutinizing X-Ray Polarization across various celestial bodies.
    - **Note:** XPoSAT energy range of 8-30 keV for polarization measurement is complimentary to IXPE energy range of 2-8 KeV (soft X-Ray band). Therefore, XPoSAT and IXPE spacecrafts will collectively probe different emission mechanisms and physics for bright X-Ray sources. Their coordinated observation will provide a wide window in the energy range of 2-30 KeV for polarimetric observations for bright X-Ray sources.
  - **Note:** India's ASTROSAT – India's first astronomy-based space mission launched in Sep 2015 – performed timing and broadband spectroscopy of X-Ray sources but no polarization studies were performed.
  
- **Which sources will be observed?**

- The XPoSat team has identified several tens of sources radiating X-Rays. XPoSat will observe two kinds of sources – Persistent Sources (targeted known source) and transient sources (pulsars, active galactic nuclei, magnetars)
- **Other Facts about XPOSAT:**
  - Launched on Jan 1, 2024
  - Precise Circular Orbit of 650 km, inclination of 6 degrees.
  - It is only the second space-based experiment, to study X-ray polarization, and at higher x-ray energies than the other, NASA's Imaging X-Ray Polarimetry explorer.
  - The instrument is totally indigenous in design and fabrication.

## A) UNDERSTANDING POLARIZATION – CLASS DISCUSSION

### B) UNDERSTANDING POLARIZED GLASSES

Polarized glasses cut the hazardous glare off the flat surfaces such as water, glass, and asphalt. When the polarized axis is vertical, all light that has been polarized through reflection and is now traveling horizontally (such as glare off of water or a windshield), will be blocked by the filter.

Polarized glasses are special materials which allow only vertically altering electric fields, and helps to decrease the glare from ground reflection, which consist of mostly horizontal polarization. Reflection polarizes the randomly varying sunlight into a single direction. Scattering of sunlight by air molecules also has a similar effect.

## 5) NASA-ISRO SYNTHETIC APERTURE RADAR (NISAR) IMAGING SATELLITE

- **Introduction:**
  - NASA-ISRO SAR (NISAR) is a LEO observatory being jointly developed by NASA and ISRO. It will map the entire globe in 12 days and provide spatially and temporally consistent data.
  - It carries L and S dual band SAR, which works with sweep SAR technique to achieve large swath with high resolution data.
  - Once launched, it will be world's most expensive earth-imaging satellite till date costing around \$1.5 billion.
- **Collaboration**
  - NISAR is considered the first big collaboration between ISRO and NASA, certainly on RADAR but just in general as well.
    - S-Band SAR is being built by ISRO and L-band by NASA
    - » The satellite will be launched from India using **GSLV-MK-2**.
    - » **Uses:** NISAR will provide an unprecedented, detailed view of the earth by using Advanced RADAR imaging. It is designed to observe and take measurements of some of the planet's most complex process, including ecosystem disturbances, ice-sheet collapse, and natural hazards such as earthquakes, tsunamis, volcanoes, and landslides. The satellite thus will be used for:

- Mapping and monitoring of natural resources
- Estimating agricultural biomass over full duration of crop cycle.
- Assessing soil moisture
- Monitoring of floods and oil slicks
- Monitoring coastal erosion, coastline changes, and variation in the wind.
- **Target:** The target launch readiness date is January 2024.

## 7. NASA'S INTERPLANETARY MISSION

### 1) MARS ORBITER MISSION

- **Details**
  - Mars Mission (MOM), also called Mangalyaan is spacecraft orbiting MARS since 24 September 2014.
  - It was launched on 5 November 2013 by the Indian Space Research Organization (ISRO).
  - It is India's first interplanetary mission and ISRO has become the fourth space agency to reach Mars, after the Soviet space program, NASA, and the European Space Agency.
  - It is the first Asian nation to reach Mars orbit, and the first nation in the world to do so in its first attempt.
- **What is MOM doing?**
  - It has been looking for signs of atmospheric methane while studying surface features - just like NASA's MAVEN Mission. Methane is considered a biomarker: a substance whose presence indicates the current or historical presence of life.
  - MOM is also exploring and observing Mars surface features, morphology, mineralogy, and the Martian atmosphere.
- **Mars Orbiter Mission – 2** (Mangalyaan – 2) is expected to be launched in the year 2024. It will consist of an orbiter and may also include a lander and rover.

### 2) VENUS: SHUKRAYAAN-1

#### Why in news?

- India to launch Shukrayaan Venus Mission in 2024 after pandemic delays

#### Details

- Shukrayaan-1 is a **proposed orbiter to Venus by ISRO** to study the surface and atmosphere of Venus. It will be first mission to Venus by ISRO.
- ISRO has been soliciting ideas for instruments for a Venus-mission since at least 2018.
- **Earlier**, ISRO was aiming for a mid-2023, but pandemic related delays have pushed the target to Dec 2024.

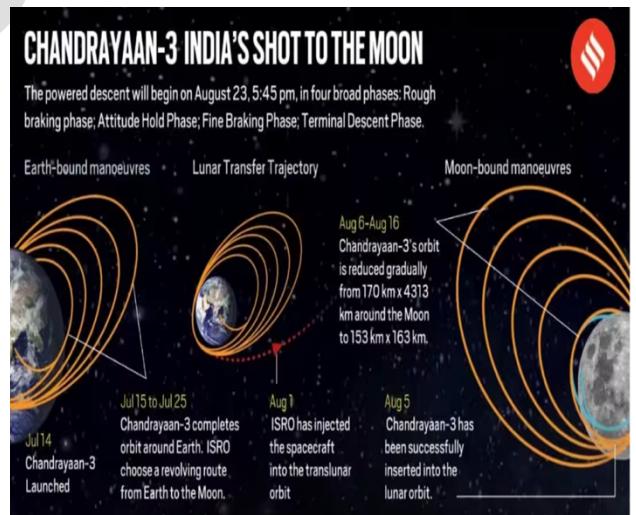
- » **Note:** This launch opportunity comes only in 19 months due to orbital configuration and period of Earth and Venus. So, after Dec 2024, the next opportunity will be available in mid-2026.
- It will be launched with the help of GSLV MK-II or GSLV MK-III.
- **Venus Missions in the Past**
  - » **Dozens of missions** have flown to Venus since the 1960s, but only a few in recent years.
    - **ESA's Venus Express** orbited the Venus between 2006 – 2014.
    - **Japan's Akatsuki** spacecraft entered orbit in 2015 after a previous unsuccessful attempt.
    - Several aircrafts are also performing **flybys** of Venus in the near future, including **NASA's Parker Solar Probe** for Solar Observation, and **Europe's BEPIColombo** en route to Mercury.

### 3) CHANDRAYAAN 3.0 (LVM3-M4) MISSION

- **Why in news?**
  - Chandrayaan-3 becomes the first to land near Moon's south pole (Aug 2023)
- **Details**
  - Chandrayaan -3 is the third Moon Mission of ISRO that was launched in July 2023 perched on GSLV-MK-3 heavy lift vehicle. It is a follow-on mission to Chandrayaan-2 and demonstrated end-to-end capability in safe landing and roving in lunar surface when it landed on the south pole of Moon on 23<sup>rd</sup> Aug 2023.
  - With this, India has become the fourth country in the world after USA, Russia and China to successfully land on Moon.

#### A) UNDERSTANDING THE DIFFERENT PHASES AND PATH TAKEN BY CHANDRAYAAN

- LVM-3 launched the Chandrayaan-3 in an elliptical parking orbit of 170 X 36500 km.
- Chandrayaan was launched on 14<sup>th</sup> July 2023. The whole process took 42 days, with the landing taking place on Aug 23.



#### B) COMPONENTS OF CHANDRAYAAN 3.0:

- It consists of a Propulsion Module (PM), Lander Module (LM), and a Rover with an objective of developing and demonstrating new technologies required for inter-planetary mission. **Note:** It doesn't have an orbiter module.

### **Propulsion Module (PM)**

PM carried the LM from launch vehicle injection till final lunar 100 km circular orbit and separated LM from PM.

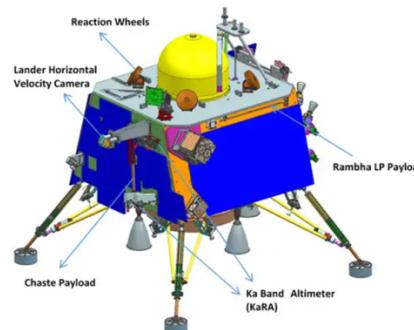
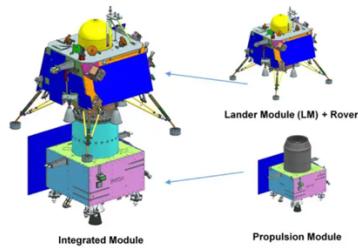
This propulsion module has Spectro-Polarimetry of Habitable Planet Earth (SHAPE) payload to study the spectral and Polarimetric measurements of Earth from the lunar orbit.

**The Lander (Vikram)** had the capability to soft land at a specified lunar site and deploy rover. It happened on 23<sup>rd</sup> Aug 2023. It remained stationary on the surface and carries four payloads which would record the chemical, thermal, and seismic instruments of the moon's surface.

**Lander Payloads:** Lander module has four payloads (Chaste, RAMBHA, ILSA and LRA)

**Chandra Surface Thermophysical Experiment (ChaSTE):** To carry out the measurements of thermal properties of lunar surface near polar region.

**Instrument for Lunar Seismic Activity (ILSA)** for measuring the seismicity around the landing site and delineating the structure of the lunar crust and mantle.



**RAMBHA- LP (Radio Anatomy of Moon Bound Hypersensitive ionosphere and atmosphere) -**

**RAMBHA:** To measure the near surface plasma (ions and electrons) density and its changes with time.

A passive **Laser Retroreflector Array** (LRA) from NASA is accommodated for lunar laser ranging studies. It acts as a target for lasers for very accurate measurements for future missions.

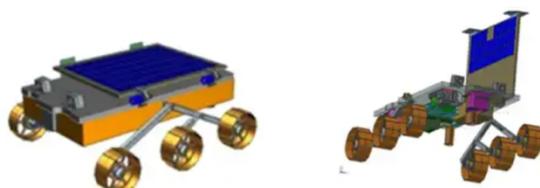
**Rover (Pragyaan)** is a 6 wheeled robotic vehicle.

**Life:** One lunar day (14 earth day)

#### **Payload:**

**Laser Induced breakdown Spectrometer (LIBS):** It will determine the chemical and mineral composition of the lunar surface.

**Alpha Particle X-Ray Spectrometer (APXS):** It will determine the composition of elements such as magnesium, aluminium, silicon, potassium, calcium, titanium and iron in the lunar soil and rocks.



### **C) LANDING WAS THE MOST COMPLICATED PART HERE:**

- Landing is the most complicated part of the mission. The Lander and Rover get ejected at a speed of around 6,000 km/hr and have to be slowed down to roughly 3 km/hr before it lands. Since

moon doesn't have atmosphere, parachute kind of mechanism can't be used. Here, thrusters had to be fired in opposite direction to slow down the lander.

#### D) WHERE DID LANDER LAND?

- It landed at around 70-degree S near the southern pole of the moon.
- **Why?**
  - a. The site was selected as there are several craters here that are permanent in shade and can be reservoir of frozen water which is key to the future space mission.

#### E) ROVER:

Within a few hours of landing, ISRO also released a 26-kg rover from the lander module, which滑了 on the ramp to reach the moon's surface. The six wheeled rover, which is carrying two instruments and moves very slowly, is expected to crawl on the surface for 14 days, conducting chemical and elemental analysis of lunar soil and rocks.

#### E) COMPARING CHANDRAYAAN-1, CHANDRAYAAN-2 AND CHANDRAYAAN-3

	Chandrayaan-1	Chandrayaan-2	Chandrayaan-3
<b>Year</b>	2008	2019	2023
<b>Rocket Used</b>	PSLV	LVM-3	LVM-3
<b>Payloads</b>	Orbiter + Impactor Module (for crash landing)	Orbiter + Lander (Vikram) + Rover (Pragyan)	Lander + Rover
<b>Successful</b>	Yes	Partially Yes (Lander failed)	Yes
	<p>Perhaps the <u>most important discovery of Chandrayaan-1 was the discovery of water and hydroxyl (OH) molecules</u> in the Moon's thin atmosphere (exosphere) as well on the lunar surface.</p> <p><b>Buried Lava Tubes:</b> The terrain mapping camera and hyperspectral imager on board Chandrayaan-1 detected an <u>underground lava tube</u>, which, scientists believe, can provide a <u>safe environment for human habitation in the future</u>. It can protect against hazardous radiation, small meteoric impacts, extreme temperature and dust storms on the surface.</p>	<p>It helped in <u>separately identifying the water and hydroxyl molecules, and mapping water features across the moon for the first time</u>.</p>	

## D) CHANDRAYAAN 3 PROPULSION MODULE RETRACES STEPS TO EARTH ORBIT: WHY IT MATTERS? (DEC 2023)

- **What happened?**
  - Scientists have brought the propulsion module (PM) of Chandrayaan 3 mission back into earth orbit.
  - This was not part of original mission plan. It utilized the logistics advantage of near perfect mission, especially the availability of more than 100 Kg of fuel.
- **How was this achieved?**
  - ISRO performed maneuver to raise the orbit of the PM around the moon (from 150 km to 5,112 kms)
  - Second maneuver targeted an earth orbit of 1.8 lakh X 3.8 lakh km.
- **Significance:**
  - This experiment prepares ISRO for future missions, especially the ambitious Lunar Sample Return Mission.
    - Through this ISRO has been able to understand what is involved in the “planning and execution of trajectory and maneuvers to return from Moon to Earth”

## E) SIGNIFICANCE OF GOING TO MOON:

- It underlined India's rise as a space and technology powerhouse. It will also strengthen India's soft power in the global community.
- Since moon is the closest cosmic body to Earth, the plans to explore rest of the universe starts with exploration of the moon. Moon can also act as a promising test bed to demonstrate technologies required for future deep-space missions.
- It would further help “stimulate the advancement of technology, promote global alliances and inspire a future generation of explorers and scientists.”
- **Resources:** Recent increase in interest in Moon is primarily due to possibility of important minerals being found on Moon.

## 8. OTHER IMPORTANT PROJECTS OF ISRO

### 1) INDIA'S OWN SPACE STATION: PLANS

- **What advancements will India need to achieve to have its space Stations?**
  - All the **Gaganyaan requirements** (Space suits, Training facilities for astronauts, Crew Escape Module, making GSLV Human rated, developing a habitable module etc)
  - **Larger bigger rocket** by upgrading the capabilities of GSLV-MK-III (it is right now capable of carrying on 10 tonnes to LEO)
  - Developing ability to perform **space docking**. ISRO has revealed its plan to carry out a space docking experiment, Spadex.



## 8. INTERNATIONAL COLLABORATION IN NEWS

### 1) ISRO – NORWAY

- **Why in news?**
  - Norwegian Ambassador Han Jacob Frydenlund's visit to ISRO's headquarters (June 2023)
- In June 2023, Norwegian Ambassador Frydenlund, accompanied by officials of Kongsberg Satellite service (KSAT), called on ISRO Chairman S. Somanath in Bengaluru, ISRO. The meeting concluded with a mutual agreement on the importance of maintaining a continued partnership and fostering increased engagements between India and Norway.
- It also offered an occasion to recall the 'Svalbard mission' of 1997.

#### A) SVALBARD MISSION OF 1997

- On Nov 20, 1997, a Rohini RH-300 Mk-II sounding rocket rose to the skies from Svalbard, Norway, operationalizing a new rocket launching range.
- ISRO bagged the Norway mission after its commercial arm Antrix Corporation won a global tender floated by the Norwegian space agency.
- The RH-300 MK-II was given a new name by the NSC (Norwegian Space Centre): **Ibjorn-1**, which translates literally as 'Polar Bear-1'.

## 9. IMPORTANT TELESCOPES IN NEWS RECENTLY

### 1) VARIOUS TELESCOPES AT DEVASTHAL

- Devasthal observatory is located at Aryabhatta Research Institute of Observational Science (ARIES) in Nainital. It is located at the height of 2,450 metres in Himalayas. It is considered as one of the best sites for astronomical observations. This facility is the result of collaborative work between astronomers from ARIES, Institute of Astrophysics and Geophysics, Liege University, Belgium; the Canadian Astronomical Institutes from Vancouver, University of British Columbia; etc.

