TARGET PRELIMS 2024
BOOKLET-50; S&T-UPDATES-3

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3. SPACE

1) SPACEPORTS OF INDIA

A) 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 situated along the **east coast of Andhra Pradesh** and is located 80 km off **Chennai**. It currently provides launch infrastructure to **all ISRO missions**. It is equipped with a solid propellant processing setup, static testing, and launch vehicle integration facility, telemetry services, -tracking and command network to oversee the launch – and a mission control centre.

B) KULASEKARAPATTINAM SPACE PORT

In Feb 2024, PM Modi laid down the foundation stone for India's **second spaceport** at **Kulasekharapattinam**, a coastal village in TN's Thoothukudi district on 28th Feb 2024.

Why this location?

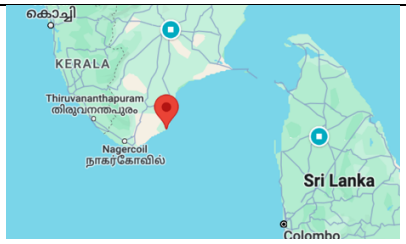
- It offers a strategic advantage, particularly in enhancing payload capability with its direct southward launch trajectory for small launch vehicles.

On the day of laying of foundation stone only, ISRO launched Rohini Sounding Rocket "**RH200"** from the newly established launch complex.

- The RH200 rocket, developed by Vikram Sarabhai Space Center (VSSC), has a long-standing reputation for reliability, with this launch marking its 1928th successful mission.

Launch site is expected to be fully commissioned within 24 months and will **enhance the space activities of NGEs** (Non-Government Entities).

- The new site will focus on launches of smaller payloads.
- The new facility will permit anywhere between 20 to 30 SSLV launches annually.
- **Advantages:**
  - As the **Penetration of private sector increases**, more launchpads (spaceports) will be needed to launch satellites.



Problem with launching small satellites from Sriharikota: **Dogleg Maneuver** takes extra fuel and reduces the payload capacity. Polar satellites launched from Sriharikota spaceport of south India frequently use this maneuver to avoid flying over Sri Lanka. **Rockets make a steep 40-degree arc** in order to bypass the city of Colombo. For larger satellites, fuel required for this maneuver is insignificant compared to the total fuel. However, this is very inefficient for smaller rockets.

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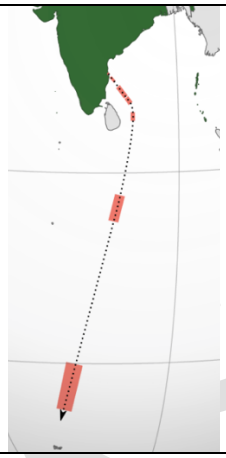
- The Kulasekharapattinam space port will allow a direct southward and smaller trajectory for the light weight SSLVs carrying less fuel. It is because Kulasekharapattinam is located several kms to the west of Colombo. It will enhance the payload capacity.



2) TATA ADVANCED SYSTEM LIMITED (TASL)'S TSAT-1A

- In April 2024, Tata Advanced Systems Limited (TASL) announced the successful deployment in space of its **sub-metre resolution optical satellite**, TSAT-1A.
  - » SpaceX's Falcon 9 rocket launched **TSAT-1A** satellite from the **Kennedy Space Centre**, Florida.

- **About TASL**: It is a wholly owned subsidiary of Tata Sons and is a significant player for aerospace and defence solutions in India.

- **About TSAT-1A:**
  - » It will deliver high resolution optical satellite images with increased collection capacity, dynamic range, and low-latency delivery through its multispectral and hyperspectral capabilities.
  - » It was assembled in TASL's Assembly, Integration and Testing (AIT) plant in its Vemagal facility in Karnataka.

- **Collaboration with Satellogic:** The achievement follows the collaboration agreement signed between **TASL** and **Satellogic** in Nov 2023, leveraging Satellogic's expertise to develop and integrate an advanced EOS in India and TASL's capability to undertake complex system integration.

- **About Satellogic**: It is a company specializing in Earth Observation Satellites. It is headquartered in Montevideo, Uruguay.

3) IN APRIL 2024, ISRO RELEASED SATELLITE DATA ANALYSIS ON EXPANSION OF GLACIAL LAKES IN THE CATCHMENTS OF INDIAN HIMALAYAS RIVER BASINS

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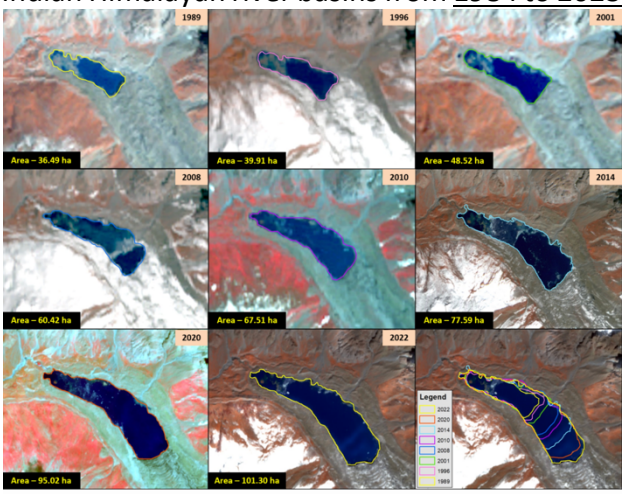
- Satellite remote sensing technology is an excellent tool for inventory monitoring due to its wide coverage and revisit capability.
- Long term satellite imagery covering the catchments of Indian Himalayan river basins from 1984 to 2023 indicates significant changes in glacial lakes.
- **Key Highlights of ISRO's Data**
  - Of the 2,431 lakes larger than 10 hectares identified during 2016-17:
    - » **676 glacial lakes have notably** expanded since 1984. (Specifically, 130 lakes are situated within India).
      - 601 lakes (89%) have expanded more than twice
      - 10 lakes have grown between 1.5 to 2 times
      - 65 lakes at 1.5 times.



