



CURRENT AFFAIRS PROGRAM

PRE-CUM-MAINS 2024

JULY 2023 - BOOKLET-2

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1. GENERAL STUDIES – PAPER-2

1) POLITY: UNIFORM CIVIL CODE (UCC)

- **Why in news?**
 - The 22nd Law Commission of India on Wednesday sought fresh suggestions from various stakeholders, including public and religious organizations, on the Uniform Civil Code (June 2023)
- **Example Questions**
 1. Discuss the possible factors that inhibit India from enacting for its citizens a uniform civil code as provided for in the Directive Principles of state policy. [12.5 marks, 200 words] [CSM 2015]
 2. What is meant by a Uniform Civil Code (UCC). What are the key arguments put forth by its proponents and opponents? Examine the challenges associated with implementing a UCC in a diverse and multicultural country like India [15 marks, 250 words]
 3. 'Legislature should first consider guaranteeing equality 'within communities' between men and women, rather than 'equality between communities'. Discuss in light of the debate around Uniform Civil Code. [15 marks, 250 words]
- **Introduction**
 - Uniform Civil Code means **same law for every citizen of the country** in civil matters such as marriage & divorce, succession & inheritance; Minority & Guardianship; and adoption & maintenance.
 - » It doesn't only mean same law (or equality before law) between different communities, but also within the communities (i.e., between men, women, transgenders etc.)
 - **Article 44**, of the Constitution of India declares that the state shall endeavor to secure the citizens a Uniform Civil Code.
 - » Further **Article 37** of the constitution states that "the principles laid down under DPSP are fundamental in the governance of the country and it shall be the duty of the state to apply these principles in making laws".
 - At the time of independence, **UCC was only accommodated as a DPSP** due to communal disharmony and resistance to remove personal laws against the backdrop of partition.
 - » There was a need to placate every community by providing that their way living was not endangered in India.
- **Need of Uniform Civil Code**
 - **National Integration:** Different civil laws for different religious group, "communalize" the society. It is an affront to the nation's unity.
 - **Absence of UCC can be seen as Violation of Fundamental Right to Equality**
 - Different civil laws complicate the legal system and leads to more delays.

- UCC will provide an **opportunity to reform personal laws** which are currently discriminatory because of patriarchal influence (Polygamy, Property Rights, Maintenance Rights etc.)
- **Supreme Court has supported introduction of UCC in a number of rulings:**
 - **Shah Bano Case, 1985:** The SC upheld the right of a Muslim woman to seek alimony. The court had said that "A common civil code will help the cause of the national integration by removing disparate loyalties to law which have conflicting ideologies".
 - The judgment set off a political battle as well as a controversy about the extent to which courts can interfere in Muslim personal law and the decision was undone by Parliament.
 - In **Sarla Mudgal vs Union of India (1995)**, the SC prohibited conversion to Islam to benefit from the laws that allow polygamy and added that the need for polygamy can hardly be doubted.
- **Why has India not been able to implement UCC yet?**
 - **Lack of understanding of UCC among people:**
 - » Perception of UCC being an encroachment on religious freedom. It is seen as a threat to minority culture and way of life.
 - » For e.g., the All-India Muslim Personal Law Board (AIMPLB) has been consistently opposing a UCC because it fears that such a code will undermine Muslim identity.
 - **Diversity of personal practices in India**
 - » For e.g.
 - In South India, marriage among cousins is acceptable among Hindu community, whereas it would be considered a big taboo in northern India.
 - Some tribes follow the custom of asking the husband to move over to the wife's place after marriage and the wife has the right to drive the man out any time during their married cohabitation if she decides to do so in consultation with the community.
 - In some Indian communities, property is inherited by daughters, not by sons. Among the Khasis in Meghalaya, a woman is treated as the head of the family, and she plays the role for all legal purposes.
 - Among the Kinnaurs of Himachal Pradesh, the custom is for a woman to take up to five husbands.
 - » A prominent Constitutional expert - Upendra Baxi asks, "Do we know enough about the personal law of various tribal communities from which the UCC may choose?"
 - **Contradictory Provisions of the Constitution (UCC vs other provisions of the Constitution)**
 - » The sixth schedule of the Constitution was added for the administration of tribal areas in Assam, Meghalaya, Tripura and Mizoram and confers powers on district councils and Regional Councils in those states to make laws with respect to inheritance, marriage, divorce and social customs.
 - » **Special Provisions** (Article 371A for Nagaland, 371F for Sikkim, and 371G for Mizoram) provide special provisions protecting the religious or social practices and customary laws.