- **Telescopes at Devasthal:**
  - **Devasthal Optical Telescope (DOT)** is a custom-built instrument of great complexity. It has the distinction of being the largest telescope in India for study of celestial objects at optical wavelength. It is a national facility installed at Devasthal in the district of Nainital, India. It was commissioned in 2016 and is being maintained and operated by ARIES (Aryabhata Research Institute of Observational Sciences)
  - **Devasthal Fast Optical Telescope (DFOT)**: It was commissioned in 2010.
  - **The International Liquid Mirror Telescope (ILMT)** is the only liquid mirror telescope operational anywhere in the world. It will also hold the unique tag of being the maiden liquid-telescope globally to be designed exclusively for astronomical purposes. It is the third telescope operating from Devasthal after DOT and DFOT.
    - The telescope was designed and built at the Advanced Mechanical and Optical Systems Corporation and the Centre Spatial de Liege, Belgium. The major instrumentation funding was jointly provided by Canada and Belgium while India will be responsible for the operations and upkeep of the telescope.
    - Unlike the conventional telescopes that can be steered to track specific stellar source objects, the ILMT will be stationary. It will basically carryout observations and imaging at the Zenith, that is, of the overhead sky. This is a survey telescope having high potential for discovering newer objects.
    - ILMT will operate every night for five years and carry out daily imaging except during June – Aug monsoon months, a precaution to protect the instruments from humid conditions.
- **What is liquid mirror telescope?**
  - LMTs are telescopes with mirrors made with a reflective liquid. The most common liquid is mercury, but other liquid will also work including (low melting alloys of gallium).
  - The liquid is rotated at a constant speed around a vertical axis, which causes the surface of liquid to assume a paraboloidal shape. This parabolic reflector can serve as the primary mirror of a reflecting telescope.
  - **Advantages:**
    - Low-cost alternative to conventional large telescopes.
  - **Limitations:** It can only be used as zenith telescopes (i.e. for looking straight up), so it is not suitable for investigation where the telescope needs to be continuously moved.

## 2) INDIA'S FIRST DARK SKY RESERVE

- **What is a Dark Sky Reserve?**
  - A Dark Sky Reserve is a designation given to a place that has policies in place to ensure that a tract of land or region has minimal artificial interference.

- The International Dark Sky Association (IDSA) is a US based non-profit that designates places as International Dark Sky Places, Parks, Sanctuaries, and Reserves, depending on the criteria they meet. Several such reserves exist in the world. **Between 2001 and Jan 2022**, there have been 195 sites recognized as International Dark Sky Places globally. But, so far, no such reserve is in India.
  - These reserves “consist of a core area meeting minimum criteria for sky quality and natural darkness, and a peripheral area that supports dark sky preservation in the core”.
- **How does a site become a ‘Dark Sky Reserve’?**
- Individuals or groups can nominate a site for certification to the IDSA. There are five designated categories, namely International Dark Sky parks, communities, reserves, sanctuaries, and Urban Night Sky Places.
  - The certification process is similar to that of a site being awarded the UNESCO World Heritage Site tag or getting recognized as a Biosphere Reserve.
  - **Note:** India is still in the process of filing its nomination to IDSA.
- **Who is developing India’s first Dark Sky Reserve?**
- The Ladakh UT administration is leading the efforts to establish the country’s first Dark Sky Reserve. The Department of Science and Technology (DST) and experts from Indian Institute of Astrophysics (IIA), Bengaluru, are providing scientific and technological support in developing this first of its kind facility. The formal decision to set up this Dark Sky Reserve was made through a MoU signed between officials from the IIA, Bengaluru, the Ladakh UT and the Ladakh Autonomous Hill Development Council in June 2022.
  - It will be situated at a height of 4,500 metres above sea level, the Hanle Dark Sky Reserve (HDSR) will come up within the Changthang WLS.
  - The IIA already manages the Indian Astronomical Observatory (IAO) complex at Hanle, Ladakh. Here scientists have been carrying out astronomical observations using the existing gamma ray, an infrared and an optical telescope to study exoplanets, galaxies, and stars through the pristine skies of Hanle.
  - For Dark Sky Reserve, in the pilot phase, IIA has procured ten small and easy to handle telescopes and light reflecting shields. IIA’s scientific and outreach experts will identify locals and train them to use these telescopes. This will include basic sky gazing, identification of constellations, and locating the pole star, among others. These telescopes will be installed at the homestays, which is a popular option for tourist accommodation in Ladakh.
- **Why was Ladakh chosen for the project?**
- It is a unique cold desert located about 3,000 metres above sea level with high mountainous terrains. Very cold temperature and long and harsh winter makes the UT very inhabitable. This aridity, limited vegetation, high elevation, and large area with sparse populations – all make it the perfect setting for long-term astronomical observatories and dark sky places.

- **Promotion of Astronomy Tourism** in an environment friendly and sustainable manner is one of the primary objectives of the proposed reserve. Scientific methods would be used here to keep light pollution under control.

### A) THE INDIAN ASTRONOMICAL OBSERVATORY (IAO)

- The Indian Astronomical Observatory, the high-altitude station of IIA, is situated to the north of Western Himalayas, at an altitude of 4,500 meters above mean sea level.
- It is located atop Mt. Saraswati in the Nilamkhul Plain in the Hanle Valley in Changthang, it is a dry, cold desert with sparse human population and has the Hanle monastery as its nearest neighbours.
- The cloudless sky and low atmospheric water vapor make it one of the best sites in the world for optical, infrared, sub-millimeter, and millimeter wavelengths.
- **Prominent Telescopes located at the Hanle Observatory:**
  - The Himalayan Chandra Telescope
  - High Energy Gamma Ray Telescope (HAGAR)
  - The Major Atmospheric Cherenkov Experiment Telescope (MACE)
  - Growth-India

## 10. SPACE INFRASTRUCTURE IN INDIA

- **Background:**
  - Space activities in India began with the establishment of the Indian National Committee for Space Research (INCOSPAR) in 1962. In the same year, work on establishment of Thumba Equatorial Rocket Launching Station (TERLS) near Thiruvananthapuram was also started.
  - ISRO was formed on 15<sup>th</sup> Aug 1969, and superseded INCOSPAR with an expanded role. In 1972, Space Commission and Department of Space (DOS) were constituted by the GoI, and ISRO was brought under DOS.
    - ISRO is the space agency of India. It is involved in science, engineering, and technology to harvest the benefits of our space for India and mankind. It has established major space systems for communication, television broadcasting, and remote sensing. It has also developed satellite launch vehicles like PSLV, GSLV, LVM-3 etc. It also contributes to science and science education in the country. It has launched Indian's NAVIC, Chandrayaan, MOM-1, Aditya-L1 and several other incredible missions.
    - Space Commission formulates the policies and oversees the implementation of the Indian Space Program to promote development and application of space science and technology for the socio-economic benefit of the country.
    - DOS implements these programs through ISRO and other associated organizations:



- The Major establishments of DOS and their area of activities are:

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#### A) VIKRAM SARABHAI SPACE CENTRE (VSSC):

- Located in Thiruvananthapuram, it is responsible for design and development of launch vehicle (rocket) technology. Its major programs include, PSLV, GSLV, LVM-3, RLV, Rohini Sounding Rockets etc.

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#### B) UR RAO SATELLITE CENTRE (URSC)

- Located in Bengaluru, it is the lead centre for design and development of satellites including communication, navigation and remote sensing satellites. These satellites provide applications in the areas of telecommunication, television broadcasting, VSAT services, tele-medicines, tele-education, navigation, weather forecasting, disaster warning etc.

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#### C) SATISH DHAWAN SPACE CENTRE (SDSC)-SHAR

- It is the 'Spaceport of India'. It is the backbone of the ISRO in providing launch base infrastructure for the Indian Space Program.
- It is located at Sriharikota, Andhra Pradesh.

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#### D) LIQUID PROPULSION SYSTEMS CENTRE (LPSC)

- It is the lead centre of ISRO for the design, development, and realization of advanced propulsion systems for launch vehicles.
- It is primarily responsible for developing and deploying earth storable, cryogenic, semi-cryogenic, and electric propulsion systems for ISRO's launch vehicles and satellites.
- Its activities are spread across its two campuses, namely, LPSC, Valiamala, Thiruvananthapuram, and LPSC, Bengaluru.

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#### E) SPACE APPLICATION CENTRE (SAC)

- Located in Ahemedabad, it's a major R&D centre of ISRO.
- It develops space borne and air-borne instruments and payloads and their applications for national development and societal benefits.
- For e.g., the communication transponders developed at this centre for the INSAT and GSAT series of satellites are used by the government and private sector for VSAT, DTH, Internet, broadcasting etc.
- It also designs and develops optical and microwave sensors for satellites, signal and image processing software, GIS software, and many applications for Earth Observation Program of ISRO.

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#### F) HUMAN SPACE FLIGHT CENTRE (HSFC)

- Set up in 2019, it is the lead centre for ISRO's Human Spaceflight program.

- It undertakes multidisciplinary R&D activities in new domains of human science and technology while conforming to high standards of reliability and human safety.
- It is currently focused on Gaganyaan mission and is working on end-to-end mission planning, development of orbital module, life support systems, selection and training of astronauts etc.
- It is currently operating from ISRO-HQ campus, Bengaluru.

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## G) NATIONAL REMOTE SENSING CENTRE

- It is responsible for establishment of ground centres for receiving satellite data, generation of data products, aerial remote sensing data acquisition, dissemination to the users, development of techniques for remote sensing applications including disaster management support, geospatial services etc.

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## H) ISRO PROPULSION COMPLEX (IPRC)

- Located in Mahendragiri, it is responsible for assembly, integration and testing of liquid propulsion systems for operational and developmental launch vehicles.
- It is also responsible for qualification, testing and acceptance of liquid engines, cryogenic engines, spacecraft engines etc.

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## I) ISRO TELEMETRY, TRACKING AND COMMAND NETWORK (ISTRAC)

- It is responsible for providing telemetry, tracking and command (TTC), and mission control services to major launch vehicle, laboratory for electro-Optics Systems (LEOS) and Interplanetary Spacecraft missions of ISRO.
- It is also responsible for operating the complex ground segment of NaVIC.

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## J) MASTER CONTROL FACILITY (MCF)

- It is responsible for on-orbit Operations (OOP) and Launch & Early Orbit Phase (LEOP) operations of geostationary/geosynchronous & IRNSS class of spacecrafts of ISRO.
- It is located at Hassan in Karnataka.

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## K) ISRO INERTIAL SYSTEMS UNIT (IISU)

- Located in Thiruvananthapuram, it is responsible for design and development of inertial systems for launch vehicles and satellites. These include mechanical and optical gyros, Altitude reference systems, accelerometer packages etc.

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## L) LABORATORY FOR ELECTRO OPTICS SYSTEMS (LEOS)

- Located in Bengaluru it is responsible for design, development and production of altitude sensors, high resolution imaging optics, and special purpose science instruments for several spacecrafts.

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## M) INDIAN INSTITUTE OF REMOTE SENSING (IIRS)

- IIRS, Dehradun, is a premier institute with primary aim to build capacity in Remote Sensing and Geoinformatics and their applications through education and training programs at the postgraduate levels.

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## N) DEVELOPMENT AND EDUCATIONAL COMMUNICATION UNIT (DECU)

- Located in Ahmedabad, it is responsible for implementation of satellite-based societal applications in the country.
- It is involved in the system definition, planning, implementation, and social research & evaluation of such applications.

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## O) NATIONAL ATMOSPHERIC RESEARCH LABORATORY

- Located in Gadanki near Tirupati, it is an autonomous organization engaged in cutting edge research in atmospheric and space sciences with the vision of developing capability to predict the behaviour of the earth's atmosphere through observations and modelling.

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## P) NORTHEASTERN-SPACE APPLICATIONS CENTRE (NE-SAC)

- It is an autonomous organization under DOS and Northeastern Council (NEC). It has the mandate of providing space-based governance and development by taking up projects in the fields of natural resource management, infrastructure planning, healthcare, education, emergency communication etc.
- It also conducts training and capacity building in the field of geospatial technology and UAV based remote sensing applications.

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## Q) INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY

- Established in 2007 at Thiruvananthapuram, it is Asia's first Space University. It aims to provide high quality education in Space S&T to meet the demands of the Indian Space Program. It offers undergraduate, postgraduate, doctoral and post-doctoral programs.

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## R) ANTRIX CORPORATION LIMITED (ACL)

- It is a Gol company under the administrative control of DOS.
- It is engaged in providing space sector products and services worldwide ranging from supply of hardware and software, earth observation and scientific missions, transponder lease services, launch services etc.

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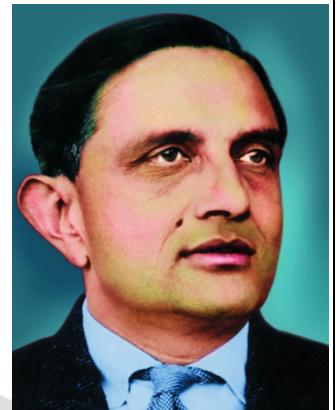
## 11. IMPORTANT PERSONALITIES

## A) DR VIKRAM SARABHAI (12<sup>TH</sup> AUG 1919 – 30<sup>TH</sup> DEC 1971)

- Vikram Sarabhai, **father of Indian Space Program**, was born on 12<sup>th</sup> of Aug, 1919 in Ahmedabad.

- **Key contributions**

- He was a great institution builder and established or helped to establish a large number of institutions in diverse fields. He established **Physical Research Laboratory (PRL)** in 1947. PRL was the cradle of space sciences in India. PRL had a modest beginning at his residence, the RETREAT, with research in cosmic rays. It was formally established at M.G. Science Institute, Ahmedabad, on 11<sup>th</sup> Nov 1947
- He played an important role in establishment of a number of institutions including IIM Ahmedabad.
- The establishment of ISRO was one of his greatest achievements. He successfully convinced the government of the importance of space program after the Russian Sputnik launch.
  - He was the first chair of Indian National Committee for Space Research (INCOSPAR) which was predecessor to ISRO (established in its current form in 1969).
  - He also contributed in the setting up of Thumba Equatorial Rocket Launching Station at Thiruvananthapuram, with its inaugural flight in 1963.
- He was also chairperson of Atomic Energy Commission.



- **Recognition**

- i) He received Shanti Swarup Bhatnagar Medal in 1962

- ii) Was awarded Padma Vibhushan (posthumously) in 1972. Earlier was awarded Padma Bhushan in 1966.

- **Other Key Positions held:**

- i) President of the Physics Section, Indian Science Congress (1962)

- ii) President of General Conference of the I.A.E.A, Vienna (1970)

## B) S SOMNATH

- » Sreedhar Panicker Somanath is the current chairperson of the ISRO. Earlier he has served as the chairperson of Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram and Director of Liquid Propulsion Systems Centre (LPSC), Thiruvananthapuram.
- » He was associated with the PSLV project during its initial days. He was also the project director of the GSLV-MK-III launch vehicle in from 2010 to 2014.

## 12. COMMERCIALIZATION AND PRIVATIZATION IN SPACE SECTOR

### A) PRARAMBH MISSION

- **Why in news?**

- Launch of Vikram-S (i.e., Vikram Suborbital) rocket by Skyroot Aerospace is being hailed as an important milestone in India's outer space journey (Nov 2022)

- **Details:**

- **Skyroot Aerospace**, an Indian private sector space enterprise, created history by launching India's first privately developed rocket **Vikram-S**.
- **Vikram-S** is a single stage rocket. It is India's first privately developed cryogenic hypergolic-liquid and solid fuel-based rocket engine. It was developed using advanced composite and 3-D printing technologies.
- It carried three customer payloads in a sub-orbital flight. It was launched from the sounding rocket complex of the ISRO's Satish Dhawan Space Centre in Sriharikota, Andhra Pradesh.
- The rocket reached a peak-altitude of 89.5 kms and has met all flight parameters.
- **More About Skyroot:**
  - It is a relatively new entity that was set up in 2018. In 2020, after government announced opening up of space sector for private entities, it became the first startup to sign an MoU with ISRO to launch a rocket.
  - It is producing a series of Vikram Satellite, named after Dr Vikram Sarabhai. The goal is to launch small satellites using this rocket.
- **Future Plans of SkyRoot:**
  - **Vikram-1** is being developed to carry 480 kg payload to Low inclination Orbit.
  - **Vikram-2** which will follow Vikram-1, will carry 595 kg to low inclination orbit.
  - **Vikram-3** will carry 815 kg to Low inclination orbit.
  - Skyrocket also says that the rockets will be able to undertake multi-orbit insertion and inter-planetary missions as well as offer "customized, dedicated and ride share options covering a wide spectrum of small satellite customers needs".

