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SHANKAR IAS ACADEMY

MAY 2024

1. GEOGRAPHY

1.1 Impacts of warming of Indian Ocean

Why in news?

A new study published in journal Science Direct has said that Indian Ocean is experiencing unprecedented and accelerated warming, which may continue throughout the century unless greenhouse gases (GHGs) are reduced immediately.

What are the key highlights of the study?

- **Rapid warming**-The study has predicted that between 2020 and 2100, the Indian Ocean could warm at a rate of 1.7-3.8°C increase per century if greenhouse gas emissions are not reduced.
- **Ocean basin heat**-The study examined the Indian Ocean's warming over the past century, finding that the ocean basin heated at a rate of 1.2°C per century between 1950 and 2020.
- **Expansion of Indian Ocean Warm Pool**- The study found that the area of the IOWP characterized by Sea Surface Temperature values exceeding 28°C, has expanded notably, particularly in the south-central basin.
- **Variability in Net Primary Production**- NPP exhibited large inter annual variability in northern and central regions of Indian Ocean, while some northern regions shows slightly decreasing trends in NPP.
- **Decline in chlorophyll**- The productivity and surface levels of chlorophyll are also expected to decline by 2100, with the greatest reduction in the western Arabian Sea, where levels could fall by 8-10% from their current state.
- **Temporal patterns**-

The future increase in heat content is equivalent to adding the energy of one Hiroshima atomic bomb detonation every second, all day, every day, for a decade.

Net Primary Production represents the net amount of energy that is stored by primary producers and made available to the rest of the ecosystem for growth and consumption.

Temporal patterns	
Time period	Key finding
1998-2008	This period have cooler temperatures and higher productivity with few exceptions.
2009-2019	This period saw warmer temperatures and lower productivity
2017-19	This period showed increased productivity, particularly during the northeast monsoon period in the north-western regions.

- **Changes in Indian Ocean Dipole (IOD)**-The study predicts an increase in the frequency of extreme IOD events by 66%, while the frequency of moderate events is projected to decrease by 52% by the end of the century. These changes could further exacerbate the variability in monsoon rainfall patterns and impact regional climate dynamics.
- **Increase in heat content**-The current rate of increase in heat content within the first 2,000 meters below the ocean surface is 4.5 zettajoules per decade. However, future projections suggest a substantial rise to 16-22 zettajoules per decade.
- **Vulnerability**- The north-western parts of the Indian Ocean, including the Arabian Sea, experienced the most significant warming, while the south-eastern parts of the ocean, off the coasts of Sumatra and Java, experienced the least warming.
- **Change in pH level**- The bio-geochemical characteristics of the Indian Ocean are also expected to change due to the warming, for instance the pH levels of the ocean's waters are projected to decrease from about 8.1 currently to 7.7 by the end of the century.

What are the impacts of warming of Indian Ocean?

- **Monsoon changes-** The southwest monsoon, crucial for India's rainfall, could be affected by the increased heat content in the ocean's surface and subsurface layers.

- **Extreme weather events-** *Heavy rainfall events and extremely severe cyclones* have already become more frequent since the 1950s and are projected to increase further with rising ocean temperatures.

- **Sea level rise-** Thermal expansion of seawater contributes significantly to rising sea levels, which could lead to coastal erosion, flooding, and displacement of populations in the 40 countries bordering the Indian Ocean.

- **Changes in marine ecosystem-** The warming of the Indian Ocean is expected to disrupt marine ecosystems, leading to coral bleaching, loss of biodiversity, and habitat destruction.

- **Acidification-** The projected changes in pH may be detrimental to the marine ecosystem since many marine organisms particularly corals and organisms that depend on calcification to build and maintain their shells as they are sensitive to the change in ocean acidity.
- **Decline in productivity-** Decline in chlorophyll levels could further affect marine productivity and food chains.
- **Marine heatwaves-** The frequency and intensity of [marine heatwaves](#) are expected to rise that could cause severe cyclones, they also lead to habitat destruction through coral bleaching, seagrass loss and the degradation of kelp forests, adversely affecting the fisheries sector and also

Phases of IOD	About
Positive phase	<ul style="list-style-type: none"> • The western parts of the Indian Ocean are warmer than the eastern parts. • This leads to increased monsoon rainfall across many regions in India and South Asia.
Negative phase	<ul style="list-style-type: none"> • The western parts of the ocean are cooler than the eastern parts. • This can lead to below-normal rainfall during the post-monsoon period in north-western India.
Neutral phase	<ul style="list-style-type: none"> • Water flows from the Pacific between Indonesia's islands, keeping seas warm to the northwest of Australia. • This has very less impact on Indian monsoon.

What lies ahead?

- The study underscores the urgency of reducing greenhouse gas emissions to mitigate the impacts of ocean warming.
- The findings emphasizes the importance of building climate-resilient infrastructure, conserving marine ecosystems, and enhancing forecasting capabilities to adapt to the changing conditions.

1.2 Heatwaves in India

Why in news?

The Indian Meteorological Department (IMD) issued a red alert for heatwaves in Delhi, Punjab, Haryana, and most parts of Western Rajasthan.

What is a heatwave?

- **About-** According to IMD, heatwave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the summer season in the North-Western parts of India.
- **Occurrence-** Heatwaves typically occur between March and June, and in some rare cases even extend till July.
- **Impact-** The extreme temperatures and resultant atmospheric conditions adversely affect people living in these regions as they cause physiological stress, sometimes resulting in death.
- **Qualitatively-** Heat wave is a condition of air temperature which becomes fatal to human body when exposed.
- **Quantitatively-** Heatwave is defined based on the temperature thresholds over a region in terms of actual temperature or its departure from normal.
- **Heatwave-** If the prevalent temperature is 4.5°C to 6.4°C more than normal, it is classified as a heatwave.

- **Severe heatwave**-A rise of more than 6.4°C is considered a severe heatwave. May is the peak month for heatwaves in India.
- **For coastal areas** - When maximum temperature departure is 4.5 °C or more from normal, heat wave may be described provided actual maximum temperature is 37°C or more.
- **Vulnerable**- The States frequently affected include Punjab, Haryana, Delhi, Uttar Pradesh and Bihar.
- **Red alert**- A red alert refers to an extreme heat warning. It means that a severe heatwave has persisted for more than 2 days or the total number of heat/severe heatwave days has been more than 6 days.

What are the factors contribute to heatwaves?

- **Climate change**- As GHG emissions increase, the Earth’s atmosphere retains more heat, causing overall temperature rise. This in turn leads to extreme weather events, including heatwaves which become more common and severe.
- **El Nino**- It is a climatic phenomenon characterized by the abnormal warming of surface waters in the equatorial Pacific Ocean. El Nino years often experience

- **Extreme temperatures**- Increased likelihood of breaking temperature records.
- **Extended heatwave spells**- More frequent and prolonged heatwaves.
- **Reduced pre-monsoon rainfall**- Less precipitation before the monsoon season, exacerbating the heat condition.

Region	Temperature range to declare as a heatwave
Plains	• Maximum temperature of at least 40°C or more
Hilly regions	• Maximum temperature of at least 30°C or more.
Coastal region	• Maximum temperature departure of 37°C or more from normal.
• For a heatwave to be declared, these conditions must be met in at least two weather stations in a meteorological sub-division for at least two consecutive days. The heatwave is officially declared on the second day.	

- **Heat dome**- It occurs when an area of high pressure traps warm air over a region for an extended period, acting like lid on a pot. Prolonged heat domes can result in deadly heatwaves due to persistent and intense heat.
- **Anticyclone**- It is a high-pressure system, involves descending air that increases in temperature as it is compressed. This results in hot, dry weather conditions.
- **Urban heat island effect**- Urban areas experience higher temperatures than rural surroundings due to the urban heat island effect. The concentration of buildings, concrete, and asphalt absorbs and retains heat, elevating temperatures during heatwaves.
- **Loss of evapotranspiration**- Due to deforestation and changing land use pattern there is loss of trees and vegetation, it leads to less cooling through evapotranspiration, leading to higher local temperatures.

What are the impacts of heatwaves?

- **Heat exhaustion**- It is characterized by heavy sweating, weakness, dizziness, nausea, and fainting which occurs when the body loses excessive amounts of water and salt.
- **Heat stroke**- A severe, life-threatening condition where the body fails to regulate its temperature, leading to dry, warm skin, confusion, unconsciousness, and potential organ failure. Immediate medical intervention is critical.]
- **Health impact**- Heatwaves increase the incidence of heat-related illness such as heatstroke, dehydration, heat exhaustion and heat cramps.
- **Drought**- Prolonged heatwaves can exacerbate drought conditions by increasing evaporation rates and reducing soil moisture.
- **Water scarcity**- Reduced water availability affects both human populations and natural ecosystems.
- **Ecosystem stress**- Wildfires can destroy habitats, reduce biodiversity, and disrupt ecological balances.
- **Economic impact**-Farmers and the food industry face significant economic losses due to reduced productivity and increased costs for irrigation and livestock care.

World Meteorological Organization (WMO) states that El Niño greatly increases the likelihood of extreme heat events both on land and in the oceans.

- **Food security**- Reduced agricultural output can lead to food shortages and increased food prices, affecting food security for populations.
- **Infrastructural damages**-Prolonged heat can damage infrastructure such as roads, railways, and power lines, further compounding the challenges during heatwave.

What are the precautions that should be taken for heatwaves?

- **NDMA**- National Disaster Management Authority (NDMA) has prescribed the following measures can be taken to minimise heatwave impact.

- **Avoid sun exposure**- Stay indoors during the hottest part of the day, especially between noon and 3 pm. If you need to be outside, use protective gear like a hat or an umbrella.

- **Stay hydrated**- Drink plenty of water, even if you don't feel thirsty. Staying hydrated is essential to prevent heat-related illnesses.

- **Appropriate clothing**- Wear lightweight, light-coloured, loose-fitting, and breathable cotton clothes. Protect your eyes with goggles, and use an umbrella or hat to shield yourself from direct sunlight.

- **Avoid dehydrating beverages**- Limit alcohol, tea, coffee, and carbonated soft drinks, as they can dehydrate your body. Instead, opt for oral rehydration solutions (ORS) or homemade drinks like lassi, torani (rice water), lemon water, or buttermilk.

- **Treatment of heatstroke**- Immediate action is to lay the person in a cool place, wipe with a wet cloth and pour normal temperature water on head. Hydrate the person with ORS and other liquids finally the person must be taken to the nearest health centre or hospital promptly.

Colour Code	Alert	Warning	Impact	Suggested Actions
Green (No action)	Normal Day	Maximum temperatures are near normal	Comfortable temperature. No cautionary action required	Nil
Yellow Alert (Be updated)	Heat Alert	Heat wave conditions at isolated pockets persists on 2 days	Moderate temperature. Heat is tolerable for general public but moderate health concern for vulnerable people e.g. infants, elderly, people with chronic diseases	(a) Avoid heat exposure. (b) Wear lightweight, light-coloured, loose, cotton clothes. (c) Cover your head: Use a cloth, hat or umbrella
Orange Alert (Be prepared)	Severe Heat Alert for the day	(i) Severe heat wave conditions persists for 2 days (ii) Through not severe, but heat wave persists for 4 days or more	High temperature. Increased likelihood of heat illness symptoms in people who are either exposed to sun for a prolonged period or doing heavy work. High health concern for vulnerable people e.g. infants, elderly, people with chronic diseases.	(b) Avoid heat exposure— keep cool. Avoid dehydration. (b) Drink sufficient water- even if not thirsty. (c) Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. to keep yourself hydrated
Red Alert (Take Action)	Extreme Heat Alert for the day	(i) Severe heat wave persists for more than 2 days. (ii) Total number of heat/severe heat wave days exceeding 8 days	Very high likelihood of developing heat illness and heat stroke in all ages.	Extreme care needed for vulnerable people.