- Various laws allow for diversity in Civil Code:
 - » For e.g., PESA Act, 1996; the Chota Nagpur Tenancy Act, 1908; and the Santhal Parganas Tenancy Act, 1876, recognize various customary practices among tribals. This is also protected under 5th schedule of the Constitution.
- Politicization of the issue -> The issue is now perceived as a Hindu-Muslim issue.
- Some criticisms of UCC
 - 'United' Nation does not mean uniformity.
 - » A 'united' nation need not necessarily have 'uniformity', it is making diversity reconcile with certain universal and indisputable arguments on human rights.
 - » The diversity both religious and regional, should not be subsumed under the louder voice of the majority.
 - Secularism cannot contradict the plurality prevalent in the country. Secularism has meaning only if it assures the expression of any form of difference.
 - Society is not ready.
 - » Implementation of UCC in the absence of proper awareness about its need in the society can be counterproductive and result into political and social tensions.
 - » 21st Law Commission of India had suggested changes in personal laws of all the religions to reduce discrimination against females, disabled or transgenders. It had said that "**UCC is neither necessary nor desirable at this stage**".
- Way forward
 - Don't politicize the issue (no chest thumping).
 - Educate people about significance of UCC and remove misconceptions and apprehensions from among them.
 - For now, in the absence of any consensus on UCC, the best way forward, as suggested by 21st Law Commission of India in 2018, will be to preserve the diversity of personal laws but at the same time ensure that personal laws don't contradict the fundamental rights guaranteed under the Indian Constitution.
 - For this there is a need of the "codification of all personal laws" so that the prejudices and stereotypes in every one of them would come to light and would be tested on the anvils of Fundamental Rights guaranteed by the Constitution.
- Conclusion:
 - Uniform Civil Code in India is a complex and nuanced issue, and opinions of the matter vary widely across different sections of society. The decision to implement a UCC ultimately lies with the Indian government and will require careful consideration of the diverse perspectives and interests involved.

2) SOCIAL JUSTICE: ELDERLIES

- Example Questions:

- i. "Proof of a truly developed country lies in the way it not only nurtures its young but also cares for its elders, equally". In this light discuss the key initiatives in India for the welfare of Elderlies. Do you think these initiatives have been effective. Give reasons. [10 marks, 150 words]
- ii. "Phenomena of population aging is becoming a major concern for policy makers all over the world". Discuss. [150 words, 10 marks]
- iii. Discuss the key challenges faced by elderly population in India. What steps should be taken to truly make the decade 2020-30 as the Decade of Healthy Ageing. [200 words, 12.5 marks]
- iv. Examine the main provisions of the National Policy for Older People (NPOP) and throw light on the status of its implementation. [10 marks, 150 words]
- v. Critically analyze the provisions of "The Maintenance and Welfare of Parents and Senior Citizens (Amendment) Bill, 2019" [10 marks, 150 words]

- **Quotes**

- » "*By despising all that has preceded us, we teach others to despise ourselves.*" - William Hazlitt
- » "*To care for those who once cared for us is one of the highest honors.*" - Tia Walker

- **Introduction**

- » **Ageing is a natural process**, which brings a lot of challenges for elderly people, which are mostly engineered by the changes that occur in their body, mind and pattern of living.
- » The phenomena of population aging are becoming a major concern for policy makers all over the world, both for developed and developing countries. India too is not immune to this demographic change. The changing demographic profile has thrown many new challenges in the social, economic and political domains.

» **Elderly Population in India**

- According to the Report of the Technical Group on Population Projections for India and States 2011-2036, there are nearly 138 million [10.1%] elderly population in India in 2021 (67 million males and 71 million females) and this is further expected to increase by around 56 million [to 13.1%] elderly persons in 2031.
- States with higher Human development performance has higher percentage of elderly population - E.g., **Kerala** (16.5%), **Tamil Nadu** (13.6%) etc. and states with poor human development have very low elderly population (e.g., **Bihar** (7.7%), **Uttar Pradesh** (8.1%) etc.

- **Key Problems faced by Elderlies in India**

1. **Lack of Financial Security**

- Elderlies are in urgent need of care, as nearly 90% of them have/had been associated with the unorganized sector and thus, are not included in any sustainable social security scheme.
- Both center and states have pension schemes for the elders, but these provide very low amounts - sometimes as low as Rs 350 to Rs 400 a month in some states.
- Even these pension initiatives are not universal.

2. Poor Health Services -> Limited access; low expense on old age health; lack of geriatrics care facilities; poor health insurance cover; missing emergency response infrastructure.

- As the growth rate of elderly population increase, we will have to enhance the range of quality, affordable, and accessible health care services to the elderly.

3. Poor institutional support and Infrastructure

- Very few governments run elderly homes and elderly recreational homes exist.
- There are very few public ramps and elderly friendly infrastructure available for less mobile elderlies.

4. Psychological Problems: Isolation/Loneliness due to increased nuclear families and migration.

- Care-management of elderlies who are living alone also becomes difficult.
- Mental Health and Depression is becoming more prevalent. A recent study by Abdul Latif Jameel Poverty Action Lab (J-PAL) and the Government of TN shows that among elderlies around 30-50% have symptoms of being depressed. In most cases the depression remains undiagnosed and untreated.

5. Poor Legal Aid

- Though a number of legal provisions exists for the protection of elderlies, these provisions are hardly implemented as elderlies find it difficult to access legal aid in case of violation of their rights.

6. Elderlies are generally among the worst affected during any kind of disaster.

7. Other Recent Emerging Problems

A. **Digital Illiteracy:** Makes it difficult to access government benefits.

B. **Feminization of Aging**

- Sex ratio among elderlies - 1033 women for every 1000 men - According to 2011 census.
 - Women represent an even greater majority of the 'Oldest Old' population of 80 years and above.
- Discrimination and neglect faced by women exacerbate as they age.

C. **Ruralization of elderlies**

- In case of India, 71% of elderlies live in villages where income insecurity, access to healthcare and isolation are more acute.

D. **Climate Change** has impacted elderlies more:

- Conditions like heatwaves, floods, cyclones, air pollution etc. are exacerbated by climate change. They tend to impact elderlies more than the rest of the population.