## 2) NEW INSTITUTIONS

### B) NEW SPACE INDIA LIMITED (NSIL)

- NSIL is a wholly owned government of India undertaking/CPSE, under the administrative control of Department of Space (DOS). It was established in March 2019 to commercially utilize the R&D work of ISRO Centers and other constituent units of DOS.
- **Roles and Functions:**
  - i. Small Satellite technology transfer to Industry, wherein NSIL will obtain license from ISRO/DOS and sub-license it to industry.
  - ii. Manufacture of SSLVs in collaboration with Private sector.
  - iii. Productionization of PSLV through Indian Industry.
  - iv. Productionization and marketing of space-based products and services, including launch and applications
  - v. Transfer of technology developed by ISRO Centres and constituent units of DOS

- vi. Marketing spin-off technologies and product/services, both in India and abroad.
  - vii. Any other subject which GoI deems fit.
  
- **As part of the space sector reforms announced by GOI in June 2020, NSIL was mandated to build, launch, own and operate satellites in “Demand-driven mode” to meet the service needs of the user.**
- The **launch of Brazil’s Amazonia-1 satellite** in March 2021, was the first dedicated communication mission of NewSpace India Limited. Earlier launches facilitated by NSIL were piggybacked with ISRO’s primary satellites.
  - i. Launch of GSAT-24 in June 2022 was the first demand driven satellite mission undertaken by NSIL. The capacity onboard the satellite was fully secured by TataPlay.
  - ii. **Presently (Jan 2024) NSIL owns and operates 11 communication satellites in India.**
  - iii. On similar lines, in 2024, NSIL will be undertaking the GSAT-20 satellite mission to offer cost-effective Ka-Ka band HTS capacity primarily for meeting the Broadband. The bulk of the capacity onboard GSAT-20 have already been secured by Indian Service Providers.
  
- **Significance of NSIL:**
  - i. Meet the ever-increasing demands of Indian Space Program.
  - ii. Commercially exploit the emerging global space sector.
  - iii. Spur the growth of Indian Industries in the space sector and enable Indian industries to scale up manufacturing and production base.

## B) IN-SPACE (INDIAN NATIONAL SPACE PROMOTION AND AUTHORIZATION CENTRE)

- It is an independent nodal agency under Department of Space (DoS). It was set up in 2020 to boost commercialization of Indian Space Activities and encourage private sector participation.
- It will permit and oversee the following activities of **non-Government Private Entities** (NGPEs):
  - Building of launch vehicles and satellites and providing space-based service as per the definition of space activities.
  - Sharing ISRO infrastructure/premise etc.
  - Establishment of temporary facilities within the premise of ISRO
  - Establishment of new space infrastructure and facilities, by NGPEs, in pursuance of space activities based on safety norms and other statutory guidelines and necessary clearance.
  - Building of Spacecrafts by NGPEs for registration as Indian satellites and all associated infrastructure
  - Using of spacecraft data and rolling out of space based services and all other associated infrastructure for the same.
- It will draw up integrated launch manifest – considering the needs of ISRO, NSIL, and NGPEs based on priorities and readiness.
- It will draw up suitable mechanism for promotion, handholding, infra-sharing etc. to encourage participation of NGPEs.
- The decision of IN-SPACe shall be final and binding on all stakeholders including ISRO, NSIL etc. NGPEs will not be required to seek separate permission from ISRO.

- **Structure of In-SPACe** – It has a Chairman, technical experts for space activities, safety experts, experts from academia and industries, legal and strategic experts from other departments, members from PMO and MEA of GoI.
- **Monitoring and Promotion Directorate of IN-SPACe** will have the oversight of the activities as per IN-SPACe decisions and shall report back to IN-SPACe for corrective actions and resolutions if any.



# TARGET PRELIMS 2024

## BOOKLET-2; S&T-2

### SPACE AND ASTRONOMY-2

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LevelUpIAS

## 1. INTERNATIONAL EFFORTS

### 1) SPACE GOVERNANCE: GLOBAL NORMS

- Current Space Regulations: Gaps and Loopholes
  - » United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) was established in 1958 with UN Office for outer space affairs as its secretariat. It oversees the implementation of five UN treaties related to outer space:
    - » Treaty on Principles Governing Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial bodies of 1967 (Outer Space Treaty)
      - It designates space as the “province of all mankind” and states that the exploration of the outer space would be for the benefit of all countries, irrespective of their degree of economic or scientific development. It also prohibits deployment of weapons of mass destruction in space, and establishment of military bases, installations, and fortifications.
      - Limitations: Doesn't clearly prohibit weapons other than weapon of mass destruction; Doesn't properly cover modern day technologies like lasers for communication.
      - Further, it doesn't provide a detailed mechanism to decide if activities are inconsistent with the treaty and it failed to address issues like growing weaponization of the space.
    - » Agreement on the Rescue of Astronauts, the Return of Astronauts and Return of Objects Launched into Outer Space of 1968 (Rescue Agreement)
    - » Convention on International Liability for Damage Caused by Space Objects of 1972 (Liability Convention)
      - Limitation: The **Liability Convention** and **OST** have the potential to impede the private sector investment as it makes state liable for all the damages thus compelling states to impose license and insurance on such entities.
    - » Convention on Registration of Objects Launched into outer space of 1976 (Registration Convention). It has helped in development of an international registration system. Full knowledge of the presence of objects in space is crucial for peaceful and safe use.
    - » The Agreement Governing the Activities of States on the Moon and other Celestial Bodies of 1979 (Moon Treaty).
    - » It also oversees **other related treaties** including Treaties Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and under Water (NTB) of 1963 and the **Brussels Convention Relating to the Distribution of Programme – Carrying Signals transmitted by Satellite (BRS) of 1979** among others.

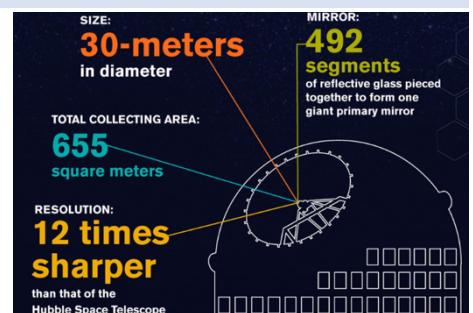
### 2) INTERNATIONAL SPACE STATION (ISS)

- The International Space Station (ISS) is a modular space station (habitable artificial satellite) in LEO.

- Its main construction was completed between 1988 and 2011, although the station continuously evolves to include new mission and experiments. It has been continuously occupied since Nov 2, 2000.
- It is a multinational collaboration with contribution from 15 nations.
  - A) NASA, ESA, ROSCOSMOS are the major partners of the space station and contribute most of the funding.
  - B) JAXA, and Canadian Space Agency are other partners.
  - C) Through a private company called Axiom Space, private astronauts are starting to work on the orbiting complex, from time to time.
  - D) The ownership and use of the space station is established by intergovernmental treaties and agreement.
- Details:
  - A) ISS is 109 meters from end to end with a weight of more than 4 lakh kg without visiting vehicles.
  - B) Orbits at an average height of 400 kms. It circles earth every 90 minutes at a speed of about 28,000 km/h.
- Space Vehicles to reach ISS:
  - A) Currently, astronauts travel to ISS via SpaceX's Crew Dragon capsule. Russian astronauts travel to the space station using Soyuz capsule.
  - B) Note: After retirement of NASA's Space Shuttle Program in 2011, Soyuz was the only spacecraft which could take humans to ISS. Later, in 2020, SpaceX's Crew Dragon also became available.
- Purpose:
  - A) It provides a platform for multi-gravity and space environment research laboratory.
- Future:
  - A) Current Plan calls for the space station to be operated through at least 2024 with the partners discussing a possible extension.
  - B) NASA has approved extension till 2030.
  - C) Russia has announced its withdrawal after 2024 to focus on building its own space station around 2028.
  - D) After 2030, plans for ISS are not clearly known. It could be deorbited or recycled for future commercial space stations in orbit.

## 1) THIRTY METER TELESCOPE (TMT)

- What is thirty-meter telescope?
  - Thirty-meter telescope is a new class of extremely large telescopes that will allow us to see deeper into space and observe cosmic objects with unprecedented sensitivity.
  - With its 30 m prime mirror diameter, TMT will be three times as wide, with nine times more area, than the largest



currently existing visible light telescope in the world. The images of TMT will be **12 times sharper than Hubble Space Telescope.**

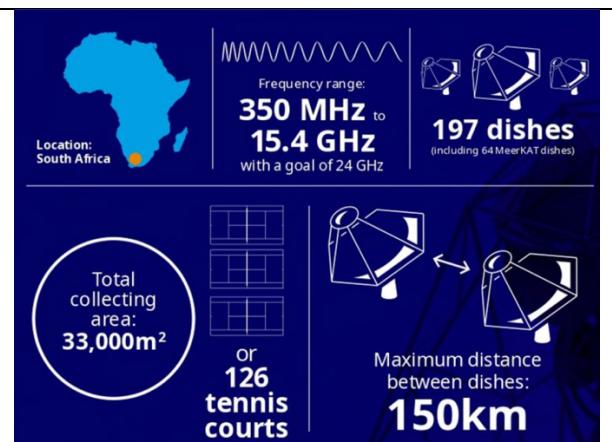
- The TMT will **observe wavelengths** ranging from the ultraviolet to the mid-infrared.
- **Who is building TMT?**
  - » It is being built by **TMT International Observatory LLC (TIO).**
- The TIO is a non-profit international partnership between the California Institute of Technology, the University of California, the National Institute of Natural Science of Japan, the National Astronomical Observatory of Chinese Academy of Sciences, the **DST India** and the National Research Council, Canada.

## 2) SKAO (SQUARE KILOMETER ARRAY OBSERVATORY)

- The Square Kilometer Array (SKA) is an inter-governmental radio telescope project under construction. Once completed it will be the world's largest and most powerful radio telescope.
- It will be built in two phases – with the core arrays located in:
  - **Australia:** Focusing on low frequency observation.
  - **South Africa:** Focusing on mid-frequency observation.
- **How will it function?**
  - The SKA will combine signals from thousands of smaller antennas spread across vast distances to function as a single giant telescope with exceptional sensitivity and angular resolution. This is achieved through a technique called aperture synthesis.
  - Some sub-arrays will also have very broad field view, allowing for surveying huge areas of the sky simultaneously.
- **The headquarters** and combining infrastructure, called the Square Kilometer Array Observatory (SKAO), are located at the Jodrell Bank Observatory in the UK.
- **The incredible sensitivity** of SKA will help understand the universe in a better way.
- **How will the SKA Observatory work?**

**The 197 dishes in South Africa** are collectively referred to as **SKA-Mid** and will observe at radiofrequencies between 350 MHz and 15.4 GHz. They have combined effective collecting area of 33,000 sq m.

SKA-Mid's resolution will be 4-times that of JVLA (the current best similar instrument in the world)



**In Australia**, the 131,072 low frequency antennas are known as **SKA-Low** and have combined collecting area of **419,000 sqm**.

Compared to LOFAR(Low Frequency Array) in the Netherlands, this will be 8x more sensitive.



- The collecting area is a crucial component that makes the SKAO so powerful. It makes the telescope detect even the fainter objects.

- **Progress:**

- The construction of the project began in 2018, with the first light (the start of the scientific observations) expected in 2027

#### A) INDIA MOVES TOWARDS BECOMING FULL MEMBER OF SKAO (JAN 2024)

- In Jan 2024, GOI has approved India's participation in SKA, with a financial sanction of Rs 1,250 crores. This is the first step towards ratification of SKAO Convention. Countries have to sign and ratify this convention to formally become members.
  - **India**, through the Pune-based National Centre for Radio Astrophysics (NCRA) and some other institutions, has been involved in the development of SKA since its inception in the 1990s. India contributed heavily to the design and development of the SKA telescope over time, particularly in software domain, having been involved in SKA project since its earliest days.
  - **Full membership** was long anticipated. The Indian government was a party to the negotiation of the SKAO Convention and participated in the preparatory activities that led to the creation of the observatory in early 2021.
- The approval covers the funding support for the construction phase of the international SKA Observatory (SKAO) spread over the next 7 years.
- The project will be jointly funded by DAE and DST, with DAE being the lead agency.
- This participation is nationwide including project led consortium of more than 20 academic and research institutes (with NCRA-TIFR as the nodal institute)

### 3) SPACE BASED INTERNET

- **Space X Plan**
  - **The Starlink Network** of SpaceX eventually plans to install 42,000 satellites to ensure non-stop internet services throughout the earth at a cost-effective rate. These satellites will be connected with their neighboring satellites using lasers.

- China's "Guowang" (GW) constellation has also been announced which is meant to meet satellite-based internet services.
  - It will also be a LEO based system with satellites operating at different heights (500-1145 km), inclinations (30-85 degrees) and frequency bands.
- **Other such projects:** Several other companies including Amazon, OneWeb and O3B have also planned large constellation of satellites in LEO and MEO – but these projects are very small compared to Starlink.
- **Comparing Geostationary vs LEO satellites** for providing internet services [Advantages of LEO – Low latency-> allows real time communication; Disadvantage -> need more satellites for coverage as they cover small part of earth]
- **Significance**
  - Prelable and uninterrupted internet services universally to everyone on earth.
  - Services during emergency: For e.g. During Russia Ukraine war in 2022, the Starlink played an important role in strengthening the Ukrainian military might after the European SATCOM system was cyber attacked.
  - IOT services
  - Better e-governance
- **Concerns:**
  - **Increased Space debris**
  - **Increased chances of collision of satellites**
  - **Difficulty in Space Observation -> Light Pollution**
  - **Increased crowding in LEO and signal interference** in space may emerge as another problem

## 2. NASA INITIATIVES

### 1) GREAT OBSERVATORY PROGRAM

- NASA's series of Great Observatories satellite are four large, powerful space-based telescopes. The four missions were designed to examine a specific region of the electromagnetic spectrum using very different technologies. The program was developed in 1994.
- **Great Observatories**

#### B) THE HUBBLE SPACE TELESCOPE (HST)

- The Hubble Space Telescope was deployed on April 25, 1990 from the space shuttle Discovery.
- It primarily observes visible light and near-ultraviolet. A servicing mission in 1999 added capability in near infrared range and one last mission in 2009 was to fix and extend the life of Hubble which resulted in some of the best results to date.

- Hubble is one of the largest and most versatile, and is well known as both vital research tool and a public relation boon for astronomy.

#### C) THE COMPTOM GAMMA RAY OBSERVATORY (CGRO) (NOT OPERATING CURRENTLY)

- Primarily observed gamma rays, though it extended into hard x rays as well. It was launched in 1991 aboard Atlantis and was deorbited in 2000 after failure of a gyroscope.

#### D) THE CHANDRA X-RAY OBSERVATORY (CXO)

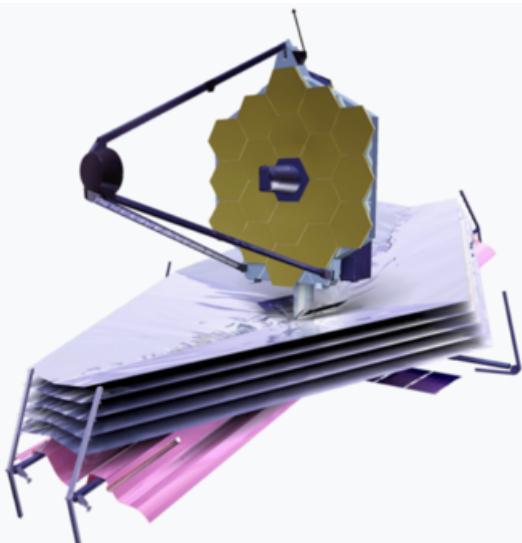
- It is primarily observing soft x-rays. It was launched in 1999 aboard Columbia and was initially named advanced X-ray Astronomical Facility (AXAF).
- Because X-Rays are absorbed by Earth's atmosphere, Chandra must orbit above it and therefore is a space-based telescope.

#### E) THE SPITZER SPACE TELESCOPE (SST)

It observes the infrared spectrum. It was launched in 2003 aboard a Delta II rocket and was called the Space Infrared Telescope Facility (SITF) before launch.