1.3 La Nina & its impact on global weather

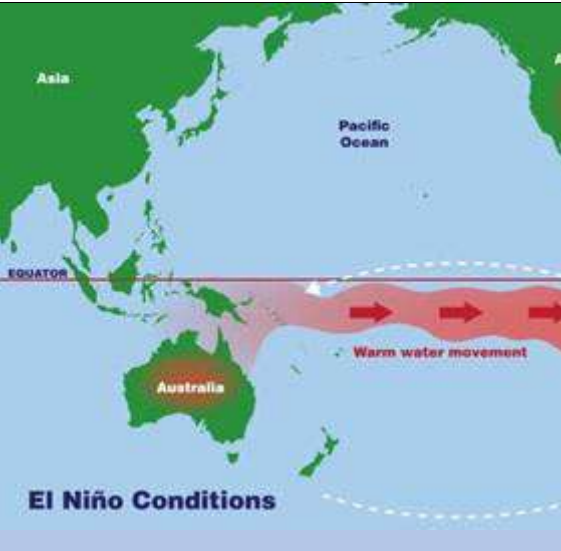
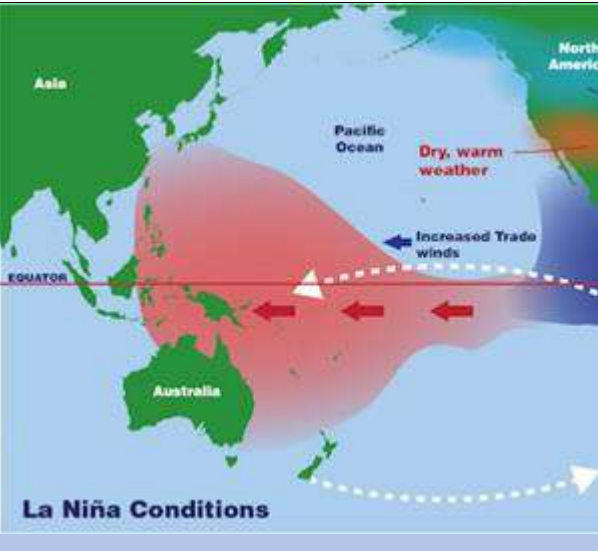
Why in news?

The India Meteorological Department (IMD) forecasted above-normal rain in the upcoming monsoon season in India, with “favourable” La Nina conditions expected to set in by August-September.

What is ENSO?

- El Nino and La Nino together called as El Nino Southern Oscillation which affects weather events across the world.

Key aspects	El Nino	La Nina
Meaning	It is a loose translation of “little boy” or “Christ child” in Spanish.	It is called as “Little girl” in Spanish which is the opposite of El Niño.
About	It is the warming of sea waters in Central-east Equatorial Pacific that occurs every few years (Warm phase off the coast of Peru).	It sees cooler than average sea surface temperatures in the equatorial Pacific region (Cool phase).

	 <p>El Niño Conditions</p>	 <p>La Niña Conditions</p>
Trade winds	It weakens in the western Pacific which cause warmer waters in the East.	It becomes stronger than normal and cause warmer waters in the west.
Sea surface temperature	It increases across the Eastern Pacific by 6-8°C.	It reduces across the Eastern Pacific by 3-5°C.
Impact	It <i>disrupts normal upwelling</i> , reducing the rise of cold, nutrient-rich water from the ocean depths.	It <i>enhances upwelling</i> , bringing cold, and nutrient-rich water to the surface near South America.
Impact on India	It has the impact of suppressing monsoon rainfall, can cause droughts , adversely affecting agriculture and water supply.	It is associated with <i>good rainfall</i> during the monsoon season.
Frequency	It occurs every 3-7 years	It occurs half the amount of time El Niño events do.
Fish population	Reduced upwelling of deep nutrient rich waters leads to reduction in fish populations along South America coast.	Enhanced upwelling of nutrient rich waters increasing fish populations along South American coast.

How La-Niña will impact global weather?

- **Asia and the Indian Subcontinent-** It brings above-average rainfall, benefiting regions like India by *enhancing the monsoon*.
- **Water shortage-** However, eastern and north-eastern India may receive *below-average rainfall*, potentially leading to water shortages.
 - Increased thunderstorms and lightning during La Niña years pose risks, especially during peak agricultural seasons.
- **Southeast Asia-** Countries such as Indonesia, the Philippines, and Malaysia often experience *increased rainfall*, leading to flooding risks.
- **North America-** Southern regions, including the *southern U.S.*, face drier and warmer conditions, potentially causing *droughts*.
 - Conversely, the *Pacific Northwest and Canada* can experience *heavier rainfall* and flooding.
- **Africa-** Southern Africa generally sees higher rainfall, while eastern regions might suffer from drought.

Recent ENSO trends
<ul style="list-style-type: none"> • 2020-2023 La Niña event- The period from 2020 to 2023 experienced the longest La Niña event of the century, which typically brings above-average monsoon rains to India. • Transition to El Niño- Following the prolonged La Niña, ENSO neutral conditions developed and gave way to an El Niño by June 2023. This El Niño has been weakening since December 2023. • Potential Shift to La Niña: According to meteorological experts, this transition from El Niño back to La Niña is a natural and recurring process.

- **Atlantic Ocean-** La Niña years see heightened hurricane activity, with more frequent and intense storms.

How the climate change is impacting ENSO?

- **Increased frequency-** Studies suggest global warming could lead to more frequent and intense El Niño events.
- **Extreme weather events-** This would affect weather patterns and climatic conditions globally, exacerbating extreme weather events.
- **Shifts in ocean conditions-** Warming oceans can alter the baseline conditions, potentially triggering more pronounced ENSO cycles.
- **WMO warning-** The World Meteorological Organization (WMO) suggests that climate change is likely to increase the intensity and frequency of extreme weather events such as severe heatwaves, droughts and storms associated with both El Niño and La Niña.

Quick facts

Indian Metrological Department

- **Launch year-** 1875.
- **Nodal ministry-** Ministry of Earth Science.
- **About-** It is the national meteorological service of the country and the principal government agency in all matters relating to meteorology and allied subjects.
- **Mausam app-** It is designed by IMD to communicate the weather information and forecasts to the general public.
- **Meghdoot agro app-** It is a joint initiative of India Meteorological Department (IMD), Indian Institute of Tropical Meteorology (IITM) and Indian Council of Agricultural Research (ICAR) that aims to deliver critical information to farmers through a simple and easy to use mobile application.
- **Damini app-** It was developed by IITM-Pune that monitors all lightning activity happening over India and alert the person if lightning is happening near the person by GPS notification under 20 km and 40 km radius.
- **UMANG-** Unified Mobile Application for New-age Governance is a Government of India *all-in-one single, unified, secure*, multi-channel, multi-platform, multi-lingual, multi-service mobile app, powered by a robust back-end platform providing access to high impact services (Current weather, city forecast, tourism forecast etc.,) of various organization

1.4 Raising Heat Stress

Why in news?

The recent study by the Centre for Science and Environment (CSE) has highlighted the escalating problem of “heat stress” in India’s major cities.

What are the key highlights of the study?

- **Increasing heat stress-** India’s megacities of Delhi, Mumbai, Chennai, Bengaluru, Kolkata and Hyderabad are experiencing worsening “heat stress.”
- **Rising relative humidity-** Over the past two decades, there has been a significant increase in relative humidity in these cities, with the exception of Bengaluru.
- **Humidity rise in cities-**Hyderabad experienced the highest rise in humidity (10%), followed by Delhi, Mumbai, Kolkata, and Chennai with increases of 8%, 7%, and 5%, respectively.
- **Urban heat island effect-** This effect causes city centers to be significantly warmer, particularly at night, than surrounding areas.
- **Warmer nights-** The study noted that land surface temperatures at night are not cooling as rapidly as they did a decade ago.
- Hot nights are especially dangerous as they prevent people from recovering from daytime heat, exacerbating heat stress.
- **Heat index-** The combination of high temperatures and humidity limits the body’s ability to cool itself through sweating, leading to higher heat indices and increased heat stress.

Urban heat island phenomenon is caused by increased built-up- areas, reduced green cover, congestion, heat absorption by urban structures, and heat generated by human activities.

- **Heat stress in Delhi-** Delhi has seen a direct correlation between increased built-up areas and rising urban heat stress.
- The city's built-up area grew from 31.4% in 2003 to 38.2% in 2022, contributing significantly to the heat problem.
- **Monsoon period heat index-** The heat index during the monsoon period was higher than in the pre-monsoon period (March to May) in all cities studied.

Heat index is a measure of how hot it feels to the human body when the air temperature and the relative humidity are combined ability to cool itself by sweating.

What are the implications of the study?

- **Heat related illness-** Higher temperatures and humidity can lead to heat exhaustion, heat stroke, dehydration, and other heat-related illnesses.
- **Reduce work productivity-** Higher temperatures can reduce worker productivity, particularly in outdoor occupations such as construction, agriculture, and manual labor.
- **Ecosystem stress-** Elevated temperatures can stress urban vegetation and wildlife, leading to reduced biodiversity and the degradation of urban ecosystems.
- **Impact on infrastructure-** It can accelerate the deterioration of infrastructure such as roads, bridges, and buildings.
- **Energy costs-** The combined effect of higher energy bills and healthcare costs can significantly impact family budgets, reducing disposable income and increasing financial stress.
- **Invest in sustainable solutions-** To mitigate these costs, there is a growing need for investment in sustainable urban planning, such as increasing green spaces, improving building insulation, and promoting energy-efficient technologies.

Major cities	Monsoon period heat index
Delhi, Mumbai and Kolkata	• Monsoon period become hotter
Chennai	• Slight cooling effect previously seen during the monsoon has disappeared,
Bengaluru and Hyderabad	• It remain somewhat cooler during this period.

What lies ahead?

- Raising public awareness about heat risks and promoting preparedness measures can help communities better cope with extreme heat events.
- Sustainable urban planning and development are crucial, emphasizing green infrastructure and the reduction of heat-absorbing surfaces to combat the urban heat island effect.

G.S PAPER II

2. INDIAN POLITY

2.1 Constitution and the redistribution of wealth

Why in news?

Supreme Court has constituted a nine-judge Bench to interpret the Directive Principles of State Policy (DPSP) with respect to ownership and control of material resources.

Constitutional provisions of wealth redistribution
<ul style="list-style-type: none"> • Preamble- It seeks to ensure social and economic justice, liberty and equality for all citizens. • Part IV- <i>Directive Principles of State Policy (DPDP)</i> outlines the governments towards achieving justice, it is not judicially enforceable. • Economic justice- It is given under Part IV of DPSP. <ul style="list-style-type: none"> ○ Article 39(b)- It states that the ownership and control of the material resources of the community should be distributed in such a way as to best serve the common good.

- **Article 39(c)**- IT aims to prevent the concentration of wealth and means of production which could be detrimental to the community.

What is the historical context of property rights in India?

Article	About
31A	It exempts certain laws from the scrutiny of fundamental rights, such as acquisition of property by the State
31B	It validates certain Acts and Regulations that are included in the Ninth Schedule of the Constitution
31C	Article 39(b) and Article 39(c) cannot be challenged on the grounds that it violates the rights granted under Articles 14 and 19
44th Amendment Act (1978)	It removed the right to property from fundamental rights to reduce litigation by property owners, thus making it a constitutional right under Article 300A.

- **Right to property**- The Constitution initially recognized the right to property as a fundamental right under Article 19(1)(f).
- **Article 31**- It also stated that the State shall pay compensation in case of private property acquisition.
- **Amendments**- Due to limited resources and the need for flexibility in land acquisition, amendments were made notably Article 31A, Article 31B, and Article 31C.
- **Judicial interpretation**- The Supreme Court has adjudicated on the balance between fundamental rights and DPSP, particularly in cases like Golak Nath case (1967), Kesavananda Bharati (1973) and Minerva Mills (1980).
- **Current status**- Right to private property remains a crucial aspect of both constitutional and legal frameworks. When the state seeks to acquire private property, it must adhere to specific principles
 - **Public purpose**- Any law allowing the state to acquire private property should serve a public purpose.
 - **Adequate compensation**- Property owners must receive fair and just compensation when their land or assets are acquired.

The Supreme Court ruled that the Constitution exists on a harmonious balance between fundamental rights and DPSP.

Overview of India's economic policies

- **Socialist model**- Post Independence, India adopted a socialist approach characterized by significant state intervention and control.
- **Land acquisition laws**- Laws were enacted by both the central and state governments to acquire land from zamindars (landlords) for public purposes, facilitating land reforms.
- **Nationalization**- Key sectors such as banking and insurance were nationalized, reflecting the state's control over important economic resources.
- **Taxation**- There were extremely high rates of direct taxes, sometimes up to 97%, along with estate duty on inheritance and a tax on wealth, aimed at redistributing wealth.
- **Regulate private enterprise**- Measures like The Monopolies and Restrictive Trade Practices Act, 1969 (MRTP Act) were implemented to regulate and restrict the growth of private enterprise, preventing the concentration of economic power.
- **Economic reforms**- During 1990s India marked a shift from a closed economy to one focused on liberalization, globalization, and privatization.
- **Industrial Policy of 1991**- A new policy aimed to empower market forces, improve efficiency, and address industrial deficiencies.
- **Legislative changes**- The Monopolies and Restrictive Trade Practices Act (MRTP Act) was repealed and replaced by the Competition Act, 2002. Additionally, income tax rates were significantly reduced.