The long-term changes in the Ghepang Ghat Glacial Lake area

- **Long term changes in the Ghepang Ghat glacial lake** (Indus River Basin) at an elevation of 4,068 m in Himachal Pradesh, India, show a 178% increase in size from **36.49 hectares** between 1989 and 2022.

4) FIRST INDIAN SPACE TOURIST: GOPI THOTAKURA

» **Blue Origin** was established by Jeff Bezos in 2000.

- **New Shepherd,** is a fully reusable sub-orbital launch vehicle developed specifically for space tourism by **Blue Origin**. It completed first human flight to space on 20th July 2021 with four private citizens on board. The flight went upto a height of **107 kms**.

- **Update: (April 2024)**
  - » Entrepreneur and Pilot **Gopi Thotakura** is set to become the **first Indian to venture into space as tourist** on the NS-25 mission of **Blue Origin** – a company founded by Jeff Bezos, who is also the founder of Amazon.
  - » This **NS-25 mission** will be suborbital mission. The whole crew members will be taken to outer space via New Shepherd.
  - » If the mission is successful, he will become only the **2nd Indian** to go into space (the first one was **Wing Commander Rakesh Sharma**, who flew to the **Salyut 7 space station** on a Soviet Spacecraft in 1984).

4. BIOTECHNOLOGY UPDATES

1) GENE EDITED CROPS

- **Note**: There is a slight difference between GM crops and Gene-Edited Crops:
  - **Gene-Edited crops** are **trans-gene free** and contain no foreign genes. Gene editing tools are used to generate changes to native genetic material to yield beneficial outcomes.

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- **Regulatory framework** for gene editing are nascent and generally less prohibitive relative to GMOs. Legislations regarding gene editing is emerging globally and trending towards allowing gene-edited products to pass from research to production with relative ease, compared to GMOs.
- **Gene Editing Tools** can be used to produce GMOs. In this case, novel configurations of genetic material can be precisely inserted into the genomes of organisms by using gene editing machinery.

- Gene-Modified Crops contains foreign genes. They leverage the genetics of other organisms to improve desired traits. (e.g. BT-Cotton, DMH-11, Golden Rice)

A) GENE EDITED MUSTARD – LESS PUNGENT, MORE USEFUL

- **Why in news?**
  - Indian Scientists have developed first ever low-pungent mustard that is pest and disease resistant (Aug 2023)

- **Understanding the Problem:**
  - Mustard/Rapeseed is one of the most significant oilseed grown in India. But, **mustard seeds** have very high levels of **glucosinolates**, a group of sulphur and nitrogen-containing compounds contributing to the characteristic **pungency** of their oil and meal. This limits the acceptance of mustard oil by many users specially those who are used to less strong odour and flavour. The problem is even more **in case of meal** (the residual cake after extraction of oil from the seeds). Rapeseed meal is **unpalatable to poultry** and **pigs**, while having to be mixed with fodder grass and water for giving to cattle and buffaloes. Moreover, high glucosinolates are also known to cause goitre (swelling of neck) and internal organ abnormalities in livestocks.

- **Efforts to improve the quality of Mustard**:
  - Various institutions including Centre for Genetic Manipulation of Crop Plants (CGMCP) and the Indian Council of Agricultural Research has gone into breeding of rapeseed-mustard lines of so called Canola Quality. Normal Mustard (***Brassica juncea***) contains 120-130 ppm of glucosinolates. Canola has sub-30 ppm levels.
  - **Scientists have bred low glucosinolates variety** of mustard, **but large scale cultivation couldn't take place**. This is because reducing glucosinolates increases the vulnerability of crops to pests and diseases.
  - So, what is needed is to reduce the glucosinolates level in seeds, without lowering the levels in rest of the plant.

- **The Gene Editing Breakthrough:**
  - **Glucosinolates** are synthesized in the leaves and pod walls of mustard plants. They are transported and **accumulated in seeds through the action of glucosinolates transporter or**

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GTR genes. There are 12 such genes under **two distinct classes** of GTR1 and GTR2 with six copies each.

- **Scientists at NIPGER, the lead lab and CGMCP have edited 10 out of 12 GTR genes** in 'Varuna', a high yielding variety of Indian mustard. They used CRISPR/Cas9 tool for this. This editing made changes in the encoded proteins which were responsible for transport of the glucosinolates to the seeds.

- **Result**:
  - **GTR Edited Low-seed high-leaf glucosinolate:** Seeds of GE Varuna mustard variety has glucosinolates content well below the **30 ppm canola quality**. Other parts of the plant, especially the leaves and pod walls enclosing the seeds, has significantly higher glucosinolate accumulation.
  - **Resistance against pest is intact**: The edited variety continues to display defence against virulent fungal pathogen ***Sclerotinia sclerotiorum*** and the insect pest **Spodoptera litura**. This defence is at par or better than that of wild variety of mustard. This is because there is **higher glucosinolate concentration** in the leaves and pod walls.
    - **These scientists** have published their research finding in *Plant Biotechnology Journal*.