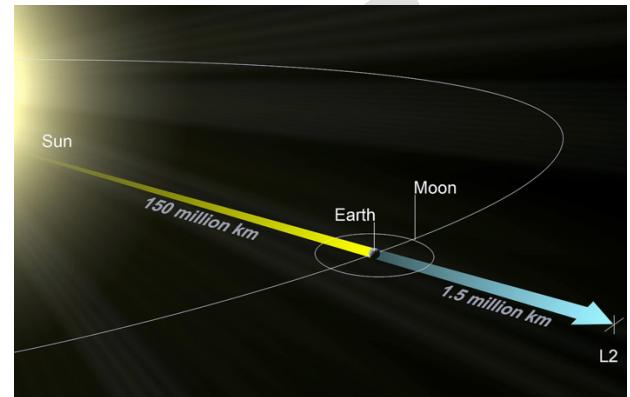
## 2) JAMES WEBB SPACE TELESCOPE

- It is the largest, most powerful, and complex space telescope ever built and launched into space. It is an infrared telescope with a 6.5-meter primary mirror.
- **International Collaboration:** JWST is an international collaboration between NASA, European Space Agency (ESA), and the Canadian Space Agency (CSA).
- **Some innovative technologies**
  - Primary Mirror made of 18 separate hexagonal segments that unfolded and adjusted to the shape after launch. The mirrors are made of ultra-lightweight beryllium and are gold coated. A single large mirror would have been too large for existing rockets to carry.
  - Biggest feature is a tennis court sized five-layer sunshield that attenuates heat from the Sun more than a million times. This sunshield is constructed from Kapton E, a commercially available polyimide film with membranes especially coated with aluminium on both sides and a layer of doped silicon on the sun facing die of the two hottest layers to reflect the sun's heat back into space.
- **Two basic reasons for it being more powerful than Hubble:**
  - It has the **biggest telescope mirror** to fly in space.



A rendering of the James Webb Space Telescope with its components fully deployed.

- 7 times light will be caught than collecting area of Hubble
- It is **designed to collect infrared light**, which **Hubble is not very sensitive to**.
  - **Why infrared observation?**
    - **High redshift (very old and distant)** objects have **their visible emissions shifted into the infrared**, and therefore their light can only be **observed today via infrared astronomy**.
    - **Colder objects** and planets **emit strongly in the infrared**.
    - Infrared rays can **better pierce cosmic dusts** and thus would be able to give **details about the earliest and furthest galaxies**. (Infrared wavelength can penetrate gas and dust)
  - **Why from L2 and what is the purpose of sunshield?**
    - **Earth's atmosphere glows in the infrared**, so measurement can't be made from the ground.
    - **Hubble emits its own heat**, which could obscure infrared readings.
    - JWST will **run close to absolute zero (around 50K or -232.2 degree C) in temperature** otherwise, infrared radiation from the telescope itself would overwhelm its instruments. For this, it would rest at a point in space called the **Lagrange Point 2**, which is **directly behind earth from the sun's perspective**. Further, the **five-layer sunshield** would attenuate heat from sun more than **a million times**.
- It was launched in 2021, and it reached **its final orbit at a distance of around 1.5 million km from the Earth in early 2022** and it took the engineers and scientists another six months to **ready the instruments before it could be used**.



### 3) NASA'S ARTEMIS ACCORD

- **Why in news?**
  - India signs US-led Artemis Accord. With this **India has become 27<sup>th</sup> signatory to the accord (June 2023)**
- **What is Artemis Accord?**
  - Artemis accord was **announced by NASA in Oct 2020** with an initial group of **eight signatories (USA, Canada, UK, Luxemburg, Italy, UAE, Japan, and Australia)**. Later, more countries joined the accord. **India became 27<sup>th</sup> country to sign the accord in June 2023**.
    - **Note:** China and Russia are not part of the accord.
  - It is a **set of 13 principles** which seek to promote **peaceful and cooperative exploration of space**. Signatory countries agree to abide by these principles which are **mostly a reiteration of established international law on space exploration** (for e.g. the OST of 1967).

- The parties who sign this would be able to participate in NASA's Artemis Program of crewed Lunar Exploration.
- The accord serves as preamble to bilateral, government-to-government agreements that participating nations will sign with the USA.
- **Key Provisions:**
  - **Peaceful purposes:** Conduct all space activities peacefully and in accordance with international law.
  - **Heritage Protection:** Help protect space heritage, such as Apollo landing sites.
  - **Transparency:** Publicly release scientific data in a timely manner
  - **Emergency Assistance:** Render aid to astronaut who need it.
  - **Interoperability:** Make their (signatory countries) hardware and other systems "interoperable" to maximize cooperative system.
  - **Registration of Space Objects:** The Artemis accord reinforces the critical nature of registration and urges any partner which isn't already a member of the Registration Convention to join ASAP.
  - **Space Resource:** Space resource extraction and utilization can and will be conducted under the auspices of the Outer Space Treaty, with specific emphasis on Article II, VI, and XI.
  - **Deconfliction of Activities:** NASA and partner nations will provide public information regarding the location and general nature of operations which will inform the scale and scope of 'Safety Zones'.
- **Analysis:**
  - **Why the project is collaborative?**
    - Huge costs involved in these projects -> so countries like USA are keen to take forward a collaborative agenda.
    - **Geopolitical dimension:** China and Russia are also planning a research station on Moon (surface or orbit), and they are also seeking partners.
  - **India's joining:**
    - India's joining of Artemis accord doesn't mean automatic participation in the Artemis program, but it does open up possibilities of much closer cooperation between the space agencies of the two countries. In fact, the text of the accord clearly mentions that its purpose is to establish a common vision and enhance the governance of civil exploration of outer space "with the intention of advancing the Artemis Program".

#### 4) NASA'S ARTEMIS LUNAR PROGRAM

- This is NASA's program for Crewed Lunar Exploration. Under this NASA aims to land two astronauts (including 1 women) near the Lunar south pole in 2024 and establish a sustainable human presence on and around the moon by the end of the decade.

- Perhaps the most ambitious of the Artemis mission's objectives involve using the moon as a **stepping stone for a mission to Mars**. Robots have done all the detective work on Mars so far, but NASA aims to send astronauts there by 2030s.
- NASA is collaborating with other countries and Private sector for this project.
- **Rockets and Spacecrafts:**
  - At the center of the Artemis Program are NASA's new megarocket, the **Space Launch Rocket (SLS)** and the **Orion Spacecraft**.
  - The **SLS** is a 322 foot tall (98 meters) rocket consisting of a core stage, upper stage, and twin five segment solid rocket boosters to launch payload into space. This rocket will launch the Orion Spacecraft to the moon.
  - **Orion** is a space capsule larger than the Apollo command modules that are designed to carry four astronauts on missions to the moon.

#### A) ARTEMIS-1 MISSION

- Artemis-1 is the first integrated test of NASA's deep space exploration systems: the Orion spacecraft, Space Launch System (SLS) rocket and the ground system at Kennedy Space Centre in Cape Canaveral, Florida. It was launched in Nov 2022 from NASA's Kennedy Space Centre in Florida.
- It tests the safety of the SLS rocket, and the Orion capsule's ability to reach moon, perform in lunar orbit and return to Earth for an ocean splashdown.
- It is an uncrewed flight test that will provide foundation for human deep space exploration and demonstrate NASA's commitment and capability to extend human existence to the Moon and beyond. It will pave the way for many moon missions including ones that will land the first woman and the first person of color on the Moon.

#### ORION SURPASSES APOLLO 13 RECORD DISTANCE FROM EARTH (NOV 2022)

- On day 11 of the Artemis 1 mission, Orion continued its journey beyond Moon after entering a distance retrograde orbit. Orion remained in this orbit for six days before exiting lunar orbit to put the spacecraft on a trajectory back to earth.
- **Orion surpassed** the distance record for a mission with a spacecraft designed to carry humans to deep space and back to Earth, on Nov 26, 2020.

#### B) ARTEMIS-2: 2024

- Carrying the first four Artemis astronauts, the Orion Capsule will take the crew farther from earth than humans have ever travelled before.
- Over the approximately 10-day mission, the crew will complete a lunar flyby and return to Earth, evaluating the spacecraft's systems while carrying humans.

### C) ARTEMIS-3: 2025

- It will see the **next man and first woman step onto the lunar surface**. Astronauts will land on the South pole of the moon using lunar lander. They will remain on the moon for around a week.

### D) NASA'S GATEWAY LUNAR ORBIT OUTPOST

#### - Details

- Gateway Lunar Orbit Outpost is basically a **spaceship that will orbit the Moon**. It will act as an airport, where spacecraft bound for lunar surface or surface of Mars can refuel or replace parts and resupply things like food, oxygen. It will also act as a temporary office and living quarters and lab for astronauts around 2,50,000 kms away from earth.

## 5) NASA'S MARS 2020 MISSION - PERSEVERANCE ROVER

#### - Details

- Perseverance (six-wheeled robot) is NASA's Martian rover. In Feb 2021, it touched down on the Martial soil when it successfully landed in Mar's Jezero Crater.
- Its design is similar to its predecessor rover- curiosity, from which it was moderately upgraded. It carries seven primary payload instruments, 19 cameras, and two microphones. It also carries a mini-helicopter Ingenuity, which in April 2021 made the **first ever powered flight on another planet**.
- The rover has **four science objectives** that support the **Mars Exploration Program's Science goals**:
  - » **Looking for habitability**
  - » **Astrobiology: Seeking biosignatures** – of possible past microbial life in those habitable environments, particularly in specific rock types known to preserve signs overtime.
  - » **Caching samples** – Collect core rocks and soil samples and store them on Martian surface which can be extracted by future programs.
  - » **Preparing for crewed missions** – Test oxygen production form the Martian atmosphere.
- The two microphones would listen to Martian sounds like the wind or the rover moving on the Martian soil.
- **Why Jajero Crater:**
  - » Jajero **crater preserves the evidence that it was once a lake** with an inflow channel and an outflow channel. There are good chances that if life existed on Mars in the past, the microorganisms could have lived here and preserved in the form of fossil here.
  - » **In Aug 2022**, NASA's perseverance found surprising volcanic rocks in Mars' Jezero Crater. The discovery was a complete surprise as the researchers initially expected to find sedimentary rocks formed by mud and detritus laid down by the ancient lake. These water altered rocks indicate the presence of water, which is an essential ingredient for a habitable environment.

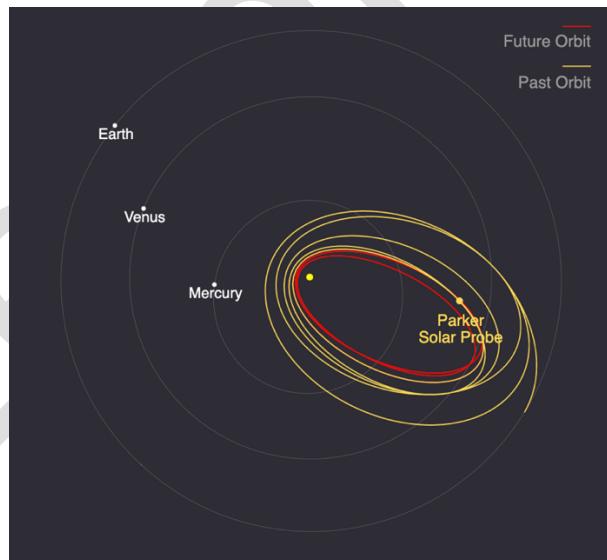
- In April 2021, NASA's Ingenuity Mars Helicopter became the first aircraft in history to make a powered, controlled flight on another planet.
  - » It is a **solar powered** helicopter.
  - » **Why flying on Mars is a challenge?**
    - Atmosphere density is only 1% of Earth's atmosphere.
    - To sustain flight, helicopter blades have to rotate at 2400 rpm (rotation per minute). For a helicopter to fly few meters from the ground on Mars, is equivalent for a helicopter to fly 2-3 times the height of Mt Everest.



## 6) PARKER SOLAR PROBE

### - Introduction

- The parker solar probe was launched in Aug 2018. It is designed to swoop through the sun's super-hot outer atmosphere and help scientists understand the way our star shapes the solar system.
  - **Using Venus' Gravity:** The parker probe has used Venus' gravity during seven flybys over nearly seven years to gradually bring its orbit closer to sun. It is done to slowdown the spacecraft to reduce gravitational pull of the Sun.
    - In June 2020, the probe reached as close as 832 kms above the planet's surface.
  - **Launch Site:** NASA's Kennedy Space Center, Florida
  - **Launch Vehicle:** Delta IV – Heavy with upper stage.



- It is designed to go closer to the sun (3.8 million miles from the solar surface), seven times closer than any other spacecraft before, facing brutal heat and radiation conditions – and ultimately provide humanity with the closest ever observation of the star. **In 2021 it has entered into the outermost part of sun's atmosphere**, known as the Corona. It is using in situ measurements and

imaging to revolutionize our understanding of the Corona. It is a monumental moment for solar science and a truly remarkable feat.

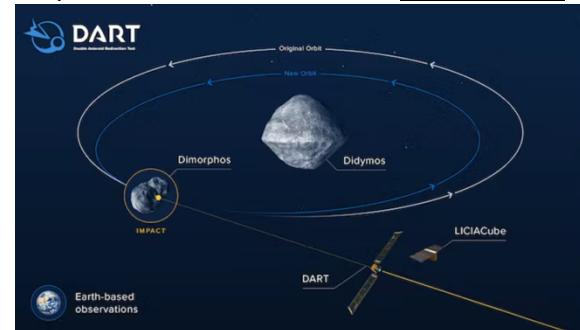
- The first passage through Corona – and the promise of more flybys to come – will continue to provide data on phenomena that are impossible to study from afar.

## 7) LUCY MISSION

- NASA has launched the LUCY spacecraft in Oct 2021, on a 12-year cruise to the Jupiter Trojan asteroids. It will fly by eight asteroids – 7 trojans and one main belt asteroid – over the next 12 years. It is NASA's first single aircraft mission which will explore so many asteroids at one go.
- LUCY will run on solar power out to 850 million kms away from sun. This makes it the farthest-flung solar powered spacecraft ever.
- **Significance:** It will look back into the origins and evolution of the solar system formed over 4 billion years ago through these celestial bodies.
- **Why named Lucy?**
  - Lucy is the name given to a hominin that lived 3.2 million years ago. She is known to be one of the most famous pre-human fossil in history.
  - Nearly, 40% of the fossilized skeleton of this hominin was discovered in 1974 by a team of Paleoanthropologists led by Donald Johanson. The name was inspired from the famous Beatles song "Lucy in the Sky with Diamonds", which Johanson's team listened to at camp the night of their discovery.

## 8) DART MISSION

- **Introduction**
  - DART is a planetary defense-driven test of technologies for preventing an impact of Earth by a hazardous asteroid.
  - Under this NASA launched a mission in Nov 2021, aboard Space X Falcon 9 rocket. It sent a space capsule of the size of a fridge towards an asteroid to shoot it off course. The target asteroids were 11 million kms away from Earth and DART mission reached here after 11 months of journey.
- **Target Asteroid:**
  - DART's test target was an asteroid (Dimorphos/Didymos B) that passed the earth in 2022 and will come back two years later.
  - Its primary body (Didymos A) is approx. 780 meters across, its secondary body (or “moonlet”) – Didymos B is about 160 meter in size, which is more typical of the size of asteroids that could pose the most likely significant threat to Earth.
  - NOTE: DART's target asteroid was **NOT** a threat to earth, and it is only a test mission.



- In Sep 2022, this space capsule was crashed into **Dimorphous/Didymos-B**.
- It used **autonomous targeting**, using images of the asteroids it acquires as it approaches. DART needed to recognize the asteroid itself, automatically lock onto Dimorphous, and adjust its trajectory to hit it. This is while it was moving at a speed of 24,000 km per hour.
  
- **Technology: Kinetic Impact Technique:**
  
- **Why Didymos system was chosen:** Easy to measure impact (binary pair); No risk to humans.
- **How observations were made:**
  - Measurements from telescopes on Earth.
  - **LICIACube:** It is an Italian Space Agency CubeSat (a small type of satellite) that was deployed from a spring-loaded box aboard the craft on 11<sup>th</sup> Sep. LICIACube followed along and photographed the collision and its aftermath.
  
- **Outcome:**
  - **For the first time**, human has changed the orbit of a planetary body. The impact shortened Dimorphos' orbit time by 32 minutes.
  - **Proof:** The test was a proof of concept for many technologies, that NASA has invested over the last few years.
  - **DART** has also given some fascinating data about both asteroid properties and the effectiveness of a kinetic impactor as a planetary defence technology.

## 9) VOYAGER-2

- **Why in news?**
  - NASA's Voyager 2 spacecraft, which is now travelling in interstellar space, has gotten a new lease of life after mission engineers developed a new plan to keep its instruments running for longer (April 2023)
- **About Voyager 2**
  - Voyager 2 is a **space probe launched by NASA in 1977 to study the outer planets**.
  - Its primary mission ended with the exploration of the Neptunian system in 1989. It had visited Jupiter, Saturn and Uranus earlier.
  - It is second spacecraft to enter interstellar space. On 10<sup>th</sup> Dec 2018, the spacecraft joined its twin – Voyager 1 – as the only human-made objects to enter the space between the stars.
- **Power:** The spacecraft is equipped with **3 Multi-hundred-Watt radioisotope thermoelectric generators (MHW RTG)**.
- **April 2023 Updates:**
  - The ageing voyager 2 spacecraft has begun using a small reservoir of backup power to keep its instruments working despite a reduced power supply. This backup power was set aside as part of an onboard safety mechanism. The spacecraft was scheduled to shut down its science instruments in 2023, but with this move, it can continue operating them until 2026.
  