- **Constitutional Protection to Elderlies**

- **Article 41:** The state shall, within the limits of economic capacity and development, make effective provisions for securing the right to work, to education and to public assistance in cases of unemployment, old age, sickness and disablement.

- **Legal Provisions**
 - A. **Under Personal Laws**
 - **Section 20 of the Hindu Adoption and Maintenance Act** imposes obligation on children to maintain their parents. (Note: the obligation is not confined to sons only and daughters also have an equal duty)
 - **Similarly, Muslim Personal law** also provides for maintenance by Children
 - **Though under Christians and Parsi** personal laws, there are no provisions for maintenance of elderlies, they can also be directed to take care of elderlies as per the **provisions of CrPC**.
 - B. **Section 125 of Code of Criminal Procedures (CrPC)**
 - Introduced in 1973
 - Provision for maintenance of elderlies if children (i.e. even daughters are responsible) have sufficient means.
 - C. **Maintenance and Welfare of Parents and Senior Citizens Act, 2007**
- **Policies/Schemes / Other Steps taken.**
 - i. **National Policy for Older Person (NPOP), 1999**
 - It was formulated by MoSJ&E with the goal of ensuring well-being of older persons.
 - It focuses upon providing financial security, health care, Shelter, re-employment opportunities, concessional rail/air fares etc.
 - ii. **Atal Vayo Abhyuday Yojana (AVYAY): Empowering the Elderly for a Dignified Life**
 - iii. **Indira Gandhi National Old Age Pension Scheme**
 - iv. **Rashtriya Vayoshri Yojna (2017)** -> for providing assisted living devices for BPL senior citizens
 - v. **Pradhan Mantri Kisan Man Dhan Yojna:** Launched in 2019; a voluntary, contribution based scheme which ensures a minimum pension of Rs 3,000 per month for small and marginal farmers who turn 60 years of age.
 - vi. **Annapurna Scheme (MoRD)** - Senior citizens above the age of 65 years and who are not getting pension under NOAPS are provided 10 kgs of food grain per person per month free of cost under the scheme.
 - vii. **Financial Concessions/Benefits**
 - a. **Special FD rates for senior citizens in banks.**
 - b. **Discount in income tax** (Income Tax Act)
- **Other Recent Initiatives:**
 - » **SAGE Project (Sep 2021)** -> It is aimed at promoting private enterprise to bring innovation in products to benefit elderlies.
 - » **SACRED PORTAL** (Senior Able Citizens for Re-Employment in Dignity (SACRED) Portal)
 - The focus of this portal is to provide opportunities for employment for older persons by involving society at large specially by involving private firms, educational institutes, government sector, local bodies, NGOs, media and public at large.
- **International Initiatives for Elderlies**
 - » **International Day of Older Persons:**

- **1st October** is celebrated as the **International Day of Older Persons**, as declared by United Nations, to recognize, enable and expand the contributions of older people in their families, communities and societies at large and to raise awareness towards the issues of ageing.
- » **UN Decade of Health Ageing:**
 - The UN Decade of Healthy Ageing (2021-2030) is a global collaboration, aligned with the last ten years of the Sustainable Development Goals, that brings together governments, civil society, international agencies, professionals, academia, the media, and the private sector to improve the lives of older people.
 - **Ministry of Health and Family Welfare** launched Decade of Healthy Ageing (2020-2030) on International Day for Older Persons (Oct 2020)
- **Way Forward**
 - **Standing committee on Social Justice and empowerment** had suggested following **measures** which have still not been implemented:
 - a. A scheme for awareness generation of Maintenance act, 2007.
 - b. Establish a National Commission for senior citizens.
 - c. Establishing a National Trust for aged.
 - d. Strengthening of MoSJ&E for proper implementation of various old age schemes.
 - e. Expansion in old age homes and geriatrics care.
 - Specialized guidelines for old age homes, especially related to design of buildings and expertise required to manage these homes.
 - f. Tax exemption to elderlyies should be raised periodically.
 - **Universal Pension Scheme:** A universal pension scheme for all elderlyies (currently it is only for BPL).
 - » Link it with Adhaar so that elderly will be able to receive pension wherever she is living.
 - » It will ensure there is no exclusion error.
 - **Focus on healthy ageing.**
 - » India should reimagine its healthcare policy for the next few decades, with an elderly prioritized approach.
 - Legislate pro-elderly healthcare and insurance policies
 - Increase public healthcare spending, and invest heavily in the creation of well-equipped and staffed medical care facilities and home-healthcare and rehabilitation services.
 - Emphasis on requirements of people with chronic conditions like dementia.
 - » More awareness about the issues of elderlyies among citizens need to be spread.
 - » Create human resource -> The ASHA program can be a template.
 - » Promoting awareness about the concept of healthy ageing and the health problems and to involve the community in the process of mitigation.
 - **Dealing with urban isolation**
 - » Communities and NGOs can play an important role.
 - » More elderly recreation centres needs to be created

- **Use of technology**
 - » Use social media platform and technology to help
 - » To advertise community-based initiatives and bring elderlyies together
- **Database of vulnerable elderlyies**
 - » Local government should keep a database of elderlyies living alone so that they can be helped in disaster/emergency situation.
- **Increasing Socio-economic participation of elderlyies**
 - » Elderlies are a massive resource of experienced, knowledgeable people.
 - » Certain strategies and approaches at different levels of policy making, planning and programming etc. will have to be adopted in order to harness this vast human resource for promoting the involvement and participation of senior citizens in socio-economic development process on a much larger scale
 - » This will reduce their social isolation and increase their general satisfaction in life.
- **Discussion over making old age care a fundamental right**
 - » At least the discussion should start. Elderlies are perhaps the most vulnerable groups in our society and it is important that they get the highest priority in every government policy.
- **Conclusion**
 - » This is the decade of Healthy Ageing as well as the Decade of Action to achieve the SDGs. As Asia-Pacific, with the rest of the world, seeks to 'build back better' from the devastating effects of the COVID-19 pandemic, let us seize this moment to transform the challenge of population ageing into an opportunity. We must collectively prioritize greater action, funding, and implementation.