- **Tax Reforms**- Income tax rates were significantly reduced, estate duty and wealth tax was abolished in 1985 and 2016 respectively.
- **Market driven economy**- The reforms increased government resources, helping to alleviate extreme poverty.
- **Inequality growth**- As per World Inequality Lab, as of 2022-23, the top 10% of the population held 65% of the wealth and 57% of the income, while the bottom 50% only had 6.5% of the wealth and 15% of the income.

What lies ahead?

- Growing inequality is a global challenge within liberalized open-market economies. While innovation and growth are essential, it is crucial for government to protect the interests of marginalized and economically vulnerable populations.
- Past policies, such as high tax rates, estate duties, and wealth taxes, did not always achieve their intended goals and sometimes led to hiding income or assets to avoid taxation or for other financial advantages.
- Balancing economic growth with equitable distribution is essential. Policies should be carefully framed through debate and consideration of current economic models. Ultimately, the underlying principle remains consistent: economic justice for all, as enshrined in our Constitution

2.2 Muslim inheritance laws in India

Why in news?

The Supreme Court of India will examine if former Muslims should be governed by Muslim personal law or secular laws in succession matters.

What is the case before Supreme Court?

- A petitioner representing former Muslims in Kerala, has filed a plea with the court seeking that individuals who choose not to be governed by Muslim Personal Law should have the option to be governed by secular law specifically Indian Succession Act, 1925.
- **Succession**- In India, issues related to succession are governed by the Indian Succession Act of 1925, the Hindu Succession Act of 1956 and the Muslim personal law or Shariat.
- **Sabarimala verdict**- The petitioner cited the Supreme Court's 2018 ruling in the Sabarimala temple entry case, which highlighted the right to freedom of religion under Article 25 of the Indian Constitution.
- **Shariat law**- The petitioner approached the the court seeking a declaration to not be governed by the Shariat for matters under Sections 2 and 3 of the 1937 Act.
- The petitioner claimed that the Indian Succession Act, 1925 can be applied for both intestate (without a will) and testamentary (with a will) succession.
- This plea is rooted in the right to freedom of religion as per Article 25 of the Indian Constitution.
- The case is significant as it addresses the legal challenges faced by those who leave their faith but are still subject to religious laws in personal matters.

Shariat law in question

- **Section 2**- It deals with the application of personal laws in interstate succession and special property for female, it states that the rules of decision in case where the parties are Muslims, shall be the Muslim Personal Law.
- **Shayara Bano vs Union of India**- In 2017 the Supreme Court has struck down the practice of triple talaq as unconstitutional, the court reaffirmed that Section 2 would be exclusively adopted as “the rule of decision” in matters listed under Section 2.
- **Section 3** - It provides a provision for individuals to opt for the application of Shariat law to themselves and their descendants.

Article 25 emphasizes the right to not follow any religion and the associated civil rights, such as inheritance, without facing discrimination.

What are the Muslim inheritance law in India?

Key aspects

About

Governed by	<ul style="list-style-type: none"> • Muslim personal laws in India are primarily governed by the <i>Muslim Personal Law (Shariat) Application Act, 1937</i>. • The law is primarily based on Islamic principles derived from the <i>Quran</i>, <i>Hadith</i> (sayings and actions of Prophet Muhammad), and customary practices.
Coverage	<ul style="list-style-type: none"> • The act deals with various aspects of personal life among Muslims, including marriage, succession, inheritance, and charities. • The act covers marriage (<i>Nikah</i>), divorce (<i>Talaq</i>) and maintenance (<i>Nafkah</i>).
Marriage	<ul style="list-style-type: none"> • Islamic law recognizes marriage as a <i>civil contract</i> between a man and a woman. • The essentials of a valid marriage include offer and acceptance (proposal and acceptance), competent parties (both parties must be of sound mind and have reached puberty), and witnesses.
Divorce	<ul style="list-style-type: none"> • Muslim personal law allows for various forms of divorce, including talaq (pronouncement of divorce by the husband), khula (divorce initiated by the wife), and mubarat (mutual consent divorce). • The <i>practice of triple talaq</i> where a husband could unilaterally divorce his wife by pronouncing talaq three times in one sitting declared <i>unconstitutional</i> by the Supreme Court in 2017.
Inheritance	<ul style="list-style-type: none"> • The rules of inheritance are defined under this law, where property is distributed among <i>12 categories of legal heirs</i>. • The daughters cannot inherit more than half of what their brothers inherit.
Successions	<ul style="list-style-type: none"> • Certain relatives (sharers) are entitled to fixed shares of the deceased's estate, while others (residuary) may inherit the remainder. • The act is applicable in cases of both intestate (without a will) and testamentary (with a will) succession.
Maintenance	<ul style="list-style-type: none"> • Islamic law imposes an obligation on individuals to provide maintenance to their spouses, children, and other dependents. • Maintenance may include <i>financial support</i> for basic necessities such as food, clothing, and shelter.
Adoption and guardianship	<ul style="list-style-type: none"> • Unlike Hindu law, Islamic law <i>does not recognize adoption</i> in the same way. • However, guardianship (custody) of children is an important aspect of Muslim personal law, and specific rules govern the rights and responsibilities of guardians.
Renounce faith	<ul style="list-style-type: none"> • Muslims who wish to renounce their faith are also bound by Shariat law – unless they formally declare that they wish to opt out under the 1937 Act. • But, doing so would render them <i>without a law to govern</i> aspects of inheritance and succession, because Indian Succession Act specifically excludes Muslims from its purview.
Exclusion	<ul style="list-style-type: none"> • These law does not apply to Muslims who are married under the <i>Special Marriage Act, 1954</i>. • It is not applicable in Goa, where the <i>Goa Civil Code</i> is applicable to all persons irrespective of religion. • Testamentary succession- If the subject matter of property is an <i>immovable property</i> situated in the states of West Bengal, Chennai, and Bombay, Muslims are bound by the Indian Succession Act, 1925.

What does the court decide?

- The Supreme Court, initially indicating that Muslims are governed by Shariat regardless of their beliefs, eventually agreed to hear the case.
- The court noted the absence of a secular law on wills and legacies for Muslims and directed responses from the Central and Kerala governments.

2.3 Religion-based' reservation in India

Why in news?

India is debating fundamental constitutional questions around reservation during Lok Sabha elections 2024.

Why does the Indian Constitution say on religion-based reservation?

- **Affirmative action**- The Indian Constitution provides for affirmative action measures such as reservation to address historical injustices and inequalities.
- **Articles 16(4)**- It enables the state to make any provision for reservation in favour of any backward class of citizens which is not adequately represented in the services under the state.
- **1st Amendment Act, 1951**- It inserted Article 15(4), which empowered the state to make “any special provision for the advancement of any socially and educationally backward classes of citizens or for the Scheduled Castes and the Scheduled Tribes”.
- **Religion based reservation**- The reservation based solely on religion is prohibited by Article 15, which prohibits discrimination on grounds of religion, caste, sex, race, or place of birth.
- **Constitutional provisions**- The term “only” in Articles 15 and 16 implies that if a group is socially and educationally backward, it is entitled to special provisions.
- **Muslim reservations**- Some Muslim castes received reservations because they were part of the backward class, not solely because they were Muslims.
- **Mandal commission, 1979**- It identified various socially and educationally backward classes, including certain Muslim castes, and recommended their inclusion in the OBC category. This inclusion was based on social and economic criteria rather than solely on religious identity.
- **Indra Sawhney case, 1992**- The Supreme Court ruled that any social group meeting the criteria for backwardness should be treated as a backward class, regardless of their specific identity.

The concept of religion-based reservation was initially introduced in 1936 in the Travancore-Cochin state.

What are the state level initiatives that included special provisions for Muslims?

- **Kerala**- Muslims, who constituted 22% of the population, were included within the OBCs.
- **Karnataka**- The 3rd Backward Classes Commission of the State headed by Justice O Chinnappa Reddy (1990) found that Muslims fulfilled the requirements for being considered among the backward classes.
- **Tamil Nadu**- Based on the recommendations of the 2nd Backward Classes Commission of the State headed by J A Ambasankar, the State provided within the 30% OBC quota, a sub-category of Muslims with 3.5% reservation in 2007, this did not include upper-caste Muslims.
- **Andhra Pradesh**- In 1994, the question of Muslim reservation was referred to the Andhra Pradesh Backward Classes Commission. By 2004, based on a report highlighting the backwardness of Muslims, the government provided a 5% reservation.
- **Judicial intervention** - The High Court struck down the reservation due to a lack of mandatory consultation with the Andhra Pradesh Commission for Backward Classes and absence of data for determining backwardness.
- **M R Balaji vs State of Mysore, 1962**- The High court referred to this case and stressed that social backwardness should not solely rely on caste considerations and acknowledged that the Muslim community as a whole could be socially backward in certain states.
- However, the court affirmed that reservations for Muslims do not conflict with the secular nature of the Constitution.
- In 2007, a law was enacted giving reservation to only 14 Muslim castes with occupational similarities to Hindu castes already enjoying reservation.
- This law was also struck down, and the Supreme Court's final decision on its constitutionality is pending.
- **Telangana**- After the bifurcation in 2014, the Telangana government proposed a 12% reservation for OBC Muslims based on the G Sudhir Commission's findings with the aim to address the educational and economic disparities faced by Muslims compared to other communities.
- The proposal exceeded the 50% reservation cap set by the Supreme Court and was referred to the central government for inclusion in the Ninth Schedule. However, the central government did not bring the proposal to Parliament.

- **Judiciary stand-** Some of these reservation policies have faced legal challenges, particularly regarding the criteria used for determining backwardness and the extent of reservation.
- Courts have emphasized the importance of ensuring that reservation policies are based on objective criteria and do not violate the constitutional principles of equality and non-discrimination.
- **SC/ST reservation-** The reservation for Muslims is intersected with the reservation for SCs and STs but the reservation for SCs and STs is based on historical disadvantage and social exclusion, rather than religious identity.

The Supreme Court has recognized that Muslims, like other religious groups, can be socially backward and thus eligible for reservations under Articles 15(4) and 16(4).

What are the Centre's intervention on special provisions for Muslims?

- **Justice Rajinder Sachar Committee, 2006-** It found that the Muslim community was almost as backward as Scheduled Castes (SCs) and Scheduled Tribes (STs), and more backward than non-Muslim Other Backward Classes (OBCs).
- **Justice Ranganath Misra Committee, 2007-** It suggested a 15% reservation for minorities, with 10% specifically for Muslims.
- **Executive Order, 2012-** The government issued an order providing 4.5% reservation for minorities within the existing 27% OBC quota.
- **Presidential order, 1950-** It specified that only Hindus could be included in the SC list, however Sikhs were included within SCs in 1956, and Buddhists in 1990.

Article 341 of the Constitution allows the President to specify Scheduled Castes (SCs) for each state or union territory, it also emphasizes that only Hindus are eligible for inclusion within SCs.

What lies ahead?

- While Sikhs and Buddhists were included within SCs, Muslims and Christians remain excluded.
- This exclusion raises questions about whether such reservations are based on religion, given the religious distinctions in eligibility criteria.

2.4 Governor immunity from criminal prosecution

Why in news?

Recently West Bengal Governor instructed Raj Bhavan staff to ignore any communication from Kolkata Police in connection with the sexual harassment complaint filed against him.

What does the Constitution say about criminal prosecution against Governor?

- **Article 361-** The President or the Governor is not answerable to any court the exercise and performance of the powers and duties of office.
- **Criminal proceedings-** The article says that no criminal proceedings shall be instituted or continued against the President or the Governor in any court during his term office.
- **No process to Arrest/ imprisonment-** The article ensures that no process for the arrest or imprisonment of the President or Governor shall be issued from any court during his term of office.
- **Civil proceedings-** It can be initiated against President and Governor for their personal acts after a notice period of 2 months.
- **Duration of immunity-** The immunity provided by Article 361 is limited to duration of their in office, once their term expires or they resign from their position, they can be subject to legal proceedings like any other citizen.
- **Balance of powers-** The article reflects the framers' intention to maintain a balance of powers between the executive, judiciary, and legislative branches of government.
- **Prevent interferences-** By providing immunity to certain constitutional officeholders, it aims to prevent undue interference or harassment that could impede the functioning of these offices.

What is the Supreme Court's stand on Article 361?

- **Rameshwar Prasad vs Union of India, 2006-** The Supreme Court held that the Governor enjoys complete immunity under Article 361 of Constitution.