- **Achievements**
  - It is the **only spacecraft to study all four of the solar system's giant planets** at close range.

- The craft is now travelling more than 11.6 billion miles from earth. It is **beyond heliopause**, or boundary region, where the sun's influence ends and the **interstellar medium begins**.
- Note:** Although both the Voyager probes – Voyager-1, launched on Sep 5, 1977, and Voyager 2, launched 16 days before its twin – have left the heliosphere, neither spacecraft has yet left the solar system, and won't be leaving anytime soon. The boundary of the solar system is considered to be beyond the outer edge of the Oort Cloud, a collection of small objects that are still under the influence of sun's gravity.

The width of the Oort Cloud is not known precisely, but it is estimated to begin at about 1,000 astronomical units from the sun and to extend to about 100,000 AU (1 AU is the distance from the sun to Earth). It will take about 300 years for Voyager 2 to reach the inner edge of the Oort Cloud and possibly 30,000 years to fly beyond it.

### 3. PEREGRINE MISSION-1: FIRST US SPACECRAFT DUE TO LAND ON MOON SINCE THE APOLLO MISSIONS IN THE 1970S LIFTS OFF

#### Why in news?

Peregrine Mission-1 is the first US attempt to land on Moon in more than half a century (since Apollo 17 in 1972). It lifted off in space as planned (Jan 2024)

#### Soft Landing on Moon So Far:

As of Jan 2024, **Soft landing on moon** has been achieved by **only four national space agencies**:

**Soviet Union** was first in 1966.

It was followed by USA's NASA which still remains the only space agency to put humans on Moon.

In the last decade, China soft landed on moon thrice in its Chang'e-3, Chang'e-4, and Chang'e-5 missions.

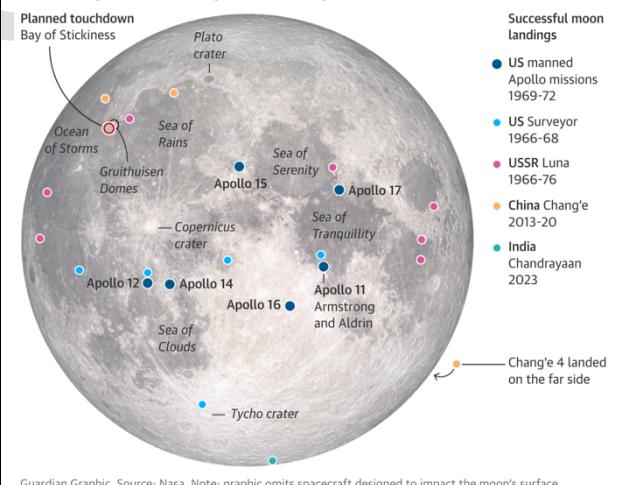
**India** achieved soft landing in 2023 in its Chandrayaan-3 mission.

#### Failures:

Private Missions by Israel and Japan, as well as an attempt by the Russian Space Agency – have all ended in failures.

**Why limited successes?** Controlled touchdown on moon is a challenging task due to absence of atmosphere and treacherous terrain.

The Peregrine lunar lander is expected to touch down on **23 February** in the newly named Bay of Stickiness



Guardian Graphic. Source: Nasa. Note: graphic omits spacecraft designed to impact the moon's surface

#### Details Of Peregrine Mission-1

**Rocket Used: Vulcan Centaur:** It's a brand-new rocket of United Launch Alliance. Peregrine Mission-1 is its maiden launch.

- » The rocket has reusable first stage booster engines which is expected to reduce cost of launches.
- » **Note:** ULA is a joint venture between Lockheed Martin and Boeing.

**Peregrine Lander:** It has been developed by a US company Astrobotic, which has been selected for NASA's Commercial Lunar Payload Services (CLPS) programme.

**Launch site:** Cape Canaveral Space Force Station, Florida.

**Touchdown:** Peregrine is schedule to touch on a mid-latitude region of the Moon called Sinus Viscositas.

NASA has contracted private players under Commercial Lunar Payload Services (CLPS) programme.

**Payload Carried:**

A suite of scientific instruments by NASA to probe radiation and surface composition – helping to pave the way for return of the astronauts.

**Some Unique Cargos:** A shoebox-sized rover built by Carnegie Mellon University (CMU), a physical bitcoin, and cremated remains and DNA including those of Star Trek creator Gene Roddenberry, legendary sci-fi author, scientist Arthur C. Clarke, and a dog.

**Note:** The Navajo Nation, the USA's largest indigenous tribe, had opposed it as sending these to the moon desecrates a body they consider sacred to their culture.

**Significance:**

- » **Stimulate Broader Lunar Economy:** USA has turned to commercial sector to stimulate broader lunar economy.
- » **Cost Reduction:** NASA has paid the startup just \$180 million for five scientific instruments to be carried to the moon – a fraction of cost of launching its own mission.

#### Future Commercial Launches:

Another US company, which NASA has contracted, Houston-based Intuitive Machines, is looking to launch in Feb 2024 and land near the south pole.

## 4. CHINA

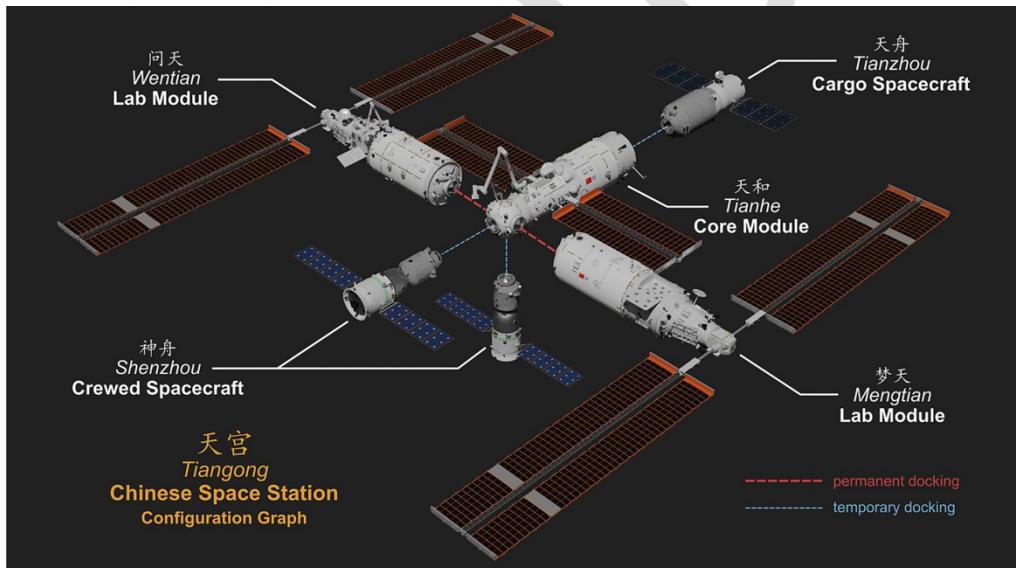
### 1) CHINA'S SPACE STATION: TIANGONG

- **Details**

- **Background:**

- China's crewed space program is officially three decades old. It truly got underway, when in 2003, China became only third country in the world, after USA and Russia, to put a human into space using its own resources.

- Work on the space station programme began a decade ago with the launch of a **space lab Tiangong-1** in 2011, and later, **Tiangong-2** in 2016.
- **Details of the Space Station - Tiangong:** It is a **T-Shaped space station** which will be able to accommodate 25 lab cabinets, each a micro lab that can be used to conduct experiments. The space station will weigh 66 tonnes – a fraction of ISS which weighs 465 tonnes.
  - It will have **three modules**
    - **Tianhe Module** (launched in April 2021) on Long March-5B.
    - **Wentian Module** (launched in July 2022) will be equipped to support life science research. It will also have airlock cabins for extravehicular trips, as well as short-term living quarters for astronauts during crew rotation.
    - **Mengtian Module** (launched in Oct 2022) will focus on microgravity experiment. It is the third and final module which docked with the station in Nov 2022.
  - The space station is designed for a lifespan of at least a decade.
  - It has facilities for long term accommodation of just three astronauts (compared to 7 of ISS). Still China has invited foreign astronauts in an effort to internationalize the space station.
  - **Scope of expansion in future:** The Three module T Shaped station could be expanded into a four-module cross shaped configuration in future.



## 2) CHANG'E-5

- **Details**
  - The Chang'e-5 probe, comprising an orbiter, a lander, an ascender, and a returner was launched on Nov 24, 2020, and its lander-ascender combination touched down on the north of the Mons Rumker in Oceanus Procellarum, also known as the ocean of Storms, on the near side of the Moon on 1<sup>st</sup> Dec 2020.
  - It was the third Chinese mission to land on the moon.

- The Chang'e-5 probe returned to earth in Dec 2020 and it brought along with it about 1,731 grams of samples. Scientists will carry out the storage, analysis, and research of the country's first samples collected from the extra-terrestrial object.

The Chang'e-5 mission marks a successful conclusion of China's current three-step lunar exploration programme of orbiting and landing and bringing back samples which began in 2004.

## 5. SPACE TOURISM

- **Why in news?**
  - » ISRO is planning space tourism by 2030
- **What is suborbital Flight?**
  - » Suborbital flights don't have enough speed to escape into orbit. Any orbit without enough energy to reach orbit will instead follow a parabolic trajectory, looping up and then back down again. This will be a suborbital space mission or suborbital flight.
  - » Such flights are short, but passengers can experience mind-blowing view of Earth and will also experience several minutes of weightlessness. This thus can attract space tourists.
  - » **Why weightlessness?**
    - During downward path, a section of the flight is a free fall.
  - » **Other Significances:**
    - Microgravity experiments can also be carried out on these flights. This would be much cheaper than doing these experiments in International Space Stations.
    - It could also be a cheaper way of testing space flight technologies or experiments before they are sent on more expensive orbital or deep space missions.
- **Space Tourism**
  - » Space Tourism is the segment of space travel which provides non-astronauts the ability to go to space for recreational, leisure or business purposes. The idea is to make space more accessible for anyone who can afford it.
  - » In the past, NASA and Russian Space Agency used to take tourists for space travel. For e.g. Dennis Tito was the first commercial spaceflight passenger before which only astronauts used to go to space. He went to space on Russian Soyuz TMA Launch Vehicle in April 2001. After him, between 2001-2009, few other space tourists went to space, aboard a Russian Soyuz space to ISS, brokered by Space Adventures (an American Space Tourist company) in conjunction with Roscosmos.
- **Recent tourism space flights:**
  - » Virgin Galactic is a company which was established by British Entrepreneur Richard Branson in 2004.
    - In July 2021, Richard Branson and five others undertook a brief trip to the edge of the space, taking off on a VSS unity spaceship.



- » **Blue Origin** was established by Jeff Bezos in 2000. It's reusable rocket **New Shepherd** successfully completed first human flight to space recently (**20<sup>th</sup> July 2021**) with **four private citizens onboard**. The flight went about **107 km** high.
- **SpaceX's Inspiration4** – debut of SpaceX's tourism business (Sep 2021)
  - » Falcon 9 rocket took a crew Dragon spacecraft with 4 civilians (first all civilian space flight) into space. They travelled to an altitude of 575 km, even higher than HST and ISS.
  - » **Isaacman**, the founder and CEO of Shift4 payments, is largely responsible for the mission's planning from birth to launch.
- Other than these three, companies such as Virgin Atlantic, XCOR Aerospace, Armadillo Aerospace are working on providing space tourism services to people.
- **Concerns**
  - » **Climate change** may be aggravated by Space Tourism.
  - » **Available only for highly rich people**

## 6. RUSSIA:

### 1) LUNA-25

- **Why in news?**
  - Russia's LUNA-25 failed to land on Moon and crashed onto Moon's surface (Aug 2023)
- **Details**
  - **Why the failure?**

An anomalous engine burn-> Instead of a planned propulsive nudge of 84 seconds, the engine operated for 127 seconds, more than the "required value" in readying the probe for its descent burn. This added impulse caused Luna-25 to smash into the moon.
  - **More about Luna-25:**

- i. It was modern Russia's first Moon mission. It was heralded as the first domestically produced moon probe in Modern Russia history. Luna-25's flight was important in both political and scientific terms. The implication of its failure is likely to be considerable.
- ii. The final soviet moon mission, Luna-24, successfully hauled home to Earth about 170 grams of lunar samples in 1976.

## 7. GENERAL SPACE ISSUES

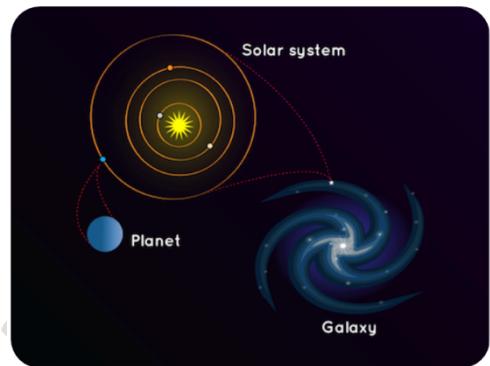
### 1) SPACE DEBRIS

- **Introduction**
  - The term “space debris” refers to **defunct human made objects which are moving in orbit around earth**. It includes big and small things like discarded boosters, retired satellites, leftover bits and pieces from spacecrafts, screwdrivers, tools, nuts, bolts, lost gloves, flecks of paints etc.
  - There are more than 20,000 pieces of debris that are larger than 5-10 cms and can be tracked and catalogued. There are hundreds of millions that we cannot because of their small size. They are all dangerous as they are moving at very high speeds.
- **How are Space Debris created?**
  - **Breakup of older spacecrafts:** For e.g., breakup of US' spacecraft called USA 109 in 2015, created 100 debris pieces and 50,000 shards larger than 1 mm.
  - **Accidently left-over objects**
  - **Testing of Space Weapons**
    - For e.g., China's testing of A-SAT missile in 2007 created more than 34,000 debris.
  - **Further breakup of space debris:** More debris increase the chance of collision – a cascade effect known as the **Kessler Syndrome**. The fear is that the space could eventually become inoperable.
  - **Mega constellations** (e.g., Starlink satellite internet constellation) would launch thousands of satellites in coming years and would make space more vulnerable to collision and debris creation.
- **Key Concerns Raised by Space Debris**
  - **Endanger the prospects for Space Missions** (Civilian, Commercial or military)
  - **Sometimes crash land on earth** harming life and livelihood of people
    - Recently parts of Zenit rocket debris are reported to have ended up crash-landing in Peru.

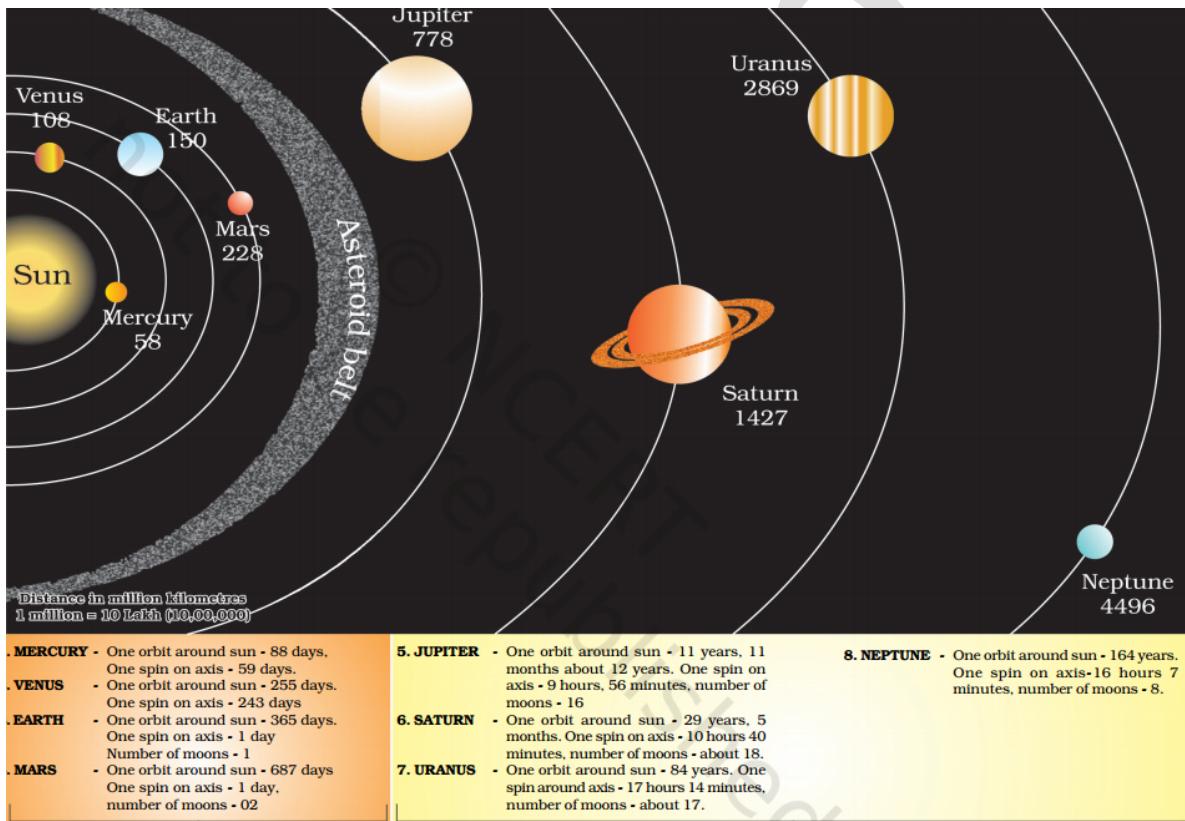
## 8. BASICS OF ASTRONOMY

### 1) GALAXY

- » Galaxies are like building blocks of Universe.
- » A galaxy is huge collection of gas, dust, and billions of stars and their solar systems. A galaxy is held together by their gravity. Our galaxy, the Milky Way, also has a supermassive black hole in the middle.
- » When we look up at the stars in the night sky, we see other stars in the Milky Way.
- » There are many galaxies besides ours. Some scientists estimate the total number of galaxies to be as much as one hundred billion.