- **GE crops are subjected to less stringent "environmental release" regulation in India**.
  - For **GM Crops**, clearance has to come from Genetic Engineering Appraisal Committee and MoEF&CC (final nod). But, for GE crops requirement is less stringent.
  - **In March 2022**, an office memorandum from the MoEF&CC exempted GE Plants "free of exogenous introduced DNA" from the requirement of GEAC approval for open field trials leading to commercial release. Such clearance is now necessary only at the level of **Institutional Bio-Safety Committee (IBSC)**, comprising scientists from the institutions engaged in the GE Crop development and from the DBT.
- **This work** will increase the acceptability of mustard oil both within country and in the export market.
- **GM Hybrid Mustard** (DMH-11) and the new GE low-seed and high-leaf glucosinolate lines are major plant breeding advancements – from Indian scientists. It can go some way towards bringing down the dependence on imported vegetable oil.

5. HEALTH:

1) TRANSMISSION MECHANISM OF VIRUSES: HOW EXTRACELLULAR VESCICLES ACT AS DEFENCE MECHANISM (APRIL 2024)

- **The mere presence of a virus in bodily fluid** doesn't mean it is transmitted via that route.

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» For e.g. Dengue, Chikungunya, zika viruses are present in body fluid like saliva and semen but don't spread orally or sexually.

- **What do virus do inside the body?**
  - » **Transmission** is a crucial event in a virus' life cycle. A virus that can't transmit is of no consequence to anyone.

  - » **Different methods:**
    - **Through bodily fluid**: Most human virus achieve transmission by ensuring that they are present in bodily fluids that contact the outer environment, and subsequently a new host.
    - **Through Vectors**: E.g Dengue, Chikungunya etc.

  - » **Role of Surface Protein and Receptor on the host:**
    - **Once inside the body**, virus must be present at correct location to infect new target cells. **Viruses are usually highly selective** in the cells they infect. This phenomenon, called **Tropism**, occurs because most viruses have special proteins on their outer surface that contact a **receptor on the host cell**. Any cell-type that makes the receptor can be infected by the virus.
      - **Examples:** for HIV virus, receptor is **CD4;** for SARS-CoV-2 the receptor is **ACE2**;
      - So, the cells which express ACE2 become the target of SARS-CoV-2. These cells include cells of respiratory tract and some cardiovascular cells. T-Cells don't have ACE2 so, SARS-CoV-2 can't infect them.

  - » **One strategy virus uses to achieve more transmission is to make proteins on the surface that have receptors on multiple cell-types**.
    - This allows them to infect different cell types, allowing access to multiple body fluids, enabling faster transmission.

- **What is PS Receptor?**
  - » **Phosphatidyl Serine (PS)**: It is a lipid which is usually expressed by dying cells in the body, as a signal to destroy them.
    - The **immune cells** express the **PS receptor** and fuse themselves with these cells, quietly destroying them.
  - » **Viruses hijack this pathway** with a process called **apoptotic mimicry**: By expressing PS lipid on their own surfaces, allowing them to infect the very cells that will destroy them.
  - » **PS Receptor** is expressed by many cells - apart from some cells of the immune system - the virus tends to be present in multiple compartments.
    - Yet, the mere presence of a virus in a given compartment wouldn't guarantee transmission from that route.
      - **Zika virus** can be detected in semen, saliva, and breast milk, but rarely spreads through these means despite the presence of target cells in the oral and genital cavities. It transmits **mainly via mosquitoes**.

- **Why Zika and some other viruses are not transmitted by non-conventional route?**
  - » **Body uses extracellular vesicles in these bodily fluids to inhibit viral infection**.

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- **Vesicles** are small structures enclosed by fat that a cell uses to transport substances from one part of the cell to another. When they are secreted outside the cell, they're called extracellular vesicles. These vesicles are abundant in saliva and semen and **contain the same PS lipids** on their surface that viruses like zika use for infection. The concentration of these extracellular vesicles that contain PS is low in blood and high in saliva and semen. These **PS containing vesicles compete for the same receptors the viruses use for entry, thus crowding the latter out and preventing an infection**.

- **The study shows that all viruses** that use the PS receptor for apoptotic mimicry - the dengue, chikungunya, West Nile, Ebola, and the vesicular stomatitis viruses - are inhibited by the presence of extracellular vesicles. The vesicles presence didn't affect the infectivity of viruses that don't use the PS receptor for entry, such as HIV and SARS-CoV-2.

- **The discovery of PS-coated vesicles for immunity represents a novel type of host defence against viral infection**.
  - While it is too early to speculate on potential therapeutic applications from this discovery, it opens up avenues for further research.

2) FOOD SAFETY: LIQUID NITROGEN IN FOOD & DRINKS (APRIL 2024)

- **Why in news?**
  - The Tamil Nadu Government has issued an advisory banning the use of liquid nitrogen in food and warned of strict action against violators (April 2024)
    - A week ago, a video of child creaming went viral on social media. There were also visuals of adults spewing white smoke from their mouth and nose.
    - Earlier in 2017, a man drank a cocktail with liquid nitrogen in a pub and ended up with a perforation in his stomach.
- Liquid nitrogen is the cooled liquified form of nitrogen gas. It can instantly freeze anything that it comes in contact with while evaporating.
- **Applications:**
  - **Food Preservation:** It is used to improve the quality of shelf life of food. It introduced droplets of liquid nitrogen the packaging on the production line.
    - Since nitrogen's volume expands 700-times when it evaporates, it displaces the oxygen in the food pack, preventing microbial action and preserving the freshness.
  - **Health: Cancer Therapy:** It has been used in the management of any benign pre-cancers and cancers since the 1960s. This from of treatment is generally used to manage cancers wherein conventional surgery is not possible or can be used as an adjunct to conventional surgery.
    - Nitrogen (at -196 degree C) is used to freeze and destroy cancer cells. This treatment is scientifically described as **Cryotherapy**.

- A **liquid nitrogen cocktail** is any mixed drink whose preparation involves the use of liquid nitrogen.