- **Immunity from legal proceedings-** The Supreme Court has affirmed that Article 361 provides immunity to the President, Governors and Rajpramukhs from legal proceedings during their term in office.
- **Actions beyond immunity-** If a President, Governor, or Rajpramukh engages in actions beyond the scope of their constitutional authority, they may still be subject to legal proceedings.
- **Unconstitutionality-** If there is evidence to suggest that an official has acted with improper motives or has violated the Constitution, courts have the authority to intervene and ensure accountability.

• **Nebam Rebia and Bamang Felix vs Deputy Speaker, 2016-** The Court reaffirmed that the discretionary power of the Governor are subject to judicial review.

• **Recording statement-** Madhya Pradesh High Court held that the immunity under Article 361 does not extend to recording of statement of the Head of a State by the police in connection with investigation of a crime, if it is so essential.

- **Defensive role of government-** The Supreme Court has recognized that the government can defend the actions of the President, Governors, or Rajpramukhs before a judicial forum.
- However, the government must provide valid justifications and refer to the material on record to support its defense.

Constitutional provisions of Governor

- **Part VI-** It deals with the government in the states.
- **Office of Governor-** It is a feature borrowed from *Government of India Act, 1935*.
- **Articles-** *Article 153 to 167* in Part VI of the Constitution deal with the state executive.
- **State executive-** It consists of the governor, the chief minister, the council of ministers and the advocate general of the state.
- **Chief executive head-** The governor is the chief executive head of the state. But, like the president, he is a nominal executive head.
- **Agent to centre-** The governor acts as an agent of the central government.
- **7th Amendment Act, 1956-** It facilitated the appointment of the same person as a governor for two or more states

2.5 Mullaperiyar Dam Dispute

Why in news?

The Tamil Nadu government has moved the Supreme Court accusing Kerala of “crying foul” about the safety of the old Mullaperiyar dam.

What is the history of Mullaperiyar dam?

- **Location-** It is a *masonry gravity dam* in Idukki district of Kerala, where the Periyar and Mullayar rivers meet.
- **Periyar National Park-** It is located in Thekkady around the reservoir of dam.
- **Built by-** Pennycuik between 1887 to 1895.
- **Need-** To provide water to the *arid shadow region of Madurai* which was in greater need of supply of water.
- **Periyar lease deed-** The dam is operated by Tamil Nadu following an 1886 lease indenture for 999 years.
- **Post independence-** In 1947, the Kerala government said that the lease agreement was invalid and needed to be renewed.
- **Agreement renewal-** The agreement was renewed in 1970, Tamil Nadu is operating the dam and has been paying to the Kerala government.
- **Ownership-** The dam is owned and operated by *Tamil Nadu Public Work Department*.
- **Risk zone-** The dam is located in the *Seismic Zone III* area (moderate damage risk zone).
- **Issue –** There lies a bone of contention between Tamil Nadu and Kerala regarding the safety of the dam, release of water etc.,

What is the genesis of the dispute?

- **Safety of the dam-** In 1979, a problem erupted over the safety of the dam which led to a tripartite meeting that decided to bring the water level from the full reservoir level of 152 ft to 136 ft.

- **Restore dam level-** By mid-1990, Tamil Nadu started demanding restoration of the water level in the Mullaperiyar as it had completed the dam strengthening works.
- **Supreme Court verdict-** Supreme Court was approached due to lack of consensus, it allowed Tamil Nadu to raise water level of the dam to 152ft in 2006.
- **Supervisory committee, 2006-** It was constituted by Supreme Court that is empowered to oversee the repair work and allowed to take the required necessary safety measures for the benefit of both the states and the dam.
- **Irrigation and Water Conservation (Amendment) Act, 2006-** It was enacted by Kerala in response to the verdict and put in the *Schedule of 'Endangered Dams'* and fixed its maximum water level to 136ft.
- **Restrictions on Kerala-** In 2014, the apex court declared the Act unconstitutional and restrained Kerala from interfering with the rights of Tamil Nadu in raising the water level in the dam to 142 feet.



- **A.S. Anand Committee, 2010-** It was set up by the Supreme Court to look into the dispute, it was mandated to study all the aspects of the dam including its safety.
- **Hydrologically safe-** The committee declared that the dam was “structurally and hydrologically safe” and that the Tamil Nadu government could raise the water level to 142 feet after carrying out some repairs.
- **Periodic inspection-** A permanent supervisory committee is set up under Ministry of Jal Sakti based on directions of Supreme Court to oversee the process of raising the water level, inspect the dam routinely and look into the safety concerns.
- **Rule curve-** The permanent supervisory committee finalised the rule curve which is a tabulation that specifies quantum of storage of water or empty space to be maintained in a reservoir during different times of a year, based on the rainfall data for 35 years.
- **Study by IIT, Roorkee-** It was commissioned by Kerala, the study reiterated that the dam would not be able to withstand a major earthquake.

According to Tamil Nadu Water Resources Organisation, Mullaperiyar is the first reservoir to have Rule Curve implemented, in India.

Tamil Nadu's stand	Kerala's stand
<ul style="list-style-type: none"> • Lifeline of people- The dam is like a lifeline for the people of Madras Presidency for irrigation and drinking. • Hydropower generation- The dam is also significant for the generation of the power in lower Periyar water station as the region is shadow and arid. • Agriculture- The State government insists on raising the water level in the dam pointing out the failure of crops. • Full control- The government has also asserted that it has full right over the control of the dam citing the Periyar lease deed. • Periodic repairs- The State claims that though it has undertaken periodic repairs on the dam, the Kerala government has not allowed it to raise the water level. 	<ul style="list-style-type: none"> • Dam safety- The Mullaperiyar dam suffers from structural issues and the possibility of a dam-break cannot be ruled out. • Earthquake prone area- It is located in an earthquake prone area and small time earthquakes that happened in 1979 and 2011 caused some cracks in the dm. • Outdated designs- The technology which was put into use for constructing the dam 130 years ago was obsolete compared to the sophisticated construction methods used now. • Impact on livelihood- According to the UN University report, 35 lakh people in Kerala will be directly hit in the case of a dam-break. • Loss of biodiversity- It will also have its impact on the National Periyar Park which hosts some of the endangered species. • Decommission the dam- Kerala has proposed to decommission the dam and to construct new dam.

What is the recent issue?

- **No progress-** Despite the constitution of three panels, including a Supervisory Committee and two sub-committees, no significant progress has been made in finding a solution to the pending issues.
- **Failure of supervisory committee-** Tamil Nadu's grievance is that the reconstituted Supervisory Committee, despite having powers under the Dam Safety Act, 2021 has failed to ensure that Kerala permits and facilitates dam strengthening and related works.
- **Dam safety evaluation-** Tamil Nadu also emphasizes the need for a comprehensive dam safety evaluation within five years, as stipulated by the Dam Safety Act, 2021.

What lies ahead?

- Kerala prioritizes dam safety, while Tamil Nadu seeks to balance safety with water availability.
- Both states should resume bilateral negotiations, maintaining their right to legal recourse.

2.6 Speakers' power over MLA's resignations

Why in news?

A split verdict was delivered by the Himachal Pradesh High Court on whether the court can impose a timeline on the Speaker for accepting MLA resignations.

What is the case?

- The case revolves around the resignation of three independent MLAs who joined the BJP after submitting their resignations to the Speaker of the Himachal Pradesh Assembly.
- The Speaker, instead of immediately accepting the resignations, issued show-cause notices and directed an inquiry to ascertain the voluntariness of the resignations.
- The Speaker said that action could be taken under anti-defection law could be taken against the 3 independent MLAs as they joined another party before the acceptance of their resignation.
- In response to the delay in acceptance of their resignations, the three independent MLAs filed a petition in the Himachal Pradesh High Court seeking to quash the show-cause notices and prompt acceptance of their resignations.

What is Anti-defection law?

- **Anti-defection law-** It punishes individual MPs/MLAs for leaving one party for another.
- **10th Schedule-** It was added by 52nd Constitutional Amendment Act as the Tenth Schedule in 1985.
- It was a response to the toppling of multiple state governments by party-hopping MLAs after the general elections of 1967.
- **Deciding authority-** The Presiding Officer of the House is empowered to make rules to give effect to the provisions of the 10th schedule.

Type	Defection
Member of political party	<ul style="list-style-type: none"> • Voluntarily giving up the membership of political party (or) • Voting or abstain from voting in that House contrary to the direction issued by the political party
Independent candidate	<ul style="list-style-type: none"> • If an MP/MLA who has been elected as an independent candidate joins a political party later
Nominated member	<ul style="list-style-type: none"> • If nominated legislators joins a political party after 6 months of being appointed to the House

- **Role of judiciary-** The decision can be challenged before the higher judiciary.
- **Exemptions-** The law allows a group of two-third MP/MLAs to join (merger) another political party without inviting the penalty for defection.
- If a person is elected as the Speaker of Lok Sabha or the Chairman of Rajya Sabha, then he could resign from his party and re-join the party once he demits the post.
- **91st Amendment Act, 2005-** It deleted the exemption from disqualification in case of split by 1/3rd members of legislature party.

What does the law say about MLAs resignation?

Article 190

- Article 190(3)(b) of the Constitution of India outlines the process for an MLA's resignation and the subsequent vacancy of their seat.
- **Resignation process**-An MLA can resign by submitting a written resignation addressed to the Speaker or the Chairman (as applicable).
- **Vacant seat**- If the Speaker or Chairman accepts the resignation, the seat becomes vacant.
- **Speaker's discretion**- The Speaker has the authority to inquire into the resignation.
- **Acceptance**- If the Speaker is satisfied that the resignation is voluntary and genuine, they may accept it immediately.
- **Non-acceptance**-If there are doubts about the voluntariness or genuineness, the Speaker can choose not to accept the resignation.

Rule 287 of the Rules of Procedure and Conduct of Business in Himachal Pradesh Legislative Assembly

- It provides guidelines for the Speaker's powers.
- **Speaker's role**-If the resignation letter is personally handed over to the Speaker members confirm its voluntariness and genuineness, the Speaker may accept it promptly.
- Otherwise, the Speaker has discretion to withhold acceptance.

Why have the judges disagreed with each other?

Refused to direct Speaker	Court can direct Speaker
<ul style="list-style-type: none"> • The judge emphasized the Speaker's constitutional authority and refused to direct the Speaker to immediately accept the resignations of independent MLAs. • Pratap Gouda Patil vs State of Karnataka, 2019- The Supreme Court did not specify a timeline for the Speaker to address the resignations of Karnataka Assembly members. • The judge suggested that the independent MLAs, by seeking judicial intervention, were attempting to override the Speaker's role in assessing the validity of their resignations. 	<ul style="list-style-type: none"> • The other judge argued that the court could instruct the Speaker to make a prompt decision if there is an unreasonable delay. • Rajendra Singh Rana vs Swami Prasad Maurya, 2007- The Supreme Court intervened due to the Speaker's prolonged inaction over disqualification petitions. • The court could involve itself at a "pre-decisional stage" if there is inaction or indecision on the part of the Speaker.

What lies ahead?

- The case may be escalated to a larger bench of the Himachal Pradesh High Court for a final decision.
- Alternatively, the MLAs could appeal to the Supreme Court for resolution.

2.7 Right to Contest Elections

Why in news?

Recently a Khalistani separatist Amritpal Singh, lodged in a jail in Assam's Dibrugarh, is contesting as an independent candidate in Lok Sabha election.

What is the legal status of right to vote?

- **Article 326**- This article provides that the right to vote shall be based on universal adult suffrage, meaning that all citizens who are 18 years of age or older have the right to vote, regardless of their religion, race, caste, or gender.
- **Representation of People's Act, 1951**- Section 62(5) of the Act prohibits individuals from voting in elections if they are confined in prison, whether under a sentence of imprisonment or otherwise, or are in lawful police custody.
- **Supreme Court verdict on Section 62(5)**- It upheld the constitutionality of Section 62(5), the court reasoned that the restriction is reasonable to keep persons with a criminal background away from the election scene.

An exception is provided for those in preventive detention.

- **Indira Gandhi v Raj Narain, 1975**- The Supreme Court recognised that free and fair elections are a part of the basic structure of the Constitution of India, and any laws or policies that would violate this principle could be struck down.
- **Kuldip Nayar v. Union of India, 2006**- It held that the right to vote (or the right to elect as it was called) is “pure and simple, a statutory right”. This means that voting is not a fundamental right and can be repealed.

What is the legal status of right to be elected?