### 2) OUR SOLAR SYSTEM



#### - Planets

- » **8 (My Very efficient mother just served us nuts)**
- » Venus is considered as 'Earth's twin' because its size and shape are very much similar to that of earth

- » **Pluto:** Till recently (August 2006) was called a planet. However, in a meeting of **International Astronomical Union**, a decision was taken that Pluto like other celestial objects (Ceres, 2003 UB<sub>313</sub>) discovered in recent past may be called a dwarf planet<sup>1</sup>.

**Inner Planet :** Mercury, Venus, Earth, Mars (*very close to sun, made of rocks*). They are called *inner planets* as they lie between the sun and the belt of asteroids. They are also called **terrestrial planets**, meaning earth like as they are made up of rock and metals, and have relatively high densities.

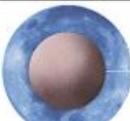
**Outer Planet:** Jupiter, Saturn, Uranus, Neptune. They are called outer planets. They are also known as **Jovian or Gas** planets. Jovian means Jupiter like. Most of them are much larger than the terrestrial planet and have a thick atmosphere, mostly of helium and hydrogen.

- The difference between terrestrial and Jovian planets can be attributed to the following conditions
  - i. The terrestrial planets were formed in the close vicinity of the parent star where it was too warm for gases to condense to solid particles. Jovian planets were formed at quite a distant location. ()
  - ii. The solar wind was most intense nearer the sun; so, it blew off lots of gas and dust from the terrestrial planets. The solar winds are not all that intense to cause similar removal of gases from the Jovian planets.

The terrestrial planets are smaller and their lower gravity could not hold the escaping gas.

### 3) PLANETS, DWARF PLANTS AND OTHER CELESTIAL BODIES

#### DWARFS, THEIR DIAMETERS

	<b>CERES</b>	<b>950 km</b>
Between Mars and Jupiter		
	<b>PLUTO</b>	<b>2,400 km</b>
Beyond Neptune, once seen as planet		
	<b>ERIS</b>	<b>2,300 km</b>
Beyond Neptune, close to Pluto in size		
	<b>MAKEMAKE</b>	<b>1,400 km</b>
Beyond Neptune, discovered in 2005		
	<b>HAUMEA</b>	<b>1,400 km</b>
Beyond Neptune; measurements vary		

## 4) MOON

- » It is Earth's only natural satellite
- » **Size:** 1737.1 km (Radius)
- » **Distance:** 3,84,400 km away from earth
- » **Only one side visible**
  - The moon moves around the earth in about **27 days**. It takes exactly the same time to complete one spin. As a result, only one side of the moon is visible to us on earth.

## 5) PLANETS WITH HIGHEST NUMBER OF MOON

- SATURN

## 6) ASTEROIDS

- Apart from the stars, planets and satellite, there are numerous tiny bodies which also move around sun. These bodies are called asteroids. They are found between **orbits of Mars and Jupiter**. Scientists are of the view that asteroids are parts of a planet which exploded many years back.

### A) NEAR EARTH ASTEROID:

- **About Near Earth Objects**
  - NEOs are comets and asteroids nudged by the gravitational attraction of nearby planets into orbits which allows them to enter the Earth's neighborhood. They occasionally approach close to the Earth as they orbit the sun.
  - NASA's Center for Near-Earth Object Study (CNEOS) determines the times and distances of these objects as and when their approach to the Earth is close.
- **Significance of Near-Earth Objects:**
  - Scientific interest in comets and asteroids is largely due to their status as relatively unchanged remnant debris from the solar system formation process over 4.6 billion years ago. Therefore, they can give clue regarding original conditions which led to formation of planets.
  - Further, **an asteroid** is considered as one of the existential dangers for life on earth. Therefore, it's important to study these near-earth objects and prepare to ward off any future hit.
- **When is an Asteroid considered PHA (Potentially hazardous asteroid)?**
  - Asteroids with a minimum orbit intersection distance (MOID) of about 0.05 AU (i.e. roughly 7,480,000 km or less and a diameter more than 150 meters) is considered PHAs.
  - **Note:** It is not necessary that asteroids classified as PHAs will necessarily impact the earth. It only means that there is a possibility of such threat.

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## B) PSYCHE

- **Example Questions:**
  - Launched on 13<sup>th</sup> October 2023, Psyche Mission has been much in news since then. What are the key goals of the mission? What potential benefit does it hold for human race? [10 marks, 150 words]
- **About Psyche Asteroid:**
  - Psyche is one of the asteroids in the asteroid belt. What makes the asteroid unique is that it appears to be the exposed nickel-iron core of an early planet, one of the building blocks of our solar system.
- **About Psyche Mission:**
  - The Psyche Mission is a NASA space mission launched on 13<sup>th</sup> Oct 2023 to explore origin of planetary cores by orbiting and studying the metallic asteroid Psyche in 2029. The mission consists of Psyche Aircraft.
- **Significance:**
  - **Understanding the Core of a Planet:** Deep within rocky terrestrial planets – including Earth – scientists infer the presence of metallic cores. But these remain unreachably far below the planets' rocky mantles and crusts. Psyche offers a unique window into the violent history of collisions and acceleration that created terrestrial planets.
  - **Science Goals include:**
    - **Understand a previously unexplored building block of planet formation:** Iron cores.
    - **Look inside terrestrial planets, including Earth,** by directly examining the interior of a different body, which otherwise couldn't be seen.
    - **Explore a new type of world** made of metal (and not of rock and ice)
  - **Science Objectives:**
    - Understanding Psyche – Whether it is a core, or if it is an unmelted material, relative ages of psyche's surface etc.
  - **Deep Space Optical Communication (DSOC):** The Psyche mission is also testing a sophisticated new laser communication technology that encodes data in photons at near-infrared wavelength (rather than radio waves) to communicate between a probe in deep space and Earth.

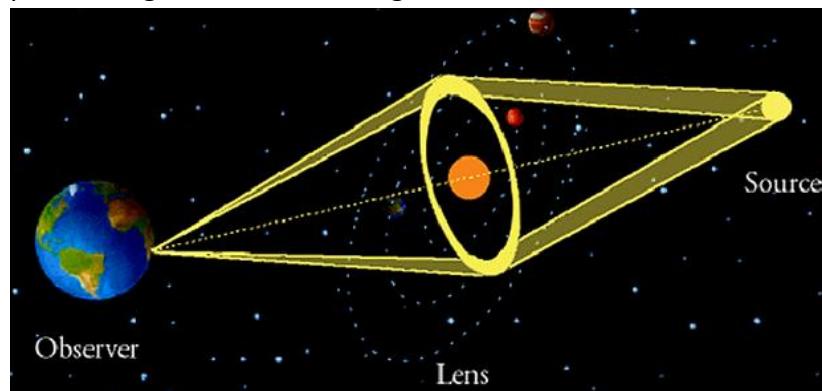
## 7) JUPITER TROJANS (CLASS DISCUSSION)

## 8) EXOPLANETS (CLASS DISCUSSION)

## 9) GRAVITATIONAL LENSING

### » Basics

- Gravity bends the time-space around us. And since light travels through space, it also bends while passing through this bent time space.
- This bending of light creates the same effect as the bending of light through a glass lens and the phenomenon is called gravitational lensing (i.e. lensing effect created by gravity). **Einstein** first predicted gravitational lensing in 1912 and is an effect of his theory of general relativity.



- It is clearly observable when gravitational force is high (i.e. bending of space-time is high) such as in case of large galaxies or cluster of galaxies. Thus, large galaxies can behave like large natural telescopes.

### » Applications

- Scientists use this phenomenon to **study distant stars/galaxies** in Universe which would otherwise have been difficult to see even by the most powerful space telescopes. The image of the distant object would be magnified if there is a gravitational source (like a large galaxy) in the path.
- The phenomenon also helps us in **understanding the origin of a galaxy/star** as we can observe light from distant stars when there were still getting formed.
  - For e.g. NASA under its **TEMPLATES** initiative is using gravitational lensing to study how galaxies are forming stars and how the star formation is distributed across galaxies.

- » It also helps us in studying of super massive blackholes at cosmological distance.

## 9. SUN

### A) BASICS ABOUT SUN

- Distance: 150 million km away from earth
- Radius: 696,000 km

## B) SUN'S STRUCTURE – 3 ATMOSPHERIC LAYERS

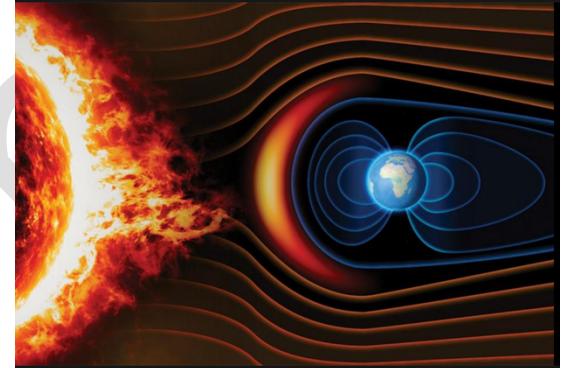
- Sun has **six layers**. The **core, radiative zone and convection zone** consist of the inner layers or the parts of the sun which is not visible. **Photosphere, Chromosphere and Corona** comprise of the sun's atmosphere or outer layer.
- **Inner Layer**
  - Core:** It is the innermost layer of sun. The Core is Plasma, but its movement is extremely similar to gas. The temperature in Sun's core is nearly 15-million-degree Celsius.
  - Radiative Zone:** It is the second layer of sun and sits outside the core. This zone has temperature of millions degree Celsius. The layer serves as a passage for all the energy that is released by the core.
  - Convection Zone:** It is the outermost layer and completely surrounds Radiative zone. In this layer, all the hot material found near the center of the Sun rises cools down and drops back into the radiative zone to get more heat. This is the movement that creates sunspot and Solar flares.
- **Outer Layers:**
  - Photosphere** is the deepest layer of the sun that we can observe directly. It reaches from the surface to about 250 miles above that. Temperature varies from about 6700-degree Celsius to 3,700-degree celsius. Most of the photosphere is covered by granulations (caused by convection current) of the plasma within the Sun's convective zones.
  - Chromosphere:** The chromosphere is a layer in the Sun between about 250 miles and 1300 miles above the solar surface (the photosphere). The temperature in the chromosphere varies between (3700 (**lowest temperature**) at the bottom to 7700-degree C at the top), so in this layer (and higher layers) it actually gets hotter if you go further away from the sun, unlike in the lower layers, where it gets hotter if you go closer to the centre of the sun.
  - Transition Zone:** The transition region is very narrow (60 miles / 100 km) layer between the chromosphere and the corona where the temperature rises abruptly from about 7700-degree celsius to 5,00,000-degree C
  - Corona:** It is the outermost layer of the Sun, starting at about 13,00 miles above the solar surface (the photosphere). The temperature in the Corona is 5,00,000-degree celsius or



more upto a few million-degree celsius. It can't be seen with naked eyes except during a total solar eclipse or with use of a coronagraph. It doesn't have any upper limit.

### C) UNDERSTANDING SOLAR WINDS

- The solar wind is a **stream of charged particles released from the upper atmosphere of the sun, the Corona**. The solar wind streams plasma (a mix of positively and negatively charged particles) and particles from the sun out into space.
- **Cause**
  - The temperature of Corona reaches upto 1.1-million-degree celsius (2-million-degree Fahrenheit).
  - As rising heat and pressure push that material away from the Sun, it reaches a point where gravity and magnetic field are too weak to contain it. That point, known as the **Alfven Critical Surface**, marks the end of Solar Atmosphere and beginning of Solar Wind.
- **Why does the property of solar winds change with time?**
  - The sun's activity shifts over the course of its 11 year cycle, with sun spot numbers, radiation levels, and ejected material changing over time.
  - The wind also differs based on where on the sun it comes from and how quickly that portion is rotating.
  - As the plasma material leaves the sun, carried by solar wind, it becomes more gas-like.
- **How does it affect the earth?**
  - As the wind travels off the sun, it carries charged particles and magnetic clouds. This is constantly hitting our planet with interesting effects.
  - If the solar wind reached the earth's surface, its radiation would do severe damage to any life that might exist. They can affect Earth's satellite and the Global Positioning Systems (GPS).
  - But earth's magnetic field acts as shield, redirecting the material around the planet so that it streams beyond it.
  - The force of the wind stretches out the magnetic field so that it is smooshed inward on the sun-side and stretched out on the night side.
  - **Solar Storms (Coronal Mass Ejections - CMEs)**
    - » Sometimes, especially during the active period of the cycle - known as the solar maximum, the sun spits out large burst of plasma known as Coronal mass ejections (CMEs). These have stronger effect than the standard solar wind.



- » When the solar wind carries CMEs and other powerful bursts of radiation into a planet's magnetic field, it can cause the **magnetic field on the back side to press together**, a process known as **Magnetic Reconnection**.
- » Charged particles in case of magnetic reconnection stream back towards the **planet's magnetic poles**, causing beautiful displays known as the **aurora borealis** in the upper atmosphere.

▫ **About Auroras**

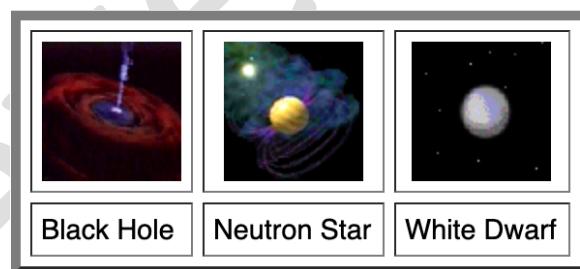
- » In the north the phenomenon is called the **aurora borealis** or the **northern light**. In the southern hemisphere, it's the **aurora australis**, or southern lights.
- » Even though the **earth's magnetic field stretches symmetrically from the north to the south**, recent satellite images of the entire planet showed **mismatched auroras happening at the same time in the two hemispheres**.
- » **Why?** Our **magnetic field is squeezed asymmetrically by solar winds approaching from an angle**, twisting and displacing the northern and southern lights in different forms and locations.

▫ **Useful video to understand Auroras:** <https://youtu.be/PgIKsuZ3RZU>

## 1) LIFE CYCLE OF STARS: STARS – DWARF STARS – NEUTRON STARS – BLACK HOLES

### A) LIFE CYCLE OF A STAR

- Where a star ends up at the end of its life depends on the mass it was born with.
  - **Stars with lots of mass** may end their lives as **black holes or neutron stars**.
  - **A low or medium mass star** (with mass less than 8 times the mass of sun) will become a **white dwarf**.



### B) MEDIUM STARS - > RED GIANT -> WHITE DWARF -> BLACK DWARF

- Class Discussion

#### CHANDRASHEKHAR LIMIT

- The Chandrasekhar Limit, named after the Indian astrophysicist Subrahmanyan Chandrasekhar, is the **maximum mass that a stable white dwarf star can have**. It is an **important concept in astrophysics**, particularly in the study of stellar evolution. Chandrasekhar discovered that if a white dwarf's mass exceeds approximately **1.4 times**

the mass of Sun (Known as Chandrasekhar mass), the pressure generated by the electrons is no longer sufficient to counteract gravity. As a result white dwarf becomes unstable and collapse under its own weight.