- **Why liquid nitrogen is added**
  - **For smoky, bubbling "cauldron effect"**

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    - » Liquid nitrogen boils at -196 degree celsius and thus room temperature quickly vaporizes to give bubbly appearance to drinks. The smoky appearance is produced because of the condensation of the moisture (water vapor) in the surrounding air above.
  - **Quick chilling affect**
    - » It has become popular in the preparation of the cocktails because it can be used to quickly chill glasses or freeze ingredients.

- **Why is it dangerous?**
  - **Very Cold:**
    - » Can be extremely damaging to body tissues, causing **frostbite and cryogenic burning** on contact.
    - » If ingested it can lead to severe internal damage, destroying tissue in the mouth and digestive tract.
  - **Explosive effect**
    - » It has a large expansion ratio 1:694 (at 20 degree celsius). When liquid nitrogen evaporates it produces a large volume of gas, which means it can burst the stomach if swallowed in a sufficiently large amount.
  - **Lack of awareness/training about its use**
    - » Drink should not be bubbling when a person consumes it, as this indicates that there is still nitrogen in it. The white smoke like liquid vapor, however, is no problem as it forms due to moisture around after the gas has evaporated and cooled the drink around.
    - » Most of the bartenders are learning the process from YouTube videos.

- **Why does its use continue?**
  - It is not a regulated substance in most of the countries.
- **Regulation in India**
  - Liquid nitrogen is permitted as an additive in frozen food as per the guidelines of the FSSAI.
  - It's use in drinks is in gray area. There is no clear cut guideline for it and generally it is considered to be a novel technique, which can be used by food and business operators.
    - **Some states** including Haryana, and TN have banned the use of liquid nitrogen in food (other than for food preservation).

3) FOOD SAFETY: ETHYLENE OXIDE (APRIL 2024)

- **Why in news?**
  - In April 2024, **Hong Kong** suspended sales of three MDH spice blends (Madras Curry, Sambhar, Curry Powder) and an Everest mix for fish curries.
    - » **Singapore** Food Agency (SFA) has also issued a recall for Everest's fish curry masala, due to the detection of **ethylene oxide,** a pesticide, exceeding safe limits for human consumption.
    - » **MDH** has released a statement saying that MDH doesn't use ethylene oxide at any stage of storing, processing, or packing of spices.
    - » In view of the above development, FSSAI has started taking samples of spices of all brands, from across the country to check the quality of product sold in the domestic market.

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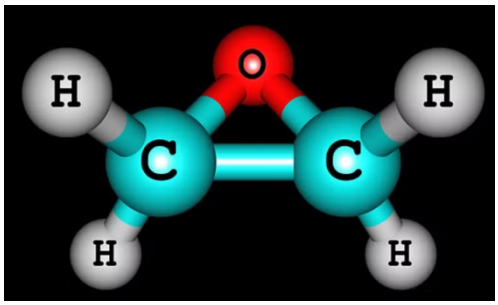
- **About Ethylene Oxide**:
  - It is a colorless gas which is used as a pesticide and sterilizing agent. It was originally intended to sterilize medical devices.
  - **Why is ethylene oxide used in food?**
    - ETO is often used as a sterilizer in order to keep a curb on microbial load. Since it is gaseous, it can easily seep into breathable packaging and come in contact with items that require sterility assuance level. The process of sterilization neutralizes yeast, molds, bacteria etc. It disrupts the reproductive processes of micro-organisms, thus preventing food from getting spoiled.
    - If food sterilized by ETO is not aerated, it leaves behind residue. This residue in turn from toxic compounds like 2-Chloroethanol (2-CE), Ethylene Chlorohydrin (ECH), and Ethylene Glycol (EG).
- **Negative Impact**:
  - Experts believe that even short term exposure can be harmful. Individuals may face respiratory issue, headaches, nausea, vomiting, or cyanosis.
  - It is classified as a **Group 1 Carcinogen** by the International Agency for Research on Cancer. It poses threats like breast cancer, lymphoma, leukemia, neurotoxicity.

4) FOOD SAFETY: SALMONELLA (APRIL 2024)

- **Why in news?**
  - The US has reportedly refused almost a third of shipments from MDH since Oct 2023 due to Salmonella contamination (April 2023)

- **Salmonella**
  - Salmonella is a group of bacteria that can cause gastrointestinal illness and fever called salmonellosis. It may lead to diarrhea, fever, stomach cramps etc. Children, elderlies and people with weak immune system may face more severe symptoms and may need hospitalization.



  - **How does it spread**?
    - » According to the Centre for Disease Control and Prevention (CDC), **Salmonella naturally lives in animals' intestine** and can be found in their feces (poop). The bacteria spreads to human if they come in contact with bacteria infected animals or items in their environment.

- **Possible reasons:**
  - **Unhygienic practices**:
    - » The FDA had physically inspected MDH's manufacturing plant in Jan 2022, during which it noted that the "plant didn't have adequate sanitary facilities and accommodations. It also observed that plants equipment and utensils were not designed and constructed to be adequately cleaned or mantained to protect against contamination.