- **Representation of People Act, 1951**- Section 8 deals with disqualification on conviction for certain offenses.
- **Section 8**- If a person is convicted of any of the offenses listed in the provision, they will be disqualified from contesting elections to Parliament or state legislatures.
- **Applicability**- The disqualification begins from the date of conviction and lasts for 6years from the date of their release.
- **Post conviction**- This disqualification applies only after a person has been convicted, not during the period when they are merely charged with criminal offenses.
- **Court stand on Section 8**- There have been challenges to this provision, including petitions seeking disqualification for individuals facing criminal charges or filing false affidavits regarding their criminal history.
- However, the courts have ruled that only the legislature can alter the RP Act.
- **Power of ECI**- Under Section 11 of the Representation of the People Act, 1951 (RP Act), the Election Commission of India (ECI) has the authority to “remove” or “reduce” the period of disqualification.
- **Exception**- In some cases, disqualified MPs or MLAs can still contest elections if their conviction is stayed on appeal to a higher court.

Supreme Court verdict on Section 62(5)

- In the case of Anukul Chandra Pradhan, Advocate, Supreme Court v. Union of India (1997), the Supreme Court rejected a challenge to Section 62(5) citing several reasons:
 - Voting rights are statutory and can be subject to limitations.
 - Resource constraints, including infrastructure and police deployment, play a role.
 - A person in prison due to their conduct cannot claim equal freedom of movement, speech, and expression.
 - Restricting prisoners’ voting rights is reasonable to keep individuals with criminal backgrounds away from the election process

Quick facts

Electoral system in India

- The electoral system in India is governed by Articles 324 to 329 of Part XV of the Indian Constitution.
- The Parliament has the power to adopt laws concerning elections to the Parliament and the State Legislature, according to the Constitution.
- **Article 324**- It establishes the Election Commission of India as the country's watchdog for free and fair elections.
- **Legislative framework**- In this context, the Representation of the People Act (RPA), 1950, and the Representation of the People Act, 1951, were enacted by Parliament.
- It governs elections to the Houses of Parliament and the Houses of the State Legislature, as well as the qualifications and disqualifications for membership in those Houses.
- It also governs the conduct of such elections and the resolution of doubts and disputes.

3. GOVERNMENT POLICIES AND INTERVENTIONS

3.1 Streamlining the Pharma Sector

Why in news?

India's drug regulator CDSCO has withdrawn powers delegated to State licensing authorities to issue NOCs (no objection certificates) for manufacture of unapproved, banned or new drugs for export purposes.

Picture of India's Pharma Industry

- From being import-dependent in the 1960s to now meeting 20% of global generics demand, the Indian pharmaceutical industry has rightfully earned India the title of **'Pharmacy of the World'**.
- The Indian Pharmaceutical industry is currently ranked
 - 3rd in pharmaceutical production by volume
 - Largest producer of generic drugs globally
- According to a recent report by Asian Lite, India accounts for 13 % of the global pharma market.
- **Global vaccine supply**- It meets 62% of the overall demand, at least 70% of WHO's vaccines are sourced from India.
- **Essential vaccines**- It provides vaccines such as DPT, BCG (primarily used against tuberculosis) and measles vaccine.
- The Pharma sector currently contributes to around 1.72% of the country's GDP.
- **Market size**- It is expected to reach US\$ 65 billion by 2024, and US\$ 130 billion by 2030.
- **Export**- India is the 12th largest exporter of medical goods in the world.



What will be the impact of CDSCO's move?

- **Aim**- To create a more standardized and efficient process for manufacturers and exporters.
- **Improve exports**- The move aligns with India's broader vision of the pharmaceutical sector, which includes ambitious targets such as reaching exports of 450 dollar billion by 2047.
- **Global player**- By improving regulatory oversight and ensuring compliance with quality standards, the government aims to enhance the reputation of Indian pharmaceutical products in international markets.
- **Uniform protocol**- By bringing uniformity in protocols, India can enhance its reputation as a reliable supplier.
- **Foster efficiency**- It can help reduce delays and administrative burdens for industry players, enabling them to focus more on innovation, research, and development.
- **Self-reliance**- It would make India a more competitive player in the global pharmaceutical market, driving economic growth and supporting the country's aspirations for self-reliance in this crucial sector.
- **Entry of generic drugs**- As several drugs are expected to go off-patent, this presents an opportunity for the entry of generic products.

Central Drug Standard Control Organisation (CDSCO)

- **About**- It is the apex drug regulatory framework.
- **Governed by**- Drugs and Cosmetics Act, 1945.
- **Ministry**- Directorate General of Health Services under Ministry of Health and Family Welfare
- **Role**
 - Ensures safety, efficacy and quality of the medical product manufactured, imported and distributed in the country.
 - Regulates the market authorization of new drugs and clinical trials standards.
 - Supervises drug imports and approves licenses to manufacture the products.
- **Drug Controller General of India (DCGI)**- It is within CDSCO that regulates pharmaceutical and medical devices

What are the challenges faced by the pharma sector in India?

- **Concern with IPR-** India has faced scrutiny and legal challenges related to its patent laws and intellectual property rights regulations, particularly regarding the production and export of generic drugs.
- **Lack of research-** India is a major player in generic drug manufacturer but still it lags behind in original research and development.
- **Regulatory compliance-** Compliance with regulations can be challenging and may require significant resources and expertise.
- **Ambiguity-** Changes in domestic and international laws, trade agreements, and political landscapes can impact the pharmaceutical industry.
- **Price-controls-** Government-imposed price controls ensure affordable healthcare but can impact the profit margins of pharmaceutical companies.
- **Import dependency-** India relies heavily on foreign nations for intermediates and active pharmaceutical ingredients (APIs), making it vulnerable to price fluctuations and supply disruptions.
- **Quality concerns-** India has faced issues such as WHO investigation into [contaminated cough syrups](#) linked to child fatalities in Gambia.

What lies ahead?

- Investing in R&D is crucial for the long-term competitiveness of the industry and for fostering innovation in drug discovery and development.
- The need of the hour is meeting stringent regulatory standards, both domestically and in international markets which is essential for ensuring the safety, efficacy, and quality of pharmaceutical products.
- The challenges must be addressed effectively by collaboration between industry stakeholders, government bodies, regulatory agencies, and research institutions.
- Aligning strategies with the evolving needs of the global pharmaceutical market is essential for success.

3.2 Draft Digital Competition bill

Why in news?

India proposes a new law to prevent anti-competitive practices by tech giants like Google, Facebook, and Amazon.

What are the key proposals of draft digital competition bill?

- **Aim-** To curb market dominance by tech companies and prevent anti-competitive practices before they occur, drawing inspiration from European Union's Digital Market Act.
- **Predictive regulation-** The bill introduces a forward-looking, preventive, and presumptive law (an ex ante framework) to foresee potential harms that can arise from antitrust issues and prescribes pre-determined no-go areas.
- **Associate Digital Enterprises (ADEs)-** The bill aims to regulate not just the primary tech giants but also their associated companies within a conglomerate.

Criteria for SSDEs	
Key aspects	About
Turnover	• A company must have a turnover in India of at least Rs 4,000 crore or a global turnover of 30 billion dollars in the last three financial years.
Global market capitalization	• It should be at least 75 billion dollars.
User base	• It should be at least 1 crore end users or 10,000 business users for their core digital services.
Prohibited activities for SSDEs	
Self preferencing	• Giving their own services preferential treatment over those of competitors
Anti-steering	• Preventing or discouraging users from using or switching to competing services
Restricted third party applications	• Limiting the ability of third-party applications to interact with their platform

- **Criteria for ADE designation-** If a subsidiary or related entity benefits from data collected by a core service of the conglomerate, it could be designated as an ADE.
- **Obligation-** Once designated, ADEs would be subjected to the same regulatory obligations as SSDEs.
 - Example: Google Maps could be designated as an ADE if it benefits from data gathered by Google Search.
- **Systematically Significant Digital Enterprise (SSDE)-** The bill proposed that the Competition Commission of India (CCI) should designate companies as SSDE based on various quantitative and qualitative parameters.
- **Penalty-** If the provisions are violated it could result in fines of up to 10% of the company's global turnover.

What are the concerns raised by tech companies regarding the bill?

- **Compliance burdens-** The ex ante requirements might impose significant compliance burdens, diverting resources from innovation and research to regulatory compliance.
- **Operational efficiency-** Industry executives are worried about the operational impact of such regulations.
- **Concerns with EU's Digital Markets Act-** It has led to a significant increase in the time required for basic operations, such as finding information via Google search.
- **Arbitrary definitions-** There is concern over the broad definitions of significant platforms and the discretionary power given to the Competition Commission of India (CCI) in designating SSDEs and ADEs.
- **Impact on startups-** Critics fear this could lead to arbitrary decision-making and potentially impact startups.
- **Impact global competitiveness-** As firms navigate complex regulatory landscapes, they might struggle to compete with counterparts in regions with more flexible regulatory frameworks.
- **Regulatory uncertainty-** Companies may be unsure about their status and obligations under the new law, leading to hesitancy in business expansion and investment.
- **Impact on venture investments-** Internet and Mobile Association of India (IAMAI) argues that the ex ante regulatory framework proposed by the bill could deter venture investments in tech startups.
- **Impact scalability-** IAMAI argues that the stringent thresholds and pre-emptive regulations might limit the scalability of businesses, as these rules could act as a ceiling on growth potential.

Competition Commission of India would designate the firms as SSDE and ADE

What is the stand of the government?

- **Historical anti-competitive practices-** Government argue that tech giants have a history of engaging in anti-competitive practices.
- **Fine on Google-** The fine imposed on Google (Rupees 1,337 crore) by the Competition Commission of India (CCI) for its anti-competitive behavior in the android ecosystem serve as evidence of ongoing issues.
- **Foster digital competition-** Innovation is largely confined to a few major tech companies, primarily from the US.
- **High market barriers-** It is created by dominant players which make it difficult for new entrants to challenge their supremacy.

3.3 GANHRI's ratings for India

Why in news?

Recently the UN recognised Global Alliance of National Human Rights Institutions (GANHRI) has deferred National Human Rights Commission's accreditation for the second time in the row.

What is Global Alliance of National Human Rights Institutions?

- **Launch year-** In 1993 at Tunis, Tunisia as the International Coordinating Committee of National Human Rights Institutions, it later got changed to GANHRI in 2016.

- **Headquarters-** Geneva, Switzerland.
- **Vision-** A world where everyone and everywhere fully enjoy their human rights.
- **Tripartite partnership-** GANHRI-UNDP-OHCHR (Office of the United Nations High Commissioner for Human Rights) aims to strengthen NHRIs in their capacity to promote and protect human rights, individually and through their regional and global networks resulting in increased fulfilment of human rights for all people.

Status	About
A status	<ul style="list-style-type: none"> • It is granted to NHRIs that are in <u>full compliance</u> with the Paris Principles • They are entitled to <u>vote or hold office</u> in the GANHRI or its regional groups
B status	<ul style="list-style-type: none"> • It is given to NHRIs that <u>partially comply</u> with the Paris Principles. • Institutions with B status can participate in GANHRI meetings but are <u>unable to vote</u> or hold governance positions

- **Members-** 115 National Human Rights Institutions (NHRIs) from all regions of the globe and provides leadership and support in the promotion and protection of human rights.
- **Uniqueness-** It is the only non-UN body whose internal accreditation system is based on compliance with the 1993 Paris Principles that grants access to UN committees.
- **Paris Principles, 1993-** It is the set of international standards which frame and guide the work of NHRIs, it was adopted by UN General Assembly (UNGA).
- **Rating-** The rating is based on the subcommittee consisting of one A status NHRI representative from each of the regional networks.
- **Sub-Committee on Accreditation-** It is a peer review process for initial accreditation, and re-accreditation every five years is managed by the subcommittee.
- **India's status-** GANHRI has deferred National Human Rights Commission's reaccreditation due to concerns regarding its compliance with the Paris Principles.

India being accredited in 1999 had retained its A ranking in 2006 and 2011, while its status was deferred in 2016 and restored after a year.

What are the concerns raised by GANHRI?

- **Lack of diversity-** There is a lack of representation from marginalized groups, and the selection process does not maximize the inclusion of candidates from various backgrounds.
- **Gender disparity-** Despite recommendations to ensure at least 1 woman in its leadership, the NHRC has historically failed to achieve significant gender representation.
- **Opaque appointment process-** The process for appointing members to the NHRC is not transparent, raising questions about the fairness and integrity of the selections.
- **Limited cooperation-** The commission has been criticized for not engaging constructively with NGOs and Human Rights Defenders (HFDs) which is essential for effective human rights advocacy
- **Conflict of interest-** The involvement of police personnel in investigations may lead to biases and conflicts of interest.
- **Inadequate response-** NHRC is perceived as being ineffective in addressing and responding to increasing human rights violations.