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### c) NEUTRON STAR

- **Neutron Star:** It is formed by catastrophic collapse of the core of a massive star. While a white dwarf is supported by electron degeneracy pressure, neutron stars are supported by neutron degeneracy pressure.
- **How is Neutron Star formed:** In its dying phase, when a star with a core containing mainly iron exhausts all its fuel, it collapses under gravity and explodes as supernova. The extreme high pressure causes protons and electrons to combine together to form neutron (thus forming a neutron star). They energy released during the process blows away the outer layer of the star.
- **Would a neutron star further collapse into blackhole?** -> It would depend on the mass of the neutron star's core. If the mass is less than three solar masses it remains as a neutron star, but if the star's mass more than about 3 solar masses, then it collapses further to form a black hole.
- **The highest possible mass** of a neutron star is not very well known, but it can't be theoretically more than 3 solar masses (beyond which, it should be a black hole). The **maximum mass** for a neutron star, which has been precisely measured so far, is around 2.1 solar mass.
- The neutron stars are among the densest objects in the universe. They have a radius of 10-20 km but carry a weight of upto 2.5 times the mass of Sun.
- A **big difference between Neutron star and Black Hole** is that neutron star has a hard surface unlike that of a black hole.

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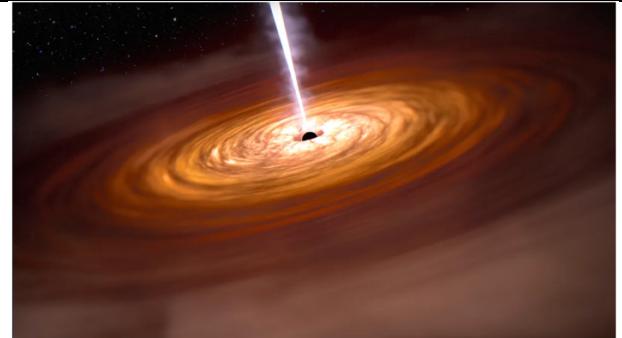
### D) BLACK HOLE

- **Why in news?**
  - » Ferocious black holes reveal 'time dilation' in early universe (July 2023: Source: The Hindu)
  - » Spotting black holes (Sep 2023: Source – The Hindu)
- **What is a Black Hole?**
  - » A Black hole is a place in space where gravity pulls so much that even light can't get out. This strong gravity is because matter has been squeezed into a tiny space. This can happen when a star is dying.
  - » Since, no light is emitted from them, they are invisible.
  - » They are generally **detected** by telescopes by analyzing the behavior of stars that are very close to this black hole.
  - » **How large is a black hole?**
    - A black hole can be as small as an atom (but having the mass of a mountain) and they can be very large as well.

- **Stellar** is a kind of blackhole whose mass is around 20 times the mass of sun. There are many many stellar blackholes in our Milky Way Galaxy.
- “**Supermassive**” are the largest black holes. These black holes have masses that are more than 1 million suns together. Every large galaxy contains a supermassive blackhole at its center. The Supermassive blackhole at the center of the **Milky Way galaxy** is called **Sagittarius**. It has a mass of 4 million suns and would fit inside a very large ball that could hold a few million earths.

**Quasars:** Quasars are a subclass of active galactic nuclei (AGNs), extremely luminous galactic cores where gas and dust falling into a supermassive black hole emit electromagnetic radiation across the entire electromagnetic spectrum. They are among the brightest objects in the Universe.

**Note:** All Quasars are AGN, but not all AGN are Quasar



- » The boundary of black hole is called **event horizon** which acts as one way towards the black hole and allows nothing to get out of it.
- **Singularities and Blackhole**
  - » In 1915 Karl Schwarzschild noticed that Einstein's then new-general theory of relativity predicted the existence of strange objects known as “**singularities**”. They were places where his new equation describing gravity seemed to go haywire. Inside them there was a bizarre place where time stopped, and space became infinite. Over the years evidence have piled up explaining that singularities do exist in our universe as **black holes**.
- **Spotting black holes: How do we identify blackholes?**
  - » A blackhole is identified by the **gravitational force** it exerts on nearby stars.

Astronomers have found systems in which a visible star orbits around an unseen companion. One cannot conclude that the companion is blackhole always; it might merely be a star that is too faint.

- If the unseen companion happens to be a black hole, then because of its high gravity it will start pulling matter off the surface of the visible star. This matter start falling towards the blackhole in a characteristic spiral path. In the process it also emits X-Rays which can be detected from earth.
- From the observed orbit of visible star one can determine the lowest possible mass of the black hole.

- Recent Updates about Blackholes
  - a. Scientists have discovered oldest black hole yet (Nov 2023)
    - A study published in Nov 2023 have confirmed that supermassive blackholes existed at the dawn of the universe. NASA's JWST and Chandra X-Ray Observatory have teamed up to confirm this observation.
    - Given the age of the Universe is 13.7 billion years old, the age of this black hole is 13.2 billion years. Further, this blackhole is whopper – 10 times bigger than the black hole in our milky way galaxy. It is believed to weigh from 10% to 100% the mass of all the stars in its galaxy.
    - How was it formed?
      - a. The researchers believed that the black hole was formed from colossal clouds of gas that collapsed in a galaxy next door to one with stars. The two galaxies merged, and the black hole was formed.
    - Role of Chandra X-Ray Observatory: The fact that Chandra X-Ray detected it confirms without doubt that it is a black hole. With X-rays you discover the gas that is being gravitationally pulled into the black hole, sped up and it starts glowing int the X-Ray.
    - This one is considered quasar since it is actively growing, and the gas is blindingly bright.
  - b. Ferocious Blackholes reveal time dilation in Early Universe (July 2023)
    - Scientists have used observation of a ferocious class of black holes called quasars to demonstrate "time dilation" in the early Universe, showing how time then passed only about a fifth as quickly as it does today. The observation stretches back to about 12.3 billion years ago, when the universe was roughly 1/10<sup>th</sup> of its present age.

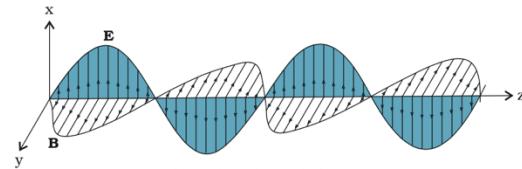
**Quasars were used as a "clock" in the study to measure time in the deep past.** The researchers used observations involving the brightness of 190 quasars across the universe dating to about 1.5 billion years after the Big Bang even that gave rise to the Cosmos. **They compared the brightness of these quasars at various wavelengths to that of quasars existing today**, finding that certain fluctuations that occur in a particular amount of time today did five times more slowly in the most ancient quasars.

## 10. ELECTROMAGNETIC WAVES AND WIRELESS COMMUNICATION

- As per Maxwell's theory accelerated charges radiate electromagnetic waves.
- Key contribution of various scientists:
  - **Hertz:** He experimentally demonstrated that accelerated charged particles emitted electromagnetic waves. [Hertz Experiment 1887] (He did it for low frequency – Radio waves)
  - **JC Bose** working at Kolkata succeeded in producing and observing electromagnetic waves of much shorter wavelength (25 mm to 5mm). His experiment like that of Hertz was confined to the laboratory.

- **Guglielmo Marconi** followed Hertz work and succeeded in transmitting electromagnetic waves over distances of many kilometers. Marconi's experiment marked the beginning of the field of communication using electromagnetic waves.

#### - Key Features of Electromagnetic Waves:

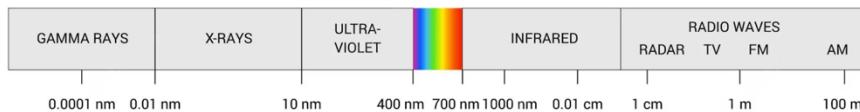
- Electric and Magnetic field are perpendicular to each other, and to the direction of propagation.
- The adjacent figure shows a linearly polarized electromagnetic wave propagating in the z-direction with the oscillating electric field **E** along the x direction and the oscillating magnetic field **B** along the y-direction.
- 
- They are self-sustaining oscillations of electric and magnetic fields in free space or vacuum.
  - It can travel in vacuum and no material medium is involved in the vibrations of the electric and magnetic fields.
  - In vacuum (free space), electromagnetic wave travels with a speed of light  $2.99792458 \times 10^8$  m/s (or roughly  $3 \times 10^8$  m/s).
    - » The constancy of the velocity is EM waves in vacuum is so strongly supported by experiments and the actual value is so well known now that this is used to define a standard of length.
  - Hertz has also established wave nature of the radiation. He demonstrated that the waves, which had wavelength ten million times that of the light waves, could be diffracted, refracted, and polarized.

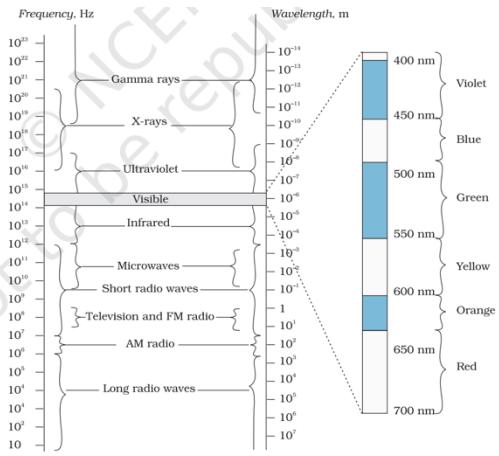
## 1) ELECTROMAGNETIC SPECTRUM

At the time Maxwell predicted the existence of electromagnetic waves, the only familiar electromagnetic waves were the visible light waves. The existence of ultraviolet and infrared waves was barely established. By the end of the nineteenth century, X-rays and gamma rays had also been discovered

- Electromagnetic Waves include radio waves, microwaves, infrared, visible light, ultraviolet, x rays and gamma rays. The classification of EM waves according to frequency is the **electromagnetic spectrum**. Note, that there is no sharp division between one kind of wave and the next. The classification is based on roughly on how the waves are produced and/or detected.

SPECTRUM





**Different Types of Electromagnetic waves, in order of increasing frequency/decreasing wavelength:**

#### A) RADIO WAVES:

- B) They are produced by accelerated motion of charges in the conducting wires.
- C) **Uses:** They are used in Radio and Television communication.
- D) **Wavelength:** They range from around a foot long to several kms.
- E) **Frequency ~: 500 KHz to 1000 MHz**
  - The AM (Amplitude Modulated) band is from 530 KHz to 1710 KHz.
  - The FM (Frequency Modulated) band is from 88 MHz to 108 MHz.
  - The TV waves range from 54 MHz to 89 MHz.
  - Cellular phones use radio waves to transmit voice communication in the Ultra High Frequency (UHF) band.
    - For e.g., in 2014, the DoT auctioned 2G telecom spectrum in the frequency range of 900 MHz and 1800 MHz.
    - For e.g., In 2022 auction, Jio bought frequencies in 700 MHz as well as in 1800 MHz band.
    - In 2022, 700 MHz was sold for the first time. Jio bought the spectrum,

#### B) MICROWAVES

- F) **Microwaves** (short wavelength radio waves) are produced by special vacuum tubes (called klystrons, magnetrons, and Gunn Diodes).
- G) **Frequency: GHz range**
- H) **Applications:**
  - **Radar:** Their short wavelength makes them suitable for Radar system in aeroplanes. Due to their short wavelength, they are suitable for Radar systems used in aircraft navigation. Radar also provides the basis for the speed guns used to time fast balls, tennis serves, and automobiles.
  - **Microwave Ovens** are an interesting application of these waves. In such ovens, the frequency of microwaves is selected to match the resonant frequency of water molecules

so that energy from the waves is transferred efficiently to kinetic energy of the molecules.  
This raises the temperature of any food containing water.

**Details of how microwave work:**

**When the temperature of a body rises, the energy of the random motion of atoms and molecules increases and the molecules travel or vibrate or rotate with higher energies.**

The frequency of rotation of water molecules is about 300 crore hertz, which is 3 gigahertz (GHz). If water receives microwaves of this frequency, its molecules absorb this radiation, which is equivalent to heating up water. These molecules share this energy with neighbouring food molecules, heating up the food.

One should use porcelain vessels and not metal containers in a microwave oven because of the danger of getting a shock from accumulated electric charges. Metals may also melt from heating. The porcelain container remains unaffected and cool, because its large molecules vibrate and rotate with much smaller frequencies, and thus cannot absorb microwaves. Hence, they do not get heated up. Thus, the basic principle of a microwave oven is to generate microwave radiation of appropriate frequency in the working space of the oven where we keep food. This way energy is not wasted in heating up the vessel. In the conventional heating method, the vessel on the burner gets heated first, and then the food inside gets heated because of transfer of energy from the vessel. In the microwave oven, on the other hand, energy is directly delivered to water molecules which is shared by the entire food.

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**c) INFRARED WAVES**

- I) Produced by hot bodies and molecules. They are sometimes also referred as heat waves. This is because, water molecules produced in most materials readily absorb infrared waves (many other molecules, for example, CO<sub>2</sub>, NH<sub>3</sub>, also absorb infrared waves). After absorption, their thermal motion increase i.e. they heat up and heat up their surroundings.
- J) **Infrared lamps** are used in physical therapy.
- K) Infrared waves also play a crucial role in maintaining the earth's warmth or the average temperature through Greenhouse Effect.
- L) Infrared Emitting Devices (IrEDs) are used in remotes of TV, AC etc.

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**D) VISIBLE RAYS**

- M) Part of the spectrum detected by Human eyes.
- N) **Frequency range:**  $4 \times 10^{14}$  Hz to about  $7 \times 10^{14}$  Hz.
- O) **Wavelength:** 700 nm to 400 nm (note: Speed of light = frequency \* Wavelength)
- P) **Note:** Different animals are sensitive to different electromagnetic spectrum. For e.g. snakes can detect infrared waves, and the 'visible' range of many insects extends well into ultraviolet.

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**E) ULTRAVIOLET RAYS**

- Q) **Wavelength:** 400 nm to 0.6 nm
- R) UV radiations are produced by special lamps or very hot objects. For e.g. Sun is an important source of ultraviolet rays, but fortunately, most of the radiation is absorbed in the ozone layer. This is because UV radiation in large quantities will be harmful for human health and other forms of biodiversity.
- S) **Applications:**
- Due to very short wavelengths, UV radiation can be focused on very narrow beams for high precision application such as LASIK (Laser assisted in situ keratomileusis) eye surgery.
  - **UV lamps** are used to kill germs in water purifiers.

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#### F) X-RAYS

- T) **Wavelength:**  $10 \text{ nm}$  to  $10^{-4} \text{ nm}$  ( $10^{-13} \text{ m}$ )
- U) One common way of generating X-Rays is to bombard a metal target by high energy electrons.
- V) **Applications:**
- They are used in diagnostic tools in medicine and as a treatment for various kinds of cancer.

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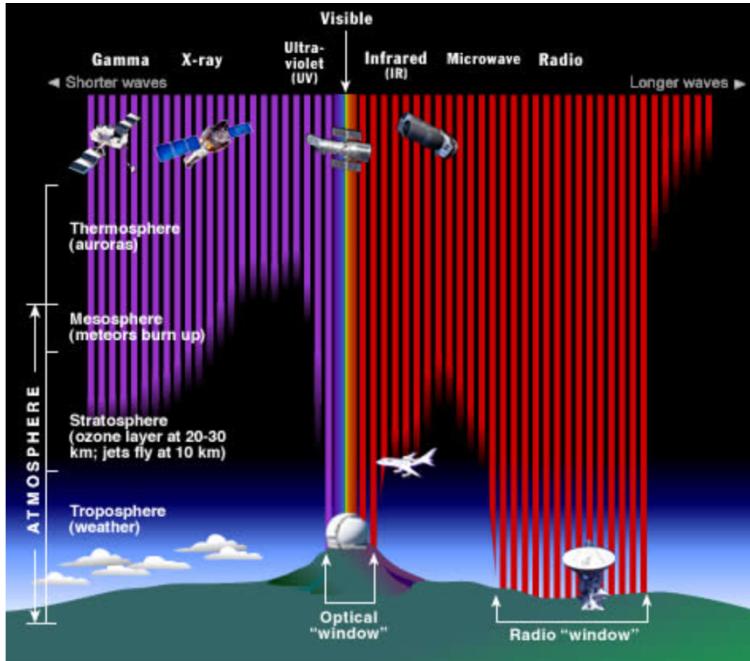
#### G) GAMMA RAYS

- W) **Wavelength:**  $10^{-10} \text{ m}$  to  $10^{-14} \text{ m}$
- X) Produced in nuclear reactions and also emitted by radioactive nuclei. They are used in radiative cancer therapies.