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5) FOOD SAFETY AND STANDARDS ACT, 2006 (ALSO KNOWN AS FOOD ACT)

- Came into force in 2011.
- **Key Provisions**
  - i. **Consolidation of existing mechanisms**
    - » The FSS Act consolidated a number of food legislations, rules, orders etc and established a single law for all matters relating to food safety and standards.
    - » It subsumes acts like Prevention of Food Adulteration Act, 1954, The Fruit Product Order, 1955 etc.
  - ii. **Classification into standardized and non-standardized**
    - » **Standardized Food products** - Standards are prescribed and do not require product approval prior to manufacture, sale distribution, or import. The first time manufacturer or importer only requires an FSSAI license to begin a food business.
    - » **Non-standardized food products** - don't have standards as their safety parameters are either not known or either not yet ascertained.
  - iii. **Statutory Authority: Food Safety and Standards Authority of India (FSSAI) and State Food Safety Authorities**
    - » FSSAI is the apex body for food quality regulation in the country. It is responsible for setting standards and regulate, manufacture, storage, distribution, sale and import of food items to ensure food safety.
  - iv. **Commissioner of Food Safety of state**
    - » Appointed by respective state governments
    - » For efficient implementation of the Food Safety Act and various rules and regulations regarding food safety
    - » Commissioner also responsible for appointing Food Safety Officers for various local areas
  - v. **Graded Punishment and penalties** for contravention of the Act

No Injury	Sentence upto six months and fine upto one lakh rupees
Non-grievous injury	Sentence upto 1 year and a fine upto 3 Lakh rupees
Grievous Injury	Sentence upto 6 years and a fine upto five lakh
Death	Sentence not less than 7 years and may extend upto life and a fine not less than 10 lakh rupees.

  - vi. **Adjudicating and Appellate Tribunal**

6. COMPUTER AND IT

A) LLAMA 3: META'S MOST SOPHISTICATED AND CAPABLE LARGE LANGUAGE MODEL YET

- **Llama (**Large Language Model AI) is a family of LLMs introduced by Meta AI in Feb 2023.
  - The **first version** of the model was released in **four sizes** – **7B**, **13B**, **33B**, and **65 billion parameters**.
    - » Meta has claimed that 13B model of Llama outperformed OpenAI's GPT-3 which had 135 billion parameters.

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    - » **Note**: Parameters is a measure of the size and complexity of an AI model and generally, a large number of parameters means an AI model is more complex and powerful.
  - **The second version** (Llama-2) was released by Meta in July 2023 which was a significantly upgraded version of Llama-1. It was trained on 40% more data than Llama-1.

- **Llama-3** is the latest iteration of Meta's large language model. It is based on Llama-2 architecture, and has been released in 2 sizes, **8B** and **70B** parameters. Both sizes come with a base model and an instruction-tuned version that has been designed to augment performance in specific tasks.
  - **According to Meta**, Llama-3 is the best open-source model that is on par with the best proprietary models available today. Llama 3 outperformed Google's Gemma 7B and Mistral's 7B, Anthropic's Claude 3 Sonnet in benchmarks such as MMLU 5-shot (Massive Multitask Language Understanding), GPQA 0-Shot (A graduate level Google Proof Q&A Benchmark), HumanEval 0-shot (A benchmark for evaluating the multilingual ability of code generative AI Models), GSM-8K 8-shot and Math 4-shot, CoT (maths and word problems).

  - **For now,** only text based models in the Llama-3 collection of models has been developed. However, the company has plans to make Llama 3 multilingual and multimodal.

- Meta will be integrating its latest model into its proprietary virtual assistant – Meta AI.
- **How to try Llama-3:**
  - Meta have said that it will be integrating Llama-3 into Meta AI which can be used on **Facebook, Instagram, Whatsapp, Messenger, and the Web**.
  - It is readily available for developers as Meta has integrated the LLM into the Hugging Face Ecosystem. It is also available through Perplexity Lab, Fireworks AI, and on Cloud provider platforms such as Azure ML and Vertex AI.
  - Llama 3 models will soon be available on AWS, Google Cloud, Hugging Face, Databricks, Kaggle, IBM WatsonX, Microsoft Azure, NVIDIA NIM, Snowflake etc.

LARGE LANGUAGE MODEL (LLMS)

LLMs are a category of foundation models trained on immense amounts of data making them capable of understanding and generating natural language and other types of content to perform a wide range of tasks.

7. IPR ISSUES

1) INTRODUCTION: IPR AND TYPES

- **Introduction**
  - Intellectual Property refers to creation of mind: inventions; literary and artistic works; and symbols, names and images used in commerce.

  - Intellectual Property Rights are the rights given to persons over the creations of their minds. They usually give the creator an exclusive right over the use of his/her creation for a certain period of time.

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- IPRs are customarily divided in **two main types (1. Copyrights and Rights related to copyrights 2. Industrial Property)**
  - **Copyrights and Rights related to copyrights** cover rights of **authors of literary and artistic work** (books, music composition, painting, computer programs, films, sculpture etc.). It also includes **rights of performers (**e.g., actors, singers, musicians, broadcasting organizations etc.)
    - Generally, these rights are protected for a period of **50 years after the death** of the author.
    - **Purpose**: Encourage and reward creative work, promote innovation, provide appropriate financial benefits.

  - **Industrial Property** focuses on protecting **inventions** and **Creative work** (with industrial or commercial applications).
    - Industrial Property includes patents for inventions, Industrial design for aesthetic creations, and trademarks or geographical indications for distinctive signs.

    - **Industrial property can be divided into two main sections**
      1. **Protection of distinctive signs in particular trademarks and geographical indications**
         - **Trademarks** distinguish the goods and services of one undertaking from those of other undertakings
         - **Geographical indications** identify a good as originating in a place where a given characteristic of the good is essentially attributable to its geographical origin).
           - The protection may last indefinitely, provided the sign in question continues to be distinctive.
         - **Aims:** The protection of such distinctive signs aims to stimulate and ensure fair competition and to protect customers, by enabling them to make informed choices between various goods and services.