National Human Rights Commission	
<ul style="list-style-type: none"> • Established year- 1993. • Governed by- The statute under which it is established is the <u>Protection of Human Rights Act</u> (PHRA), 1993 as amended by the Protection of Human Rights (Amendment) Act, 2006. • Paris Principles- It is in conformity with the Paris Principles, adopted as the 1st international workshop on national institutions for the promotion and protection of human rights held in Paris in 1991, and endorsed by the UN General Assembly in 1993. • Section 2(1)(d)- PHRA defines human rights as rights relating to life, liberty, equality and dignity of the individuals guaranteed by the Constitution or embodied in the International Covenants and enforceable by the courts in India. • HRCNet portal- It is developed by NHRC with technical assistance from <u>National Informatics Centre</u>, it can be used by all Human Rights Commissions in the country for online complaints lodging/tracking systems and handling of complaints received offline(by hand, by post etc.) 	

Consequences of losing 'A' rating

- **Lose voting rights-** The NHRC would no longer have voting rights within GANHRI.
- **Loss of representative role-** It would also lose its role as a representative at the United Nations Human Rights Council.
- **Diminish influence-** It would reduce India's influence in international human rights forums.
- **Impact on credibility-** The credibility and effectiveness of human rights protections within India could be undermined.

What lies ahead?

- The need of the hour is to address the key concerns raised by GANHRI as it is crucial for India to maintain its 'A' rating and ensure robust protection and promotion of human rights.
- Substantial reforms in the appointment process, greater independence from government influence, enhanced engagement with civil society and improved diversity are the essential steps towards restoring the credibility and functionality of the NHRC.

4. GOVERNANCE

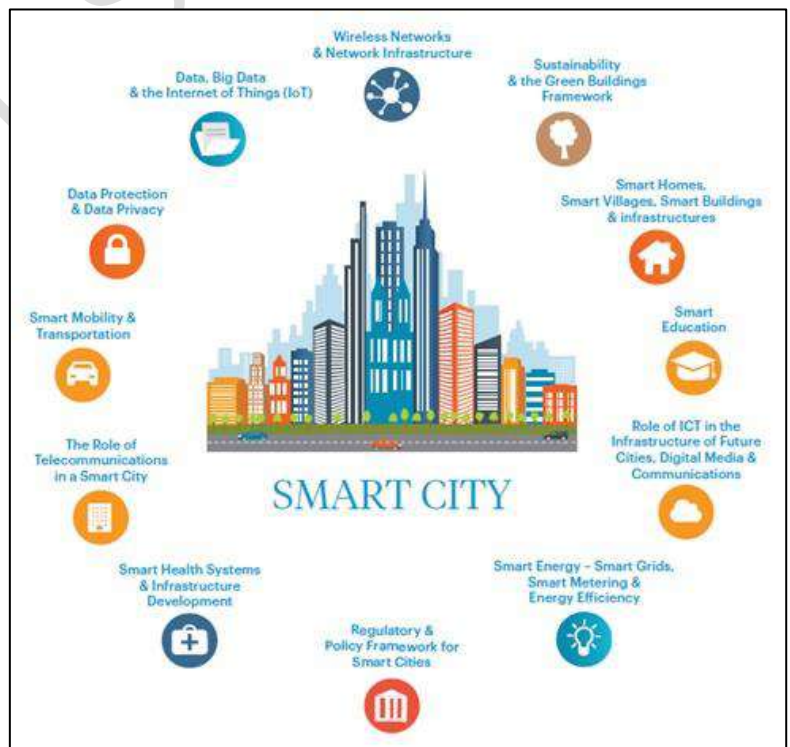
4.1 Smart Cities Mission

Why in news?

The Smart Cities Mission (SCM) has experienced a shift in focus within the political landscape, particularly in the context of recent elections and government priorities.

What is Smart Cities Mission?

- **About-** A smart city in the context of the mission is one that has basic infrastructure, utilizes 'smart' solutions to improve infrastructure and services, and relies on area-based development.
- **Launch year-** 2015
- **Implementation-** By Ministry of Housing and Urban Affairs.
- **Fund-** The Mission is operated as a Centrally Sponsored Scheme.
- **Aim-** To drive economic growth and improve quality of life through comprehensive work on social, economic, physical and institutional pillars of the city.
- **Focus-** The focus is on sustainable and inclusive development by creation of replicable models which act as lighthouses to other aspiring cities.
- **Pan-India solutions-** The mission employs strategies like pan-city initiatives where at least one smart solution is applied city-wide.
- **City selection process-** Cities are selected through a competitive process that emphasizes cooperative and competitive federalism, with each city constructing its vision of a smart city aligned to its local context. with other government
- **Convergence-** The mission seeks convergence programs like AMRUT, Smart Bharat Mission, Digital India and Skill Development for holistic urban development.
- **Integrated Command and Control Centre (ICCC)-** They are designed to enable authorities to monitor the status of various



100 cities have been selected to be developed as Smart Cities by 2024 through a two-stage competition.

amenities (water, power supply, traffic movement, city connectivity and internet infrastructure, etc.) in real time.

- **Assessment of indices**- It also assesses various indices to track urban development such as the Ease of Living Index, Municipal Performance Index, City GDP framework, Climate Smart Cities assessment framework etc.,

What are the challenges of Smart Cities Mission?

- **Flawed city selection process**-The competitive selection of 100 cities for the mission failed to adequately account for *dynamic nature of urbanization* in India, resulting in a mismatch between project objectives and local needs.

- **Exclusionary approach**- The focus on developing only a small % of a city's geographical area led to *neglected needs of marginalized communities* and areas within cities that require urgent attention.

- **Fund deficit**- The allocated funds were insufficient compared to the estimated capital expenditure required to make Indian cities *liveable by 2030*.

- **Concern with governance structure**-The use of Special Purpose Vehicles (SPVs) for smart city governance was criticized for being *top-down* and not aligned with the *74th Constitutional Amendment*, which emphasizes decentralization and local self-governance.

- **Displacement**- The execution of smart city projects resulted in the displacement of marginalized communities such as street vendors and disruption of urban commons.

- **Social impact**- The focus on infrastructure development may have *neglected social issues*, exacerbating inequalities within cities.

- **Unintended environmental consequences**- The projects led to *enhanced urban flooding* as they have altered water channels and contours in certain towns made them more vulnerable to flooding.

What lies ahead?

- Tailoring smart city projects to address the specific needs, priorities, and characteristics of each urban area can lead to more effective and sustainable outcomes.
- Governments must prioritize investment in urban infrastructure, technology, and human capital to support long-term sustainable development.
- Establishing *inclusive and participatory governance* structures is critical for ensuring that smart city initiatives reflect the diverse interests and perspectives of urban residents.
- The need of the hour is to prioritize environmental sustainability and social equity in urban development initiatives.

Features	About
Objective	<ul style="list-style-type: none"> • To promote cities that provide core infrastructure, clean and sustainable environment • Give a decent quality of life to their citizens through the application of smart solutions.
Area based development	<ul style="list-style-type: none"> • Retrofitting- City improvement • Redevelopment- City renewal and • Greenfield development- City extension
Key focus areas	<ul style="list-style-type: none"> • Construction of walkways, pedestrian crossings, cycling tracks • Efficient waste-management systems • Integrated traffic management and assessment
Fundamental principles of smart cities	<ul style="list-style-type: none"> • Community at the Core • More from less • Co-operative and Competitive Federalism • Integration, Innovation , Sustainability • Technology as a means • Convergence

4.2 Aviation sector in India

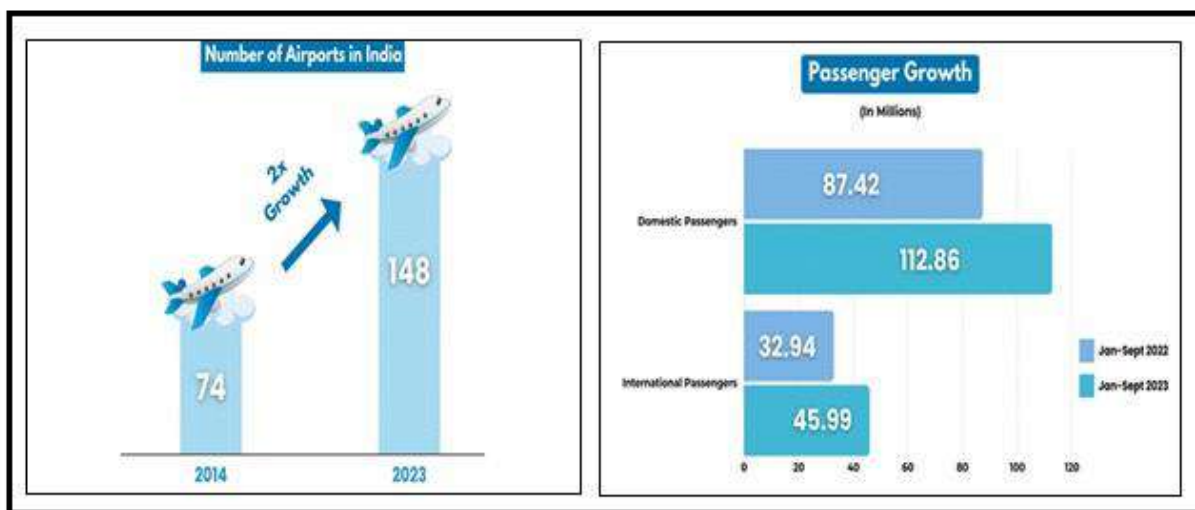
Why in news?

India has one of the fastest-growing aviation sectors, with very serious safety issues.

What is the status of Aviation Sector in India?

- **Growth**- India's aviation industry has experienced significant growth in the past 9 years.
- **Aviation market**-India has become the third-largest domestic aviation market in the world and is expected to overtake the UK to become the 3rd-largest air passenger market by 2024.
- **GDP contribution**-Indian aviation also contributed 5% of the GDP, creating a total of 4 million jobs. In addition to it, there is a 72 billion dollars gross value-added contribution to GDP by this industry.
- **Increase in operational airports**- The number of operational airports in the country has doubled from 74 in 2014 to 148 in April 2023.

The International Air Transport Association (IATA) projects that India will become the world's 3rd largest civil aviation market by 2026.



- **Increase in passengers**- The number of domestic passengers has also doubled from 60 million in 2014 to 143 million in 2020, and the number of international passengers has increased by almost 50%.

What are the concerns?

- **Lack of trained pilots** - There is a shortage of trained pilots, which can impact safety and cause delays.
- **Safety concerns**- Aircraft Accident Investigation Bureau has recommended for Runway End Safety Area at Kozhikode's Karipur airport following an air crash in 2020, this recommendation is still not implemented.
- **Inadequate airline infrastructure** - Airport infrastructure needs to be upgraded to handle the increase in air passengers, and aircraft need to be periodically maintained.
- **Complex regulatory framework** - The regulatory framework involves multiple agencies, which can lead to unclear policies and delays in obtaining permits.
- **High fuel costs** - Fuel costs are high due to high taxes on Air Turbine Fuel (ATF), and operating larger aircraft on long-haul routes is expensive.
- **High training costs** - Training costs are high, and training facilities are outdated, which can lead to a skills mismatch.
- **Financial stress** - It would have meant a drop in income by almost 50% for a young pilot who has invested over a crore of rupees to obtain his licence to fly.

What should be done?

- **Adopt ICAO standards** - India should adopt the ICAO Standard, allows a member state to recognise another ICAO licence and issue an Indian licence on the basis of only an Air Law examination and a Class I medical.
- **Experienced captains** - There will be hundreds of qualified and experienced Indian captains working abroad who will return to India if the hurdles are demolished.

India's airport capacity is expected to handle 1 billion trips annually by 2023

- **Instructor as pilot** - The DGCA, in collusion with airline management pilots, has a rule that makes it mandatory for an instructor or an examiner to be an active pilot.
- However, they will accept a retired pilot working in a training centre abroad to carry out the mandatory checks on Indian pilots.
- **Retired pilots** – They can be utilised for simulator training. Such a step will also release a large number of trained pilots for active flying.
- **Reforms in all sectors**- It is critical to understand that for passenger airlines to grow, there have to be reforms in all areas of aviation - air cargo, airports, aviation fuel taxes and Maintenance, Repair and Overhaul (MRO).
- **Updated laws**- India's Aircraft Act, 1934 and Aircraft Rules, 1937 need to be updated to keep pace with modern technology in aerospace, increasing costs to the industry and ultimately affecting passenger growth.
- **Overhaul DGCA** - India's statutory regulatory authority, the Directorate General of Civil Aviation (DGCA), needs to be modernized, well-staffed, motivated and incentivized.