A) PRELIMS FACTS: ATAL VAYO ABHYUDAYA YOJANA

- By MoSJ&E
- Central Sector Scheme Yojana
- The National Action Plan for Senior Citizens (NAPSrc) has been revamped, renamed as Atal Vayo Abhyudaya Yojana. It is a comprehensive initiative aimed at empowering and uplifting senior citizens in India. It also aims to ensure their active participation and inclusion in all aspects of life. It recognizes the invaluable contribution made by elderly to society seeks to ensure their well-being and social inclusion.
- It has a component called **Integrated Program for Senior Citizens (IPSRc)**: It provides financial assistance to eligible organizations for running and maintenance of senior citizen homes/ continuous care homes to improve the quality of life for senior citizens, especially indigent senior citizens by providing basic amenities, entertainment opportunities and by encouraging productive and active aging.
 - **Achievements:**

- Presently a total of 552 Senior citizen homes, 14 continuous care homes, 19 mobile Medicare units and 5 physiotherapy clinics are being assisted and maintained by different NGOs across the country.
- Another component under the scheme is **Rashtriya Vayoshri Yojana** (RVY). It provides eligible senior citizens suffering from any of the age-related disability/ infirmity, with assisted living devices which can restore nearly normalcy in their bodily functions, overcoming the disability/infirmity manifested such as low vision, hearing impairment, loss of teeth and loco-motor disabilities.
 - **Financial criteria** - BPL elderly or he/she has income upto Rs 15,000 per month.
 - **Achievements:** A total of 269 camps have been held till date and the number of beneficiaries of these camps is over 4 lakh.
- The scheme thus stands as a testament to the government's commitment to the well-being and empowerment of senior citizens in India

2. GENERAL STUDIES – PAPER-3

1) INDUSTRY/ENVIRONMENT: ELECTRIC VEHICLES

- **Example Questions**
 - » Discuss the key factors hindering the growth of Electric Vehicle sector in India. Enumerate some of the recent initiatives by government to promote this sector. [15 marks, 250 words]
 - » Evaluate the government policies and incentives aimed at promoting the adoption of e-vehicles in India. What can be done to accelerate their adoption. [15 marks, 250 words]
 - » Discuss the role of research and development in advancing electric vehicle technology. What are the key areas of future innovation in this field [10 marks, 250 words]
- **Introduction**
 - » According to ESI 2021-22, the automotive industry is expected to play a critical role in the transition towards green energy.
 - The domestic electric vehicle (EV) market is expected to grow at a compound annual growth rate (CAGR) of 49% between 2022 and 2030 and is expected to hit 1 crore unit sale by 2030. Further, it will create 5 crore direct and indirect jobs by 2030.
 - **Note:** As per the Federation of Automobile Dealers Association (FADA), 4.29 lakh electric vehicles were sold in 2021-22 in India. 2.31 lakh of these were electric two wheelers.
 - » **Factors:** Government initiatives; expansion in charging infrastructure; increased prices of diesel and petrol.
- **Why we need to promote electric vehicles in India?**
 - i. **Energy Security** (India imports around 80% of its crude oil requirements), reducing import dependency; reducing CAD; saving forex etc.
 - ii. **Transition to renewable** is simplified if vehicles run on electricity instead of fossil fuels.
 - iii. Dealing with **air pollution and Noise Pollution** in big cities
 - iv. **Reducing Greenhouse gas emission -> Achieve Paris Targets on Climate Change**
 - v. **Competitive Domestic Manufacturing Ecosystem: Technology Development and Make in India**

- In automobile sector, India couldn't be a pioneer and had to depend on other countries to bring in the technology in the country and initiate the development of the sector.
- It's important that in electric vehicle sector, India develops its own indigenous industry which not only serves our domestic needs but is also able to earn us export revenues in future.
- The development of electric vehicle sector will provide employment opportunities through 'Make in India' across a range of skillsets and would also grow export opportunities.

vi. **Making Transportation less expensive:**

- E.g., travelling a distance of 100 km in a conventional vehicle costs about INR 435, whereas in an EV, INR 97.

vii. **Power sector growth**

viii. **EVs can act as storage for Solar Energy**

- Thus, the development of electric vehicle sector will benefit all citizens, will promote 'Ease of Living' and enhance the quality of life.