      2. **Patents, Industrial Design and Trade Secrets**
         - This is the second type of Industrial Property.
         - The aim is to stimulate innovation and design and promote creation of technology. It also gives incentive and means to finance R&D activities.
         - A functioning IPR regime also facilitates transfer of technology in the form of FDI, joint ventures and licensing.
         - The protection is usually given for finite term (typically 20 years in the case of patents)

2) INTERNATIONAL INSTITUTIONS / AGREEMENTS DEALING WITH INTELLECTUAL PROPERTY RIGHTS

A) WORLD INTELLECTUAL PROPERTY ORGANIZATION (WIPO)

- It is one of the specialized organizations of UN which was created in 1967 "to encourage creative activity, to promote the protection of intellectual property throughout the world".
  - It is a global forum for intellectual property services, policy, information, and cooperation.

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- WIPO administers 26 international treaties.
  - The importance of intellectual property was first recognized in Paris Convention for the Protection of Industrial Property (1883) and the Berne Convention for the Protection of Literary and Artistic Works (1886).

- **In 2018, the Union Cabinet approved DIPP recommendation of accessing to WIPO Copyright Treaty, 1996 and WIPO Performance and Phonograms Treaty, 1996**

  - **WIPO Copyright Treaty**:
    - **It** came in force on March 6, 2002, and is **A Special agreement under Berne Convention** (for protection of literary and artistic works).
    - It has provisions to extend the protection of copyrights contained therein to the **digital environment**.
    - Further it recognizes the rights specific to digital environment, of making work available, to address "on-demand" and other interactive modes of access

  - **WIPO Performances and Phonograms Treaty**
    - Came into force in 2002.
    - It deals with rights of two kinds of beneficiaries
      - Performers (actors, singers, musicians) etc.
      - Producers (of phonograms) etc.
    - The treaty empowers right owners in their negotiations with **new digital platforms and distributors.**
    - It recognizes moral rights of the performers for the first time & Provides exclusive economic rights to them.

  - **Significance**
    - Making India's IPR policy compliant to global standards
    - It will contribute to fight against online privacy.

B) TRIPS AGREEMENT OF WTO

- The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) is an international agreement administered by the World Trade Organization (WTO) that sets down the **minimum standards for any forms of intellectual property (IP) regulation** as applied to nationals of other WTO members.
- It was negotiated at the Uruguay Round of General Agreement on Tariffs and Trade (GATT) in 1994.
- **Key provisions**
  - **WTO members to provide protection of**:
    - **copyrights**, covering content producers including performers, producers of sound recordings and broadcasting organizations;
    - **geographical indications**, including appellation of origin;
    - **industrial design**.
    - **integrated circuit layout design**;
    - **Patents**;
    - new plant varieties;

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- **trademarks**;
- trade dress;
- and undisclosed or confidential information.

- **Enforcement Procedures**
- **Dispute Resolution Procedures**

- Protection and enforcement of all IPRs shall meet the **objectives:**
  - To contribute to the promotion of technological innovation
  - To the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations.

C) INDIA AND INTERNATIONAL PATENT REGIME

- India has gradually aligned itself with international regimes pertaining to intellectual property rights.
- In 1994, India signed the TRIPS agreement mandated by the WTO. The agreement came into effect on January 1, 1995.
- Following this, it amended its internal laws to comply with TRIPS, most notably in 2005, when process patents and patents for pharmaceutical products were brought into legislation.
- India is also signatory to several IPR related conventions, including the Berne Convention, which governs copyright, the Budapest Treaty, the Paris Convention for the protection of IPR, and the Patent Cooperation Treaty (PCT), all of which govern various patent-related matters.
- In **recent past**, some positive steps which have been taken are – Accession to WIPO Performances and Phonograms Treaty and WIPO Copyright Treaty, collectively known as the WIPO Internet Treaties, in 2018 and the Nice Agreement in 2019.

D) 2005 AMENDMENT TO THE PATENT ACT:

- Although the TRIPS treaty was signed in 1994, India took about 10 years to establish a patent law that was in line with WTO mandate. The new patent law was officially enforced on January 1, 2005, but retrospectively from 2004.
- Through the **new Patent law of 2005 (Patent (amendment) Act, 2005)**
  - ✓ **Earlier**
    - The 1970 Act, allowed for **only process patent** and didn't allow product patent.
      - It became a major factor in the growth of Indian pharmaceutical sector as medicines couldn't be patented (only the process of making it could be). This was based on the recommendations of a 1959 commission chaired by the jurist **Rajgopala Ayyangar**, which had said that laws need to be designed "with special reference to the economic conditions of the country, the state of its scientific and technological advance, its future needs and other relevant factors.. so as to minimize if not eliminate the abuses to which a system of patent monopoly is capable of being put out".
        - They used the process of reverse engineering to manufacture the drugs
    - **Timeframe** for the validity of patent is **5-7 years**.

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- ✓ **Key changes**
  - **Product Patent** reintroduced
  - **Increased the timeframe** of the applicability of patent
    - All patents were given a time frame of 20 years. (Under the 1970 act, the life of a patent was limited between five to seven years)
  - **Intellectual Property Appellate Board** was established as a specialized judiciary to hear IP cases.

6) ACTS AND POLICIES OF GOVERNMENT OF INDIA

A) PATENT ACT, 1970

- Patent act defines what invention is and makes it clear that any existing knowledge of thing cannot be patented**.**
- **Three prerequisites for patentability defined by the act:**
  - 'Novelty' standard
  - 'Non-obviousness' or inventive step
  - Industrial applicability
  - It shouldn't attract the provisions of section 3 and 4 of the Patents Act 1970.

Discoveries are excluded from patent protection under section 3 of the Indian Patent Act.

- Discovery essentially refer to finding out something which already existed in nature but was unknown or unrecognized.