Regional Connectivity Scheme (RCS) - UDAN (Ude Desh ka Aam Nagrik)

- **Aim**- To bring essential air travel access to previously isolated communities and boost regional economic development.
- **Operational plan**- UDAN intends to ensure equitable access to air travel for all Indians with a *ten-year* operational plan.
- **Growth of aviation industry**- It is contributing to the growth of the civil aviation industry as four new & successful airlines have come up in the last 6 years.
- **Sustainable model**- The scheme has helped airline operators to begin operations and develop a sustainable business model.
- **Entrepreneurship**-It is providing opportunities to small regional airlines to scale up their businesses and their successful run is evidence of the fact that the scheme is creating an amiable ecosystem conducive to airline business.

Quick facts

International Civil Aviation Organization (ICAO)

- **About**- It is a *United Nations Specialized Agency* with the motto of "Safe Skies Sustainable Future".
- **Established year**- 1944.
- **Member countries**- 193 member states cooperate together and share their skies to their mutual benefit, India is a member of ICAO.
- **Innovation in aviation**- It recognizes that innovations carry significant potential in improving aviation safety, efficiency, security, facilitation, environmental sustainability, and economic development of air transport.
- **ICAO Carbon Emission Calculator (ICEC)**- It allows passengers to estimate the emissions attributed to their air travel, it is the *only internationally approved tool* to estimate carbon emissions from air travel.
- **Fatigue Risk Management System**- ICAO has mandated FRMS as a mandatory requirement.
- **CORSIA**- Carbon Offsetting and Reduction Scheme for International Aviation is the first global market-based measure for any sector and represents a cooperative approach that moves away from a "patchwork" of national or regional regulatory initiatives.
- **International Civil Aviation Day**- It is celebrated on *December 7*, the theme for 2023 is "Advancing Innovation for Global Aviation Development"

4.3 Road Safety

Why in news?

The recent Pune Porsche case has reignited the concern surrounding hit-and-run accidents in India.

Road Accidents in India Report 2022

- **Area of accidents** - 32.9% in National Highways, 23.1% in Road Highways and 43.9% in other roads.
- **Rural Vs Urban** – About 69% happened in rural areas and around 32% in urban areas.
- **Age group** – 66.5% of young adults (18-45 years of age).
- **Type of users** – 44.5% of 2-wheelers followed by 19.5% of pedestrians.
- **Vehicles involved** – Two-wheelers tops for the 2nd consecutive years followed by light vehicles.
- **Vulnerable States**- In 2022, Tamil Nadu topped in number of road accidents followed by Madhya Pradesh and Uttar Pradesh topped in number of fatalities due to road accidents followed by Tamil Nadu.

What are the challenges of road safety in India?

- **Drunk driving:** Driving under the influence of alcohol or drugs is a leading cause of road accidents.
- **Distracted Driving-** The use of mobile phones and other distractions while driving increases the risk of accidents.
- **Non-compliance-** Aggressive driving behaviors such as overtaking dangerously, not obeying traffic signals, and lane indiscipline.
- **Poor road infrastructure-** The poor condition of roads along with low visibility and subpar road design and engineering, including the quality of materials and construction.
- **Vehicular condition-** Old vehicles are more likely to experience frequent breakdowns, malfunctions, and lack safety features.
- **Overloading of vehicles-** It could pose a hazard to road traffic, increasing the risk of accidents for both themselves and other road users.
- **Driving without licenses-** Easy access to driving licenses without a thorough assessment of skills and driving without them is a major contributing factor to the increase in road accidents.
- **Inadequate law enforcement-** Although laws and regulations for ensuring road safety are in place but enforcement is often lacking, allowing offenders to escape accountability for their actions.
- **Lack of awareness-** Most road accident cases occur due to carelessness or lack of awareness, making road safety education essential for survival.

Global initiatives on road safety

- **Brasilia Declaration on Road Safety, 2015-** Under the declaration, the countries plan to achieve SDG 3.6, which is to halve the number of global deaths and injuries from road traffic accidents by 2030.
- India is a signatory to the declaration and is committed to a reduction in fatalities.
- **Decade of Action for Road Safety 2021-2030-** The UN General Assembly adopted resolution “Improving global road safety” with the ambitious target of preventing at least 50% of road traffic deaths and injuries by 2030.
- The Global Plan aligns with the Stockholm Declaration, by emphasizing the importance of a holistic approach to road safety.
- **Bloomberg Initiative for Global Road Safety (BIGRS) 2020-2025-** It aims to reduce road crash fatalities and injuries in low and middle-income countries and cities by implementing a comprehensive set of actions that are proven to save lives

What are the steps taken by India to promote road safety?

- **Motor Vehicle Amendment (MVA) Act 2019-** It provides for the constitution of the National Road Safety Board to advise the Central Government or State Government, on all aspects pertaining to road safety and traffic management.
- **Vehicle Scrapping Policy-** Ministry of Road Transport and Highways has formulated the policy based on incentives/dis-incentives and for creating an ecosystem to phase out older, unfit polluting vehicles.
- **National Road Safety Policy-** Based on the recommendations of the *Sunder Committee* the policy initiatives to be framed/taken by the Government at all levels to improve road safety activities in the country.

- **e-DAR project**- Electronic Detailed Accident Report (e-DAR) project has been initiated to establish a *central repository* for reporting, management, and analysis of road accident data across the nation.
- **Good Samaritan law**- The law protects good samaritans from harassment on the actions being taken by them to save the life of the road accident victims.
- **India State Support Programme for Road Safety**- The World Bank has approved loan for 7 States under which a *single accident reporting number* will be set up to better manage post-crash events.

Good Samaritan is a person who renders emergency medical or non-medical assistance to a victim at the accident scene.

What lies ahead?

- It is crucial to establish a proper driving licensing system to ensure standardised driving skills.
- Regular, professional enforcement of rules and swift and innovative solutions to traffic indiscipline and bottlenecks by the administration could help evolve a healthy safe-road culture.

5. HEALTH

5.1 Cancer cases in India

Why in news?

A recent study warned that the number of people who have cancer expected to rise exponentially over the next two decades, with India as the cancer capital of the world.

What are the key findings of the study?

Key Findings

- **Non-communicable diseases** - The study found that Non Communicable Diseases comprised 63% of all deaths in India.
- **Rise in numbers** - India recorded 13.9 lakh cancer cases in 2020 and the number is set to rise to 15.7 lakh by 2025, a 13% increase in 5 years.
- **Vulnerable**- Those suffering cancer are also tend to skew younger. Around 30% of colon cancer patients in India are under the age of 50.
- **New cases** - Around 10 lakh new cases of cancer are diagnosed in India each year. Of these, around 4% are children.
- **Low screening** - Despite these facts and figures, cancer screening in India remains an afterthought. Just 1.9% of people are screened for breast cancer in India.
- A mere 0.9% of people are screened for cervical cancer in India. That number is 73% in the US, 70% in the UK, and 43% in China.

What is cancer?

- Cancer is a disease where cells grow uncontrollably and spread to other parts of the body.
- **Common type of cancers** - Breast, cervix, and ovarian cancer are the most common forms of cancer affecting women and among men, they are lung cancer, mouth cancer, and prostate cancer.
- **Leading site of cancers**-
 - Male- Lung cancer
 - Female- Breast cancer
 - Childhood (0-14 year)- Lymphoid leukaemia (boys- 29.2% and girls- 24.2%)

World Cancer Day is observed every year on February 4. In India, November 7 is considered the National Cancer Awareness Day.

What are the factors contributing cancer?

- **Tobacco use** - Smoking and secondhand smoke exposure are the most significant risk factor for cancer.
- **Obesity** - Being overweight or obese increases the risk of 13 types of cancer.

- **Climate change** – Climate change with exposure to ultraviolet radiation, air pollution etc.,
- **Human papillomavirus (HPV)** - HPV causes almost all cervical cancers and several other types of cancer.
- **Other factors** - Advancing age, Unhealthy diets, Immunosuppression, Radiation and Genetic disorders.

At present, 1 in 3 Indians is pre-diabetic, 2 in 3 are pre-hypertensive, and 1 in 10 struggles with depression.

What are the challenges?

- **Shortage of facilities** - There is a shortage of pediatric oncology facilities in the country, particularly in government-run hospitals. Only 41% of public hospitals have dedicated pediatric oncology departments.
- **Lack of funds** - A lack of funds and access to care, as well as social stigma, are big hurdles for many affected families.
- **Infrastructure deficit** - Diagnosis, access to care and medications and follow-up are difficult and there is a lot of abandonment of treatment as the parents cannot afford treatment.
- **Low screening rates** – It poses a significant challenge for the fight against cancer, and stressed the importance of preventive health care measures.

Steps taken by government to mitigate cancer in India

- **National Cancer Control Program (NCCP)** - To reduce cancer deaths and cases, and improve the quality of life of cancer patients, launched in 1974.
- **Health Minister's Cancer Patient Fund (HMCPF)** - This fund provides up to Rs 2 Lakhs in assistance to patients living below the poverty line who are receiving cancer treatment at one of 27 Regional Cancer Centers (RCCs).
- **National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS)** - It set up NCD Clinics at the district and CHC levels to provide early diagnosis, treatment, and follow-up services for common NCDs.
- **National Cancer Institute** - It is a state-of-the-art Tertiary Cancer care cum Research Institute constructed at the AIIMS Jhajjar campus.
- **Homi Bhabha Cancer Hospital & Research Centre, Punjab**- It aims to provide world class cancer care to the residents of Punjab and neighboring states and union territories (UTs).
- **Centre for Integrative Oncology**- It has been established as a joint venture of All India Institute of Ayurveda (AIIA) and National Institute of Cancer Prevention and Research (NICPR-ICMR) with the intention of collaborative research activities in cancer.
- **Koita Centre for Digital Oncology**- It has been established by the *National Cancer Grid (NCG)* to promote use of digital technologies and tools to improve cancer care across India.
- **Pradhan Mantri Jan Arogya Yojana (PM-JAY)** - Chemotherapy and Radiotherapy packages, along with surgical oncology are covered as part of cancer treatment in the empanelled hospitals under the scheme.
- **Ayushman Bharat Health and Wellness Centers (AB-HWCs)**- Screening of 3 common cancers i.e. oral, breast and cervical, along with other common NCDs, is an integral part of service delivery under the AB-HWCs.
- **Pradhan Mantri Swasthya Suraksha Yojana (PMSSY)**- Significant focus on Oncology in its various aspects has been ensured in the new AIIMS that are being established under the program.
- **Strengthening of Tertiary Care for Cancer Scheme**- It is implemented by Central government to enhance the facilities for tertiary care of cancer.
- **CERVAVAC**- India has launched its first indigenously developed vaccine, “CERVAVAC” for the prevention of cervical cancer.
- **NexCAR19 CAR-T therapy**- It is India’s first indigenously Made-in-India CAR-T therapy which is the world’s most affordable CAR-T therapy and it puts India firmly on the global map of advanced cell and gene therapy.

What lies ahead?

- The government should incentivize screening as a first measure and support research activities for cancer detection and treatment.
- There is also a need for policies to impart financial protection and expand the screening and curative services for cancer.

- Government funds should be increased via schemes to access the health care effectively and awareness about the cancers should be wide spread to control the numbers in future.

5.2 Menstrual Hygiene in Prison

Why in news?

India has witnessed a promising shift in the landscape of menstrual hygiene management over the years.

Status of menstrual hygiene in prisons

- The National Family Health Survey (NFHS 2019-2020) revealed that about 8 out of 10 young women aged 15-24 years in India are now using safe menstrual hygiene products.
- Women in Indian prisons- They face injustice due to societal bias and systemic neglect.
- As per National Crime Records Bureau, there are 23,722 women in Indian prisons, with 77% in the reproductive age group (18-50 years).
- A study in Maharashtra prison revealed that water, sanitation and hygiene facilities failed to meet women prisoner's demands.

What are the challenges faced by women in prisons with respect to menstrual hygiene?

- **Accessibility-** Availability of sanitary napkins has been inconsistent across different prisons, and their quality has been unsatisfactory.
- **Health care services-** Female prisoners often face inadequate access to healthcare services including reproductive health.
- **Overcrowding-** This increased the poor conditions within prison making it challenging for incarcerated women to manage menstruation with dignity.
- **Societal bias-** Society often views prisoners as unworthy of fundamental rights, female prisoners face additional stigma due to unrealistic standards of female purity.
- **Quality constraints-** Prison authorities often depend on donated sanitary napkins, leading to substandard products and insufficient supply.
- **Policy paralysis-** National Menstrual Hygiene Policy acknowledges the needs of female prisoners but however it lacks a comprehensive action plan specifically tailored for prisons.