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### C) 2) PENETRATION OF VARIOUS EM WAVES IN EARTH'S ATMOSPHERE

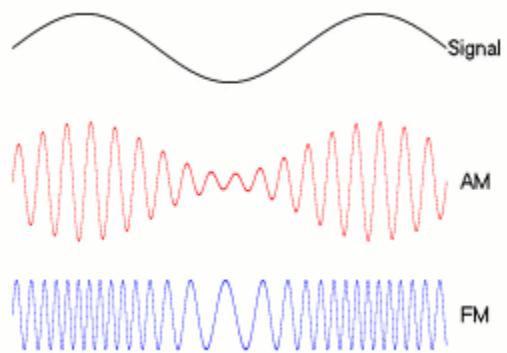
- Y) The Earth's atmosphere stops most type of EM radiation from reaching earth's surface. This illustration shows how far into the atmosphere different parts of EM spectrum can go before being absorbed. Only portions of radio and visible light reach the surface.
- Z) Radio frequencies, visible light and some part of ultraviolet lights makes it to sea level. These wavelength ranges are called atmospheric window. Ground based astronomical observation employs optical and radio telescopes that take advantage of atmospheric windows.
- AA) Astronomers can observe some infrared wavelengths by putting telescopes on mountain tops.
- BB) But, earth's atmosphere absorbs the majority of ultraviolet, X-Rays, and gamma rays. So they can only be absorbed using balloons and astronomical satellites outside the earth's atmosphere.
- CC) **Note:** Long wavelength radio waves and infrared rays also don't reach the surface.
- DD) **Note:**



## 2) WIRELESS COMMUNICATION – DIFFERENT FREQUENCY BANDS AND THEIR APPLICATIONS

### A) RADIO WAVES (500 KHZ – 1 G HZ)

- The AM (Amplitude Modulated) band is from 530 KHz to 1710 KHz.
- The FM (Frequency Modulated) band is from 88 MHz to 108 MHz.
- The TV waves range from 54 MHz to 89 MHz
- Used for broadcasting radio and TV Programmes. Anyone with receiver can tune it to the radio frequency to pick the signal. When radio stations use similar transmission frequencies the waves sometimes interfere with each other.
- Medium wavelength radio waves are reflected from the ionosphere so they can be used for long distance communication, but not for communicating with satellite above the ionosphere. Thus, they can only be used for low earth orbit satellite communication.
- **AM vs FM**



	<b>AM</b>	<b>FM</b>
<b>Full form</b>	AM stands for Amplitude modulation	Frequency modulation
<b>First used</b>	AM method of audio transmission first carried out in the mid-1870s	FM radio was developed in the US states in the 1930s, mainly by Edwin Armstrong

<b>Modulating difference</b>	In AM, a radio wave known as the "carrier" or "carrier wave" is <u>modulated in amplitude by the signal that is to be transmitted</u> . The frequency and the phase remain same	In FM, <u>a radio wave known as carrier wave is modulated in frequency by the signal that is to be transmitted</u> . The <u>amplitude and phase remains the same</u> .
<b>Pros and Cons</b>	AM has <u>poorer sound quality</u> compared with FM but is <u>cheaper and can be transmitted over long distances</u> . It has <u>lower bandwidth</u> so it can have <u>more stations available in any frequency range</u> .	FM is <u>less prone to interference than AM</u> . However, <u>FM signals are impacted by physical barriers</u> . FM has <u>better sound quality due to higher bandwidth</u> .
<b>Frequency Range</b>	AM radio ranges from <u>535 to 1705 KHz (OR) Up to 1200 bits per second</u> .	FM radio ranges in a <u>higher spectrum</u> from <u>88 to 108 MHz</u> . (OR) <u>1200 to 2400 bits per second</u>
<b>Bandwidth requirement</b>	Twice the <u>highest modulating signal</u> . In AM radio broadcasting, the modulating signal has bandwidth of 15 KHz, and hence the bandwidth of an amplitude-modulated signal is 30 KHz	Twice the <u>sum of the modulating signal frequency and the frequency deviation</u> . If the frequency deviation is 75 KHz and the modulating signal frequency is 15 KHz, the bandwidth required is 180 KHz.
<b>Zero crossing in modulated signal</b>	Equidistant	Not Equidistant
<b>Complexity</b>	Transmitter and receiver are simple but synchronization is needed in case of SSBSC AM carrier.	Transmitter and receiver are more complex as variation of modulating signal has to be converted and detected from corresponding variation in frequencies (i.e. voltage to frequency and frequency to voltage conversion has to be done)
<b>NOISE</b>	AM is more <u>susceptible to noise</u> because <u>noise effects amplitude</u> , which is where information is stored in AM.	FM is <u>less susceptible to noise</u> because <u>information in an FM signal is transmitted through varying of frequency</u> , and not amplitude.

## A) MICROWAVES

- Microwaves have shorter wavelength and thus can **pass through ionosphere**. They can thus be used for **long distance satellite communications**.
  - **Line of sight -> Prerequisite:**
  - Signals are sent to and from satellites, which relay signals around the Earth. This may be for TV programmes, telephone conversations or monitoring the earth, for example weather forecasting.
  - **Types**
- 

### L BAND: 1-2 GHZ

- Low bandwidth -> not suitable for streaming applications like video, voice, and broadband connectivity.
  - Radars, GPS signals
  - **Other advantages** -> least expensive and easiest to implement.
- 

### S BAND:

- It is a part of microwave band of the electromagnetic spectrum. It is defined by IEEE standard of radio waves with frequencies that range from **2 to 4 GHz**, crossing the conventional boundary between UHF (Ultra High Frequency) and SHF (Super High frequency) at 3.0 GHz.
  - **Used by**
    - » Weather radar
    - » Surface ship radar
    - » Some Communication Satellites
- 

### C BAND

- The C Band is the name given to certain portions of the electromagnetic spectrum, including wavelength of microwaves that are used for long-distance radio-telecommunication.
  - The IEEE C Band (**4 - 8 GHz**) and its slight variations contain frequency ranges that are used for many satellite communication transmission, some Wi-Fi devices, some cordless telephones, and some weather radar system.
- 

### Ku BAND

- Name given to **12-18 GHz** portion of electromagnetic spectrum in the microwave range of frequencies.
  - Uses
    - » Primarily used for satellite communication, most notably for fixed and broadcast services
- 

### K BAND (18-27 GHZ)

### KA BAND (27 – 40 GHZ)

### V BAND (40 – 75 GHZ)

### W BAND (75-110 GHZ)

### MILLIMETER BAND (110-300 GHZ)

## D) DEEP SPACE OPTICAL COMMUNICATION

1. Why in news?
  - a. NASA's Deep Space Optical Communication Demo sends, receives first data (Nov 2023)
2. Need of Deep Space Optical Communication:
  - a. **Low bandwidth of radio frequency communications:** Future space missions are going to require higher bandwidth of communication as they will need to transmit higher volumes of science data, images, videos etc.
  - b. **Higher frequencies (shorter wavelengths)** which can carry more data suffer from the problems of getting blocked by atmosphere, and higher scattering when it is contacted with any interference.
3. NASA's Psyche Spacecraft is on its way to Psyche asteroid and will reach there by 2029. But in between it is involved in experiments related to Deep Space Optical Communication (DSOC).
4. Primary Objective of DSOC is to give tools and technology to future NASA initiatives to communicate at much higher bandwidth.
5. Demo:
  - a. DSOC has achieved 'first light' sending data via laser to and from far beyond the Moon for the first time.
  - b. NASA's DSOC experiment has beamed a near-infrared laser encoded with test data from nearly 16 million kms away – about 40 times further than the Moon is from Earth – to the Hale Telescope at Caltech's Palomar Observatory in San Diego County, California. This is the farthest ever demonstration of optical communication.
6. Key features:
  - a. It is pioneering the use of near-infrared laser signal for communication with spacecraft.
  - b. Its bandwidth is more than 10 times higher than the state of art radio-telecommunication system of comparable size and power. This enables higher resolution images, larger volumes of science data, and streaming of videos.
7. Advantages: Higher Bandwidth, faster data transmission, improved image resolution, reduced power consumption, potential for streaming video and real-time communication
8. How were the limitations of high frequency communication overcome?
  - a. Extremely precise pointing: To achieve this, the transceiver aboard the spacecraft needs to be isolated from the craft's vibration.
  - b. Compensating for movements of spacecraft and Earth: The targeting has to adjust for this continuous movement.

- c. **Extracting information from weak signal**: Since the signal will travel several million kms, the received signal will be very weak. New Signal processing tools have to be utilized to extract precise information from the communication.
9. Psyche spacecraft is the first to carry a DSOC transceiver and will be testing high bandwidth optical communications to Earth during the first two years of the spacecraft's journey to the main asteroid belt.
- a. Achieving the first light is one of many critical DSOC milestones in the coming months, paving the way toward higher-data-rate communication.
10. Has Space based optical communication happened in past?
- a. In 2013, NASA's Lunar Laser Communications Demonstration tested record breaking uplink and downlink rates between Earth and the Moon using similar technology.
  - b. But DSOC is taking optical communication to Deep Space, paving the way for high-bandwidth communication far beyond the Moon and over 1,000 times farther than any optical communication test to date.
11. **Significance:**
- a. The DSOC holds the key for future space missions. As humans travel deep into space, they would want fast way of sending and receiving large amount of data from earth.
  - b. It would pave the way for high data rate communications capable of sending scientific information, high-definition imagery, and streaming video in support of humanity's next giant leap: Sending humans to Mars.

## PYQS

1	<p>Cryogenic Engines find applications in: [Prelims 1995]</p> <ul style="list-style-type: none"> <li>A. Sub-marine propulsion</li> <li>B. Frost-free refrigerator</li> <li>C. Rocket technology</li> <li>D. Research and Superconductivity</li> </ul>
2	<p>Consider the following statements: [Prelims 1996]</p> <p>A person in a spaceship located halfway between the earth and the sun will notice that the:</p> <ol style="list-style-type: none"> <li>1. Sky is jet black</li> <li>2. Stars don't twinkle</li> <li>3. Temperature outside the spaceship is much higher than that on the surface of earth</li> </ol> <p>Which of the above statements is/are correct?</p> <ul style="list-style-type: none"> <li>A. 3 only</li> <li>B. 1 and 2 only</li> <li>C. 1 and 3 only</li> <li>D. 1, 2 and 3 only</li> </ul>

3	<p>The tail of a comet is directed away from the sun because: [Prelims 1997]</p> <p>(a) As the comet rotates around the sun, the lighter mass of the comet is pushed away due to the centrifugal force alone.</p> <p>(b) As the comet rotates, the lighter mass of the comet is attracted by some stars situated in the direction of its tail</p> <p>(c) The radiation emitted by the sun exerts a radial pressure on the comet throwing its tail away from sun</p> <p>(d) The tail of the comet always exists in the same orientation</p>
4	<p>A 'black hole' is a body in space which doesn't allow any radiation to come out. This property is due to its: [Prelims 2000]</p> <p>(a) very small size</p> <p>(b) very large size</p> <p>(c) very high density</p> <p>(d) very low size</p>
5	<p>Assertion (A): Artificial Satellites are always launched from the earth in the eastward direction. [2002]</p> <p>Reason (R): The earth rotates from west to east and so the satellite retains the escape velocity.</p> <p>(a) Both A and R are true and R is the correct explanation of A</p> <p>(b) Both A and R are true but R is not a correct explanation of A</p> <p>(c) A is true but R is false</p> <p>(d) A is false but R is true</p>
6	<p>Consider the following statements: [Prelims 2005]</p> <ol style="list-style-type: none"> <li>1. A Geostationary satellite is at an approximate height of 10000 km</li> <li>2. FM transmission of music is of very good quality because the atmospheric or manmade noises can do little harm.             <ol style="list-style-type: none"> <li>a. 1 only</li> <li>b. 2 only</li> <li>c. Both 1 and 2</li> <li>d. Neither 1 nor 2</li> </ol> </li> </ol>
7	<p>Consider the following statements in respect of a jet engine and a rocket: [Prelims 2008]</p> <ol style="list-style-type: none"> <li>1. A jet engine uses the surrounding air for its oxygen supply and so is unsuitable for motion in space</li> <li>2. A rocket carries its own supply of oxygen in the gas form, and fuel</li> </ol> <p>Which of the statements given above is/are correct?</p> <ol style="list-style-type: none"> <li>A. 1 only</li> <li>B. 2 only</li> </ol>

	<p>C. Both 1 and 2 D. Neither 1 nor 2</p>
8	<p>Satellites used for telecommunication relay are kept in a geostationary orbit. A satellite is said to be in such an orbit when: [Prelims 2011]</p> <ol style="list-style-type: none"> <li>1. The orbit is geosynchronous.</li> <li>2. The orbit is circular</li> <li>3. The orbit lies above the earth's equator</li> <li>4. The orbit is an altitude of 22,236 km</li> </ol> <p>Choose the correct answer using the code given below:</p> <ol style="list-style-type: none"> <li>a. 1, 2 and 3 only</li> <li>b. 1,3 and 4 only</li> <li>c. 2 and 4 only</li> <li>d. 1,2,3 and 4</li> </ol>
9	<p>Cape Canaveral, the site from which space shuttles are launched is located on the coast of: [Prelims 2011]</p> <ol style="list-style-type: none"> <li>1. Florida</li> <li>2. Virginia</li> <li>3. North Carolina</li> <li>4. South Carolina</li> </ol>
10	<p>An artificial satellite orbiting around the earth does not fall down. This is so because the attraction of earth: [Prelims 2011]</p> <ol style="list-style-type: none"> <li>a. Doesn't exist at such distance</li> <li>b. Is neutralized by the attraction of the moon</li> <li>c. Provides the necessary speed for its steady motion</li> <li>d. Provides the necessary acceleration for its motion</li> </ol>
12	<p>In which of the following activities are Indian Remote Sensing (IRS) satellite used? [Prelims 2015]</p>

1. Assessment of crop productivity
2. Locating groundwater resources
3. Mineral Exploration
4. Telecommunication
5. Traffic studies

Select the correct answer using the code given below:

- a. 1, 2 and 3 only
- b. 4 and 5 only
- c. 1 and 2 only
- d. 1,2, 3, 4 and 5

13

**Consider the following statements: [2016]**

The Mangalyaan launched by ISRO

1. Is also called the Mars Orbiter Mission
2. Made India the second country to have a spacecraft orbit the Mars after the USA
3. Made India the only country to be successful in making its spacecraft orbit the Mars in its very first attempt

Which of the statements given above is/are correct?

- a) 1 only
- b) 2 and 3 only
- c) 1 and 3 only
- d) 1,2 and 3 only

14

The terms 'Event Horizon', 'Singularity', 'String Theory' and Standard Model are sometimes seen in the news in the context of [Prelims 2017]

- (a) Observation and Understanding of the Universe
- (b) Study of the Solar and Lunar Eclipse
- (c) Placing Satellite in the orbit of the earth
- (d) Origin and Evolution of Living Organisms on Earth

15

With reference to India's satellite launch vehicles, consider the following statements: (Pre 2018)

- PSLVs launch the satellites useful for Earth resources monitoring whereas GSLVs are designed mainly to launch communication satellites.
- Satellites launched by PSLV appear to remain permanently fixed in the same position in the sky, as viewed from a particular location on Earth.
- GSLV Mk III is a four-staged launch I vehicle with the first and third stages using solid rocket motors; and the second and fourth stages using liquid rocket engines.

Which of the statements given above is/are correct?

- A. 1 only
- B. 2 and 3
- C. 1 and 2
- D. 3 only

16 In which of the following areas can GPS technology be used? (Pre 2018)

- Mobile phone operations
- Banking operations
- Controlling the power grids

Select the correct answer using the code given below:

- a. 1 only
- b. 2 and 3 only
- c. 1 and 3 only
- d. 1, 2 and 3

17 With reference to the Indian Regional Navigation Satellite System (IRNSS), consider the following statements: (PRE 2018)

- IRNSS has three satellites in geostationary and four satellites in geosynchronous orbits.
- IRNSS covers entire India and about 5500 sq. km beyond its borders.
- India will have its own satellite navigation system with full global coverage by the middle of 2020.

Which of the statements given above is/are correct?

- a. 1 only
- b. 1 and 2 only
- c. 2 and 3 only
- d. None

18 For the measurement/estimation of which of the following are satellite images/remote sensing data used?

- Chlorophyll content in the vegetation of a specific location
- Greenhouse gas emissions from rice paddies of a specific location
- Land Surface temperature of a specific location

Select the correct answer using the codes given below:

- (a) 1 only

	(b) 2 and 3 only (c) 3 only (d) 1, 2 and 3
19	Which one of the following countries has its own Satellite Navigation System? [Prelims 2023] (a) Australia (b) Canada (c) Australia (d) Japan