- **Schemes / Programs / Policies / Other steps to promote EV in India**

1. Subsidy, Tax Incentives and PLI

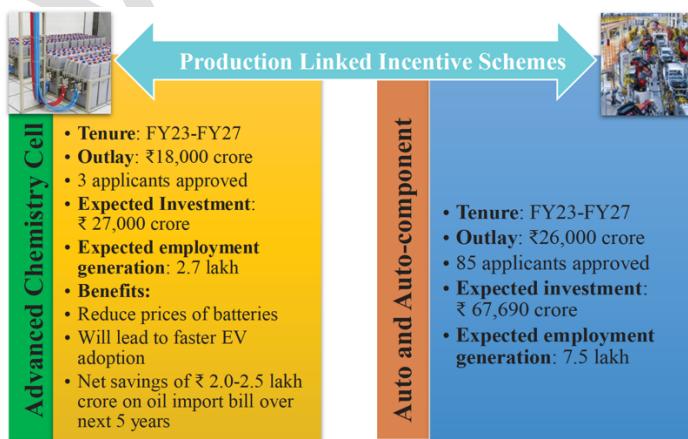
a. FAME (Faster Adoption and Manufacturing of Electric (& Hybrid) Vehicles):

- It is the key subsidy scheme for electric vehicles through which government incentivizes buyers to purchase e-vehicles.
- Phase-1 had started in 2015 and Phase-2 has been running since 2019.
- Under phase-2 companies may offer a discount of upto 40% on the cost of locally manufactured vehicles and claim it as a subsidy from government.

a. Tax Incentives:

- GST on Electric Vehicles is on the lower bracket of 5% as against 28% for conventional vehicles.
- Budget 2019-20: Tax Subsidies for EVs: Additional income tax deduction of Rs 1.5 Lakh on the interest paid on the loans taken to purchase electric vehicles before 31st March 2023.

c. PLI Schemes:



Source: Ministry of Heavy Industries

- In April 2023, government released SOP for the PLI scheme for the automobile and auto component industry.

2. EV Policies of Select States and Uts:

- A number of state/UT governments have formulated policies for the successful implementation of the national EV mission and FAME scheme.
 - For e.g., Delhi targets that 25% of all new vehicles registration should be EVs by 2024.

3. National E-Mobility Program of Ministry of Power (Launched in March 2018)

- Aggregate demand by procuring electric vehicles in Bulk to get economies of scale

4. National Mission on Transformative Mobility and Battery Storage (approved by cabinet in March 2019)

- The mission recommends and drive the strategies for transformative mobility and PMPs for EVs, EV components, and Batteries.
 - The mission will ensure holistic and comprehensive growth of the battery manufacturing industry in India.

5. E-Amrit Portal: It is a web portal on electric vehicles and provide one stop solution for all information related to EVs - bursting myths around the adoption, details about policies/ subsidies etc.

- Achievements of the above initiatives

- More than 200+ EV car models have been registered by the original equipment manufacturers (OEMs) availing benefits.
- More than 6 lakh vehicles have been sold-supported under FAME.

- Key challenges of India's EV Sector:

1. Battery Cost

- Commercial EVs run on lithium-based batteries and India imports most of Lithium and Lithium-ion batteries making it very expensive.
- Therefore, India needs to invest in research for battery technology and material sciences.

2. Low Lithium Reserves in India: -> Chinese firms are already occupying stakes in countries such as Chile, Bolivia, and Australia which have substantive reserves, thus creating a kind of monopoly situation.

- Lithium reserves in India (Mandya Karnataka) will not be enough to keep up with the future demand.
- Further, exploration of lithium reserves would be expensive, and hazardous to humans as lithium is a rare earth metal found with other radioactive elements like beryllium, niobium, tantalum etc.
- Therefore, we need to step up battery recycling capacity in India. Battery Waste Management rules, 2022 has to be effectively implemented.
- Further, India needs to invest in research into alternative battery technologies using different metals.
 - Aluminium, sodium, and zinc based batteries have emerged as viable alternatives to lithium ones.

- Aluminium based batteries could be beneficial for India as India is the fourth largest producer of aluminium and production has been consistently increasing. It is also cheaper than lithium, thus reducing the cost of EV batteries. Further, since Aluminium has higher valency (+3) than Lithium (+1), the aluminium batteries can have higher energy density.
- **Sodium ion battery technology** is another option which could reduce India's Lithium reserves.

3. Limited availability of Charging Infrastructure and long time for EV Charging

- Currently, India has about 2,000 charging stations operational and the number of EVs crossed 1 million in mid-2022.
- City planners, Municipal bodies, local administrative bodies, electricity companies, government etc. need to build a comprehensive policy document to meet future charging demands of EV.
- Further, the option of **battery swapping stations** also need to be explored.
 - There are some practical challenges associated with this as the batteries need to be standardized and made interoperable with all EVs for easy removal and reattachment of battery back.
 - With improved batter swapping services and battery-as-a-service (BaaS) setting in, sales in the segment could see further growth.
- **Provide information on public chargers to the users of EVs** through online maps and other means such as physical signage.
 - This will encourage increased use of adoption of EVs.

4. **Policy Conundrums:** Provisions of Electricity Act, 2003 is restrictive in nature and hinder setting up of charging stations - it is important to bring reforms here to promote ease of doing business.

5. **Safety Issues:** The occurrence of some incidents involving EVs catching fire has raised doubts about its safety.

- In response to this, MoRT&H have developed a new set of safety standards for EV batteries.

6. **Other Infrastructure concerns:**

- Poor electricity distribution network; Surge in demand of electricity etc.

7. **Human Resource**

- The Indian auto industry is also facing a talent crunch as there aren't enough engineers with expertise in the field.

8. **Subsidizing e-vehicles** is being criticized as some activists feel that it is subsidizing a small affluent section of the car-owning population, when there is better alternative to fossil fuels available.