- **Section 3** deals with what doesn't qualify as an invention under the Act.
- **Contentious Provisions (Section 3(d) and Section 84(1))**

B) SECTION 3D (WHAT IS NOT PATENTABLE)

- **Discovery of a new form of a known substance** which doesn't result in the enhancement of the known efficacy cannot be patented.
- **Discovery of a new property or new use** of a known substance cannot be patented
  - For e.g.
    - Ethyl alcohol acts as solvent, but further discovery of its new property as anti-knocking, thereby making it usable as fuel, cannot be patented.
    - New use of Aspirin for treatment of the cardio-vascular diseases, which was earlier used for analgesic purpose, is not patentable.
- **The mere use of a known process, machine or apparatus** unless such known process results in a new product or employs atleast one new reactant
  - However, a new and alternative process for preparing Aspirin is patentable
- **Aim of the provision under Section 3d: Prevent Evergreening**

- **Does section 3(d) violate TRIPS?**

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- No

C) SECTION 84(1) (COMPULSORY LICENSING)

- **Why in news?**
  - At the time of shortage of remdesivir, opposition parties were demanding that government should issues compulsory licenses for manufacture of an affordable generic version of Remdesivir (July 2020)

- **Provisions of the law:**

  any person may request a compulsory license if
  - after three years from the date of grant of patent, the needs of the public to be covered by invention have not been satisfied.
  - invention is not available to pubic at affordable price;
  - or the patented invention is not "worked in", or manufactured in the country, to the fullest extent possible

- **Compulsory Licensing - Basics**
  - Compulsory licensing is when a government authorizes a party other than the patent owner to produce the patented product or process, without the patent owner's consent.
  - In **2012** India Granted its first compulsory license to generic drug producer.
    - The decision effectively ended German Pharmaceutical company Bayer AG's Monopoly over an anti-cancer drug and authorizes the production of a low-cost version for the Indian market.
  - **Importance of Compulsory Licensing**
    - Promotes India's status as "pharmacy of the world"
    - Promotes "people's accessibility to medicines"
    - Benefits India's fight against Drug Resistance TB, HIV, Cancer etc
    - strengthen our soft power especially in African countries for whom India is a source of low-cost generic medicine.

- **Is Section 84(1) (Compulsory Licensing) compliant with TRIPS agreement**
  - The TRIPS agreement explicitly allows compulsory licensing as long as procedures and conditions set out in Article 31 of TRIPS are fulfilled.
    - Conditions in Article 31
      - Failure of negotiation for voluntary license
      - Payment of adequate remuneration to the patent owner
      - Compulsory license can't be given exclusively to licensee (e.g., the patent holder shall continue to produce)
      - Subject to legal review within the country
      - During emergency situation, the first condition need not be met

  - Doha declaration on TRIPS agreement and Public Health confirms that countries are free to determine the grounds for granting compulsory licenses.
  - **So yes, compulsory licensing is complaint with TRIPS agreement**

D) PATENTING TRENDS REPORT RELEASED BY NASSCOM (APRIL 2024)

- India witnessed 83,000 patents being filed in FY2023, marking an annual growth rate of 24.6%, the highest in the last two decades.
    - The **number of patents granted** also witnessed significant growth rising over **2X** between FY2019-FY2023. This trend was expected to increase significantly with over 1,00,000 patents granted between 15th March 2023 and 14th March 2024.
    - **Among the top technology patents**, Deep tech companies are filing patents for Artificial Intelligence, the IoT and Neurotechnology.

7) COPYRIGHTS ACT, 1957 (AMENDED IN 2012)

- It was the first copyright act in Independent India, it has been amended six times by now.
- Copyright Act 1957, and the Copyright Rules 2013, as last amended in 2016 are two laws that govern copyright in India.
- **Key highlights**
    1. **Types of Work** Protected: Literary, dramatic, musical and Artistic
    2. **Duration of Protection:**
        - Lifetime of the author + 60 years from the beginning of the next calendar year next following the year in which the author dies.
    3. **Foreign Work**: Copyrights of work mentioned in the International Copyright Order (WIPO) are protected in India, as if such work is Indian work.
    4. **Ownership**
        - Author
        - For work done in author's employment under a "contract of service" or apprenticeship, the employer is considered the first owner of the copy right, in the absence of any agreement on the contrary.
    5. **Exemption to Copyright infringement in India**
        - Fair dealing with any copyright work for certain specifically mentioned purposes and
        - Certain specific activities enumerated in the statute.
            - Exception for *the educational use of copyright materials*, *including their production "in the course of instruction*".
    6. **Remedies available against copyright infringement in India**
        - The act provides three kinds of remedy
            - Administrative remedies
                - Detention of the infringing goods by the custom authorities
            - Civil Remedies
                - Injunctions, damages and account of profits
            - Criminal Remedies
                - Imprisonment (up to 3 years) along with a fine (up to 200,000)
    7. **Enforcement Authorities**
        - Civil Court

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- Criminal Court -> for criminal infringement
- The Copyright Board constituted under the act -> it provides an alternative forum for resolving certain limited disputes, such as those pertaining to assignments and payments of royalties.

8) NATIONAL INTELLECTUAL PROPERTY RIGHTS POLICY

- The policy approved in May 2016, lays down the **future roadmap for intellectual property in India**.
- The Policy recognizes the **abundance of creative and innovative energies** that flow in India, and the need to tap into and channelize these energies towards a better and brighter future for all.

- **Objectives**
  - The policy lays down the following seven objectives.
    i. **IPR Awareness**: NIPR policy comes with the most important motive of increasing awareness about social, cultural and economic benefits of IPR among all sections of society.
    ii. **Stimulate generation** of IPRs -> maximize the number of IPRs being filed.
    iii. **Commercialization** of IPRs to get value through them.
    iv. **Legal and Legislative Framework** - To have strong and effective IPR laws, which balance the interests of rights owners with larger public interests.
      - For e.g. India doesn't have law on trade secrets, the policy aims to create specified laws on it.
    v. Administration and Management - To modernize and strengthen service-oriented IPR administration.
    vi. Enforcement and Adjudication - To strengthen the enforcement and adjudicatory mechanism for combating IPR infringements
    vii. Human Capital Development - To strengthen and expand human resources, institutions and capacities for teaching, training, research and skill building in IPRs.
      - The policy focuses on recruiting people and training them in order to address the pendency of cases.
- The Policy also recommends that IP be taught in schools and colleges.