9. **E-vehicle alone will not decarbonize transport** -> we will have to decarbonize the electricity sector.

10. **Public Awareness:** There is still very less understanding of EVs among the public, in terms of its benefits, risks, subsidies available, charging methods and tariffs, battery life, maintenance costs, and resale value.

- A significant step to get rid of this problem is the - e-Amrit Portal.

- **Conclusion**
 - » Electric vehicles have the potential to positively impact India's environment, climate target, economy and job market. We need to prepare ourselves by installing charging infrastructure, battery making factories and smart incentives for car companies and consumers to go electric.

2) S&T: SODIUM ION BATTERIES

- **Practice Question:**
 - Discuss the key advantages of Sodium ion battery technology for India [10 marks, 150 words]
 - "Recent developments in developing sodium-ion battery technology might provide a solution to the materials crisis in the electric mobility transition" Discuss [15 marks, 250 words]
- **Introduction:**
 - Though, lithium-ion batteries are the most common type of batteries used in electric vehicles sector in India today, it has created a number of limitations for us.
- **Key Problems associated with Lithium-Ion Batteries:**
 - **Resource Scarcity:**
 - » The most popular battery chemistry used by the global automotive industry currently is Lithium-Nickel, Manganese, and Cobalt (Li-NMC).
 - With increased demand for electric vehicles, Lithium has faced shortage and the prices per ton had touched US\$60,000 and above.
 - **Cobalt** mining (primarily from DRC) have led to persistent concerns regarding ethical mining.
 - **Nickel** prices have shot up in recent times due to Russia-Ukraine war.
 - » Due to these factors it is believed that there will be a shortage of batteries in 2024-25, followed by a lack of raw materials by 2027-28.
 - **Expensive:** Scarcity have led to these metals becoming expensive.
 - **Thermal Stability:** Lithium batteries have raised issues related to thermal stability and fire accidents.
 - **Chinese Domination and India's tense relation with China:**
 - » China has amongst the world's largest proven reserve of Lithium, Chinese companies control mines in Australia and increasing in South America as well.
 - » It also controls much of the Cobalt today in DRC.
 - » Therefore, China also dominates the Lithium Cell Manufacturing with companies like CATL, BYD, and Gengfeng Lithium accounting for over three-quarters of global cell production. It also dominates the manufacturing of Charing system.
- Therefore, there is a gradual shift to Lithium Ferro Phosphate (LFP). This is because iron and phosphate are significantly cheaper and more environment friendly to extract and refine than the metals in L-NMC. However, it suffers from heavier weight and battery memory.
- **Sodium Ion Batteries and how it mitigates the above challenges for India:**
 - **Easy Availability:** Na can be easily extracted from readily available salt and washing soda.

- **Less Corrosive:** Sodium is much less corrosive when compared to current version of Lithium being used. This will allow usage of cheaper materials like aluminium instead of copper both in the electrolyte as well as the battery frame.
 - » The usage of these cheaper and lighter material will offset some of the weight disadvantages of Sodium over Lithium.
- **Doesn't use Cobalt:** Thus, the dependency on unethical mining concerns in Democratic Republic of Congo reduces.
- **Nickel** whose prices have skyrocketed is also used in much lesser quantity in Na-ion batteries.
- **Thermal stability** of Na-ion batteries is much higher than the Li-ion batteries reducing the chances of fire accidents which have occurred on many occasions in India.
- **Lower Cost** of lithium-ion batteries may also lead to reduction in the cost of electric vehicles.

- **Limitations of Sodium-ion technology:**

- Sodium is heavier -> Na-ion cell will be heavier.
- They are also less energy dense than li-ion cells. (For e.g., the latest generation of Li-NMC cells can store 250Wh/Kg as well as run at higher voltages which allows faster charging. Whereas the first-generation Na-ion cells is at just 160 Wh/kg currently and run at lower voltages.
- Further, we are in the early stage of development of Li-ion batteries and many issues may come as more development happens. These may include number of cycles they can be charged before getting degraded; do they have the ability to be fast charged.

- **Way Forward:**

- More R&D to mitigate limitations of Sodium batteries.
- Incentivize investments in Na-ion technology by private entities with subsidies and PLI schemes.
- Increased international collaboration on Lithium: India-Australia can work together to mine Lithium deposits from western Australia.

- **Conclusion:**

- Both automotive and cell manufacturing industry are still learning, but it is imperative to not put all the eggs in the lithium basket specially India has no lithium resource.

3) CHANDRAYAAN 3.0 (LVM3-M4) MISSION

- **Why in news?**

- ISRO launched India's third lunar mission Chandrayaan-3 perched on GSLV Mark-3 heavy lift launch vehicle, named 'Bahubali' rocket, at 2:35 pm on 14th July from Sriharikota (July 2024)

- **Details**

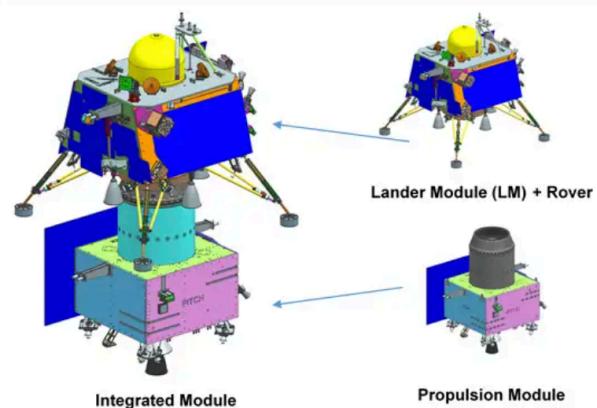
- It is a follow-on mission to Chandrayaan-2 to demonstrate end-to-end capability in safe landing and roving in lunar surface. It is thus ISRO's second attempt at soft landing robotic instruments on the lunar surface after the previous attempt, Chandrayaan-2, failed in 2019.
- So far, only three countries, USA, Russia and China, have successfully soft landed on Moon.
- It has been launched by LVM-3 from SDSC SHAR, Sriharikota. It has placed the integrated module in an elliptical Parking Orbit (EPO) of size ~ 170 x 36500 km.

- 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)

The main function of PM is to carry the LM from launch vehicle injection till final lunar 100 km circular orbit and separate 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 will have the capability to soft land at a specified lunar site and deploy rover.

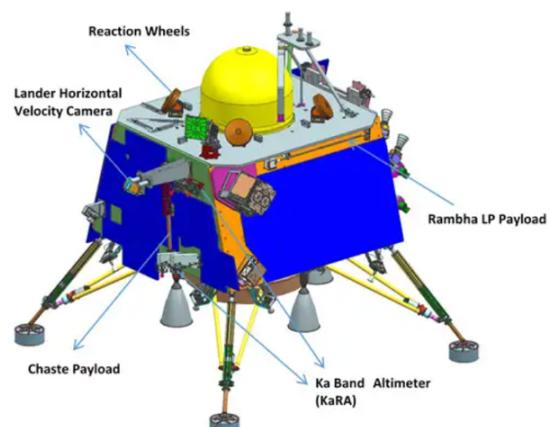
Lander Payloads:

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.

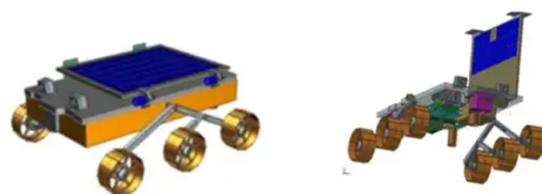
RAMBHA- LP (Radio Anatomy of Moon Bound Hypersensitive ionosphere and atmosphere) - RAMBHA: To measure the near surface plasma (ions and electrons) density and its changes with time.

A passive Laser Retroreflector Array from NASA is accommodated for lunar laser ranging studies.



Rover Payload:

Alpha Particle X-Ray Spectrometer (APXS) and **Laser Induced breakdown Spectrometer (LIBS)** for deriving elemental composition in the vicinity of landing site.

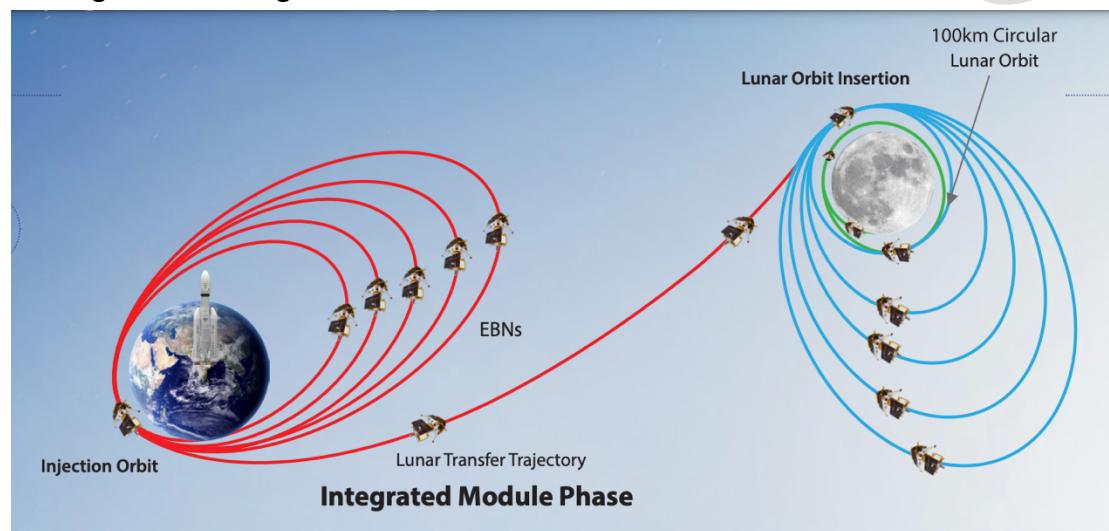


- Mission objectives of Chandrayaan 3.0**

- To demonstrate safe and soft landing on Lunar Surface
- To demonstrate Rover roving on the moon
- To conduct in-situ experiments.
- Where would the lander land?
 - In the highlands near the south pole of the Moon.

A) UNDERSTANDING THE DIFFERENT PHASES

- Chandrayaan was launched on 14th July 2023. The whole process will take 42 days, with the landing slated on Aug 23 at the lunar dawn.