9) GEOGRAPHICAL INDICATION

- **Introduction**
  - A 'geographical indication' (GI) is a place name used to identify the origin and quality, reputation, or other characteristics of products. It is a sign used on products that have specific geographical origin and possess qualities or a reputation by virtue of their geographical association. The owner of the GI tag has exclusive rights over the product and can prohibit others from using the same name.

  - For instance: champagne, Darjeeling tea, Nagpur Orange, Kangra Paintings etc.

  - **India's GI Law** "Geographical Indications of Goods (Registration and Protection) Act, 1999" has come into force with effect from Sep 2003.
    - In India, the tag is awarded by the GI Registry in Chennai, and it indicates that a produce possesses certain qualities exclusive to its land of origin.

- **WTO Law:** GIs have been defined under Article 22(1) of the WTO Agreement on TRIPS.

- **Darjeeling tea** became the first GI tagged product in India, in 2004-05. Other famous GI products of India include Basmati Rice, Chanderi Fabric, Mysore Silk, Kanchipuram Silk, Banarasi Silk Saree, Jaipur Blue Pottery, Kullu Shawl, Kangra Tea, Thanjavur Painting, etc.

- **Significance of GI registration**
  - Legal protection -> Prevents unauthorized use of GI by others.
  - Consumer protection -> right information -> GI Tag conveys an assurance of quality and distinctiveness, which is essentially attributable to the place of its origin.
  - Promotes economic prosperity of the producers of goods by enhancing demand in national and international market
  - Essential to get protection in other countries.
    1. Article 22 of TRIPS agreement says unless a geographical indication is protected in the country of its origin, there is no obligation under the agreement for other countries to extend reciprocal protection.
  - **Opportunity to promote development in rural areas**: GI registration along with strengthening of e-commerce in rural areas can promote higher income for people producing GI tagged products.
    - The hyper-localized nature of GI offers solutions to reverse urban migration and conserve India's ancient crafts, culture and food.
  - **Other wider benefits** – Encourages protection of biodiversity, local know-how and natural resources.

- **Recent GI Tagged Products: Useful for Prelims**

A) RED AUNT CHUTNEY (KAI CHUTNEY) OF ODISHA

- In Odisha's Myurbhanj district, red weaver ants are used for making chutney or a water semi-solid paste known as "Kai Chutney". This chutney is renowned in the region for its medicinal and nutritional properties.
- **In Jan 2024**, this distinctive savory chutney was **awarded the GI Tag**.
- **Red Weaver Ants**, scientifically known as Oecophylla smaragdina, are notable for their extremely painful sting, capable of causing blisters on the skin.

B) GI TAGS TO VARIOUS PRODUCTS IN JAN 2024

- **From Odisha:**
  a) **Simplipal Kai Chutney**
  b) **Dhenkanal Magji**: A type of sweet made from cheese of buffalo milk.
  c) **Lanjia Saura Paintings**: It is a style of wall mural paintings. Those paintings are also called *ekons or the idital* and have a significant **spiritual importance** for the tribe. **Lanjia Sauras** are an indigent society today, and labour in preserving their culture – the idital being an important part of it.

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d) **Dongria Kondh Shawl (Kapdaganda Shawl):** The traditional knitted shawls are both unique and ancient. Their culture, tradition, faiths and beliefs, as well as the biodiversity of the forests are reflected in the shawl.
e) **Khajuri Guda (date palm jaggery**): It is a natural sweetener produced from the sweet juice of palm called **neera**. It is prepared by the tribal population, including the Lanjia Saura, of Gajapati, Boudh, Angul, and Dhenkanal districts of Odisha.
f) **Nayagarh Kanteimundi Brinjal**, a vegetable crop with lots of prickly thorns on the flesh as well as the whole plant grown in whole of Nayagarh district of Odisha also received a tag.
g) **Koraput Khalajeera rice**: The black colored rice variety, also known as the '**Prince of Rice'** is famous for its aroma, taste, texture, and nutritional value. Tribal people of the Koraput region have preserved this rice for around 1,000 years.

- **West Bengal**:
  a) **Tangail Saree**
  b) **Garad Saree**
  c) **Korial Saree**
  d) **Kalonunia Rice**
  e) **Sundarban Honey**

- **Gujarat**
  a) **Kachchii Kharek**: The indigenous variety of dates from Kutch, known as Kuchchhi Desi Kharek.

- **J&K:**
  a) **Ramban Anardana**

- **Arunchal Pradesh:**
  a) **Wancho Wooden Craft**: It intimately weaves into the socio-cultural fabric of the skillful Wancho of Longding and Changlong districts. It has been practiced by Wancho tribes for generations. It is used to decorate drawing rooms and gifts.
  b) **Adi Kekir** (Ginger)

C) GUCCI MUSHROOM (NOT GIVEN GI TAG YET)

- As per J&K Government, Gucchi is the final stage of evaluation at the GI Registry.
- Gucci mushroom is locally known as "Kanngech" and as '**Morel Mushroom",** it is a prized harvest for people in districts of Kupwara, Baramulla, Budgam, and Anantnag.
- The market price of this mushroom is somewhere between Rs 25,000 to Rs 30,000 per kg.
- **Recent years** have seen low yield for the mushroom due to climate change and other environmental factors.

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