B) LEARNING FROM CHANDRAYAAN-2.0, SOME CHANGES HAVE BEEN DONE

- In case of Chandrayaan 2.0, the lander had failed to reduce its speed to the desirable level in the final seconds of descent.
 - Scientists later detected problems in both software and the hardware – in consequence, the software and hardware in Chandrayaan-3 have been equipped with several additional capabilities.
 - **Landing area** has been expanded. Instead of trying to reach a specific 500mx500m patch for landing as targeted by Chandrayaan-2, the current mission targets to land safely anywhere in a 4kmX2.4km area.
 - **Lander has been provided more fuel** so it can travel longer distance to the landing site or an alternate landing site.
 - **Lander will no longer depend only on the pictures it clicks during the descent** to determine a landing site. High resolution images from Chandrayaan 2 orbiter have been fed into the lander and it will click images just to confirm that it has reached the correct location.

- **Physical structure of the lander** has also been modified – The legs have been made sturdier to ensure it can land even at a higher velocity. More solar panels have been added to the body of the lander.

C) LANDING IS 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 WILL LANDER LAND?

- The landing site, at around 70-degree S near the southern pole of the moon, was selected as there are several craters here that remain permanently in shade and can be the store house of water ice and precious minerals.

E) COMPARING CHANDRAYAAN-1, CHANDRAYAAN-2 AND CHANDRAYAAN-3

	Chandrayaan-1	Chandrayaan-2	Chandrayaan-3
Year	2008	2019	2023
Rocket Used	PSLV	LVM-3	LVM-3
Payloads	Orbiter + Impact Module (for crash landing)	Orbiter (Vikram) + Lander (Pragyan)	Lander + Rover
Successful	Yes	Partially Yes (Lander failed)	Let's hope

F) WHY DO WE WANT TO GO TO MOON?

- The moon is the closest cosmic body to earth, where the space discovery can be attempted and documented.
- Moon is also 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."

4) DISASTER MANAGEMENT: FLOODS – THE MOST RECURRENT DISASTER FOR INDIA

- **Why in news?**
 - » Last week, parts of North India witnessed rains that triggered flash floods and left train of destruction (July 2023)

- Homes were flooded, roads and bridges washed away and communication networks disrupted. At least 50 deaths were reported.
 - » 94% of the districts in Assam were impacted by floods in 2022.
 - » Flash floods in Amarnath killed more than a dozen people in July 2022.
- **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 Plain 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.

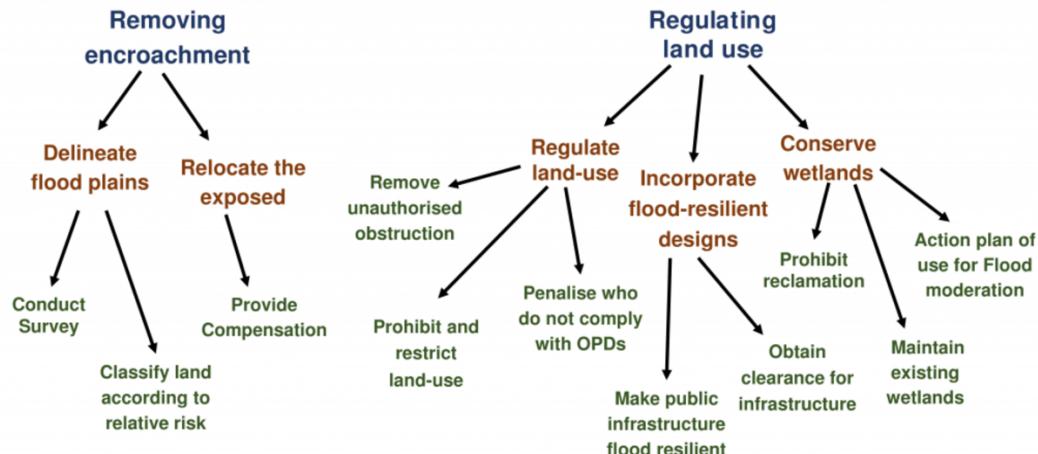


Figure 2: Flow Diagram showing the Operational Attributes of the proposed Floodplain Zoning Policy in India. Source – Modak and Kapuria (2020)

- **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:

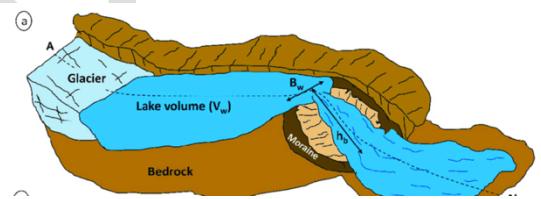
- India being a sub-tropical country with Monsoon kind of climate will remain vulnerable to floods due to heavy rainfall and increased climate variability. An efficient disaster management

mechanism will ensure that these floods remain a natural phenomenon and doesn't become a natural disaster.

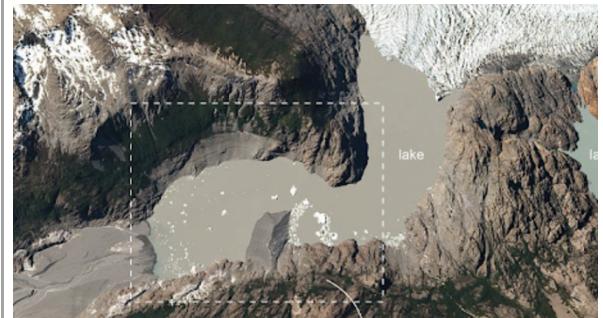
5) DISASTER MANAGEMENT: GLACIAL LAKE OUTBURST FLOOD (GLOF)

- **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)
- **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.
- **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

6) DISASTER MANAGEMENT: CLOUDBURST

- **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.