What are the steps taken by India to promote menstrual hygiene?

- **Menstrual hygiene scheme-** It aims to improve access to menstrual hygiene products for women across the country. It has contributed to raising awareness and promoting safe practices.
- **Suraksha suvidha napkins-** The government has launched 100% oxy-biodegradable sanitary napkin called Suvidha they are available at Jan Aushadhi Kendras (government-run pharmacies).
- **SABLA program-** The Scheme for Adolescent Girls is implemented by Ministry of Women and Child Development, it has incorporated awareness generation on menstrual hygiene as an important initiative to improve health, nutrition, and empowerment for adolescent girls
- **National Menstrual Hygiene Policy, 2023-** The draft policy emphasizes to prioritize equity to enable all menstruating individuals, regardless of their socioeconomic status and geographical location, to have equal opportunities to access and manage their menstruation in a safe and hygienic way.
- **Menstrual Hygiene Management-** The Ministry of Health and Family Welfare has prioritized MHM as a part of National Health Mission and the RMNCH+A strategy.

Goal 6.2 of the Sustainable Development Goals advocates explicitly for "access to adequate and equitable sanitation and hygiene for all, paying special attention to the needs of women and girls and those in vulnerable situations"

What can be done to promote MHM in prison?

- **Uniform implementation-** The government must ensure that every state adheres to the recommendations of the 2016 Model Prison Manual, particularly those concerning menstrual hygiene.

- **Holistic approach-** Public health authorities and prison administrators should collaborate to develop a comprehensive strategy ensuring access to adequate menstrual hygiene products and facilities, prioritizing the health and dignity of incarcerated women.
- **Foster research-** There is an urgent need for empirical research to understand the current state of menstrual hygiene within prisons, providing data to inform policy and improve conditions.
- **Inclusive policy making-** The National Menstrual Hygiene Policy should include concrete plans for prisons and involve key stakeholders such as the Ministry of Home Affairs to address menstrual hygiene management effectively within prison systems.

WHO on menstrual hygiene

- To recognize and frame menstruation as a health issue, not a hygiene issue – a health issue with physical, psychological, and social dimensions.
- To recognize that menstrual health means that women and girls and other people who menstruate, have access to information and education about it.
- To ensure that these activities are included in the relevant sectoral work plans and budgets, and their performance is measured.

What lies ahead?

- While progress has been made, a more comprehensive approach is necessary to safeguard the menstrual health of incarcerated women.
- Advocacy, awareness and targeted interventions is the need of the hour.

6. BILATERAL ISSUES

6.1 India-Nepal Relations

Why in news?

The new government in India in June 2024 could consider offering Nepal a new and holistic development road map.

What is the history of relations between India and Nepal?

- **Historical ties-** India and Nepal share close and friendly relations characterized by age-old historical and cultural linkages, open border and deep-rooted people-to-people contacts.
- **Diplomatic relation-** The two countries established diplomatic relations in 1947.
- **Neighbourhood first policy-** India’s foreign policy focuses on centrality of neighbours, it stems from clear understanding that a peaceful periphery is essential for India to achieve for multifarious development.
- **Political relations-** The frequent high level visits by the leaders of the two countries at different points of time and the interactions constitute the hallmark of the ties between the two countries.
- **Trade-** Nepal is India’s 11th largest export destination which constituted 2.34% of India’s exports.
 - **Main imports from India-** Petroleum products, iron and steel, cereals, vehicles and parts, machinery parts.
 - **Major export to India-** Soyabean oil, Spices, Jute fiber & products, synthetic yarn and tea.
- **Defence cooperation-** The ‘Indo-Nepal Battalion-level Joint Military Exercise Surya Kiran is conducted alternately in India and in Nepal.
- **Operation Maitri-** In the wake of the 2015 earthquake in Nepal, India was the first responder and carried out its largest disaster relief operation in Nepal.

The India-Nepal Treaty of Peace and Friendship of 1950 forms the bedrock of the special relations that exist between India and Nepal.



- **Energy cooperation-** Both have a *Power Exchange Agreement since 1971* for meeting the power requirements in the border areas of the two countries, taking advantage of each other's transmission infrastructure.

- **Education- *Sampark India-Nepal Alumni network*** was launched in 2021, it seeks to bring Nepali alumni and students presently pursuing studies in India together on a common platform to establish a vibrant alumni network.

- **BBIN Motor Vehicles Agreement (MVA)-** Nepal is a partner in this agreement, it permits the member states to ply their vehicles in each other's territory for transportation of cargo and passengers.

Initiative	About
Swami Vivekananda Centre for Indian Culture at Kathmandu in 2007	• To showcase the best of Indian culture
Nepal-Bharat Library was founded in 1951 in Kathmandu	• It is regarded as the <i>1st foreign library in Nepal</i> with the objective to enhance and strengthen cultural relations and information exchange between India and Nepal.
B.P. Koirala India-Nepal Foundation	• It was set up in 1999 through an MoU signed between both countries.

- **Mahakali treaty, 1996-** Implementation of Pancheshwar Multipurpose Project is the centerpiece of the treaty.
- **People to people exchange-** India and Nepal extend visa-free entry in their respective territories to each other's nationals.
- **Sister city agreements-** With a view to strengthen people to people exchanges, sister city agreements have been signed
 - Kathmandu-Varanasi
 - Lumbini-Bodhgaya
 - Janakpur-Ayodhya and
 - India-Nepal Ramayana Circuit
- **COVID-19 assistance-** India's efforts to ensure uninterrupted supply of Medical Oxygen to Nepal as well as in maintaining normal trade flows through border points even during the peak of the pandemic has been greatly appreciated in Nepal.

BBIN is Bangladesh, Bhutan, India and Nepal MVA for the regulation of passenger, personal and cargo vehicular traffic

What are the changes faced by Nepal due to China's influence?

- **Economic influence-** China has been increasing its economic footprint in Nepal through investments, infrastructure projects, and trade. Projects like the Belt and Road Initiative (BRI) have provided Nepal with avenues for economic development and connectivity.
- **Chinese investments-** It has invested in Nepal's infrastructure, such as roads, bridges, and hydropower projects which offer alternatives to Indian investments and aid.
- **Strategic cooperation-** Nepal's growing strategic alignment with China can create perceptions of a shift in its traditional geopolitical orientation towards India.
- **Security concerns-** Increased Chinese presence in Nepal, especially in strategic sectors like defense and infrastructure, may raise security concerns for India.
- **Strategic cooperation-** It has been cultivating closer ties with Nepal on strategic fronts, including defense and security cooperation, this strategic alignment can influence Nepal's security policies and outlook, potentially impacting its relationship with India.
- **Diplomatic support-** It often provides diplomatic support to Nepal on international platforms potentially altering the dynamics of regional diplomacy.
- **Aggressive China-** China's assertive stance and its strategic interests in Nepal challenge India's traditional influence in the region, potentially exacerbating tensions and complicating Nepal's domestic politics.

What lies ahead?

- India's approach to its relationship with Nepal must carefully balance its interests with respect for Nepal's sovereignty and the aspirations of its people.

- While offering development assistance and promoting cross-border projects can foster goodwill and stability, India must avoid appearing heavy-handed or interfering in Nepal's internal affairs.

6.2 India's stakes in Iran's Chabahar port

Why in News?

India and Iran recently signed a 10-year contract for the operation of a Shahid Beheshti terminal at the Chabahar port in Iran.

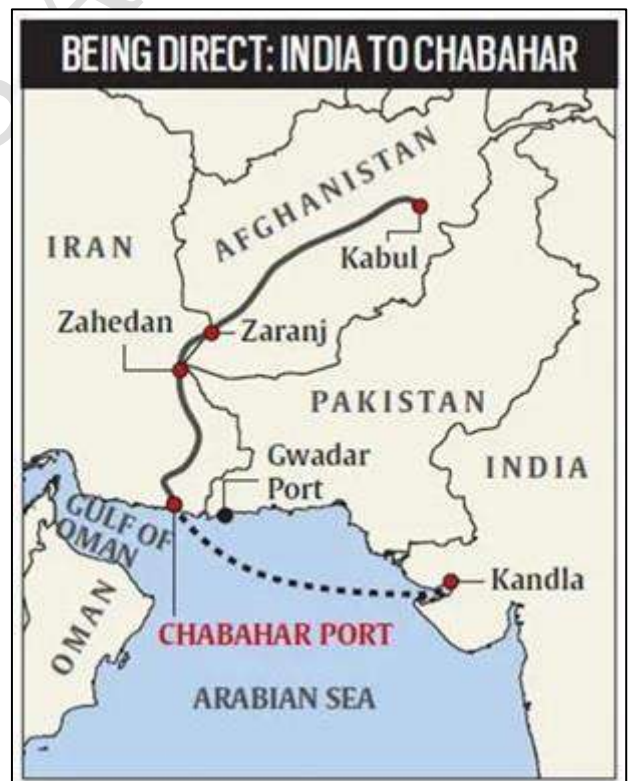
Where is Chabahar port located?

- **About-** It is a deep-water port in Sistan-Balochistan province of Iran, on the Gulf of Oman.
- **Ports-** It consists of two separate ports
 - Shahid Kalantari
 - Shahid Beheshti.
- **Geographical proximity-**The port is closer to Afghanistan, Pakistan, India and International North-South Transport Corridor (INSTC) gives it the potential to develop into one of the most important commercial hubs.
- **Chabahar day-** Maritime India 2021 celebrated March 4, 2021 as "Chabahar Day", this signifies the strategic importance of the port to India.

It serves as Iran's only deep sea oceanic port.

What are the stakes of India?

- **Strategic investment-** In 2013, India committed to investing 100 million dollars towards the development of Chabahar port. A Memorandum of Understanding to develop the port is signed in May 2015.
- **Trilateral agreement-** In 2016, a trilateral agreement to establish the International Transport and Transit Corridor (Chabahar Agreement) is signed by India, Iran, and Afghanistan.
- **Objectives of the agreement-**
 - India was granted a 10-year lease to develop and operate two terminals and five berths, access to the Chabahar free trade zone.
 - India got the opportunity to build the 628 km rail line from Chabahar to Zahedan, just across the border from Afghanistan.
- **Assistance-** India has so far supplied 6 mobile harbour cranes two with a lifting capacity of 140 tonnes each and 4 with a capacity of 100 tonnes.
- **New Delhi declaration-** India and Iran signed a long-term contract for the operation of its Shahid Beheshti Port terminal.
- **Long term contract-**The contract is signed by **India Ports Global Ltd (IPGL) and Iran's Ports and Maritime Organisation (PMO).**
- **Replaced 2016 agreement-**The new pact that signed recently replaces a 2016 agreement, which covered India's operations at Shahid Beheshti terminal in Chabahar port and was renewed annually.



This is the 1st time India will take over the management of an overseas port.

What is the significance of the Chabahar port for India?

- **Counter mechanism** – It is serving as India's counter to the Pakistan's Gwadar Port and China's Belt and Road Initiative.

- **Geostrategic location-** Chabahar port has geographic proximity to countries such as Afghanistan, Pakistan, and India.

- **Access Afghanistan-** India can bypass Pakistan which does not allow India land access for trade with Afghanistan and Central Asia.

- **Infrastructure development-** The Zaranj-Delaram road constructed by India in 2009 can give access to Afghanistan's Garland Highway, setting up road access to four major cities in Afghanistan - Herat, Kandahar, Kabul and Mazar-e-Sharif.



- **Gateway to Central Asia-** It will boost India's access to Iran, the key gateway to the International North-South Transport Corridor (INSTC) that has sea, rail and road routes between India, Russia, Iran, Europe and Central Asia.

- **Counter China-** It will be beneficial to India in countering Chinese presence in the Arabian Sea which China is trying to ensure by helping Pakistan develop the Gwadar port.

Gwadar port is located in Pakistan and is less than 400 km from Chabahar by road and 100 km by sea.

- **Defence ally-** The port being developed and operated by India, Iran also becomes a military ally to India.
- **Reduce import bill-** There will be a significant boost in the import of iron ore, sugar and rice to India.

- The import cost of oil to India will also see a considerable decline.

INSTC is a multi-modal transportation project linking the Indian Ocean and Persian Gulf to the Caspian Sea via Iran, and onward to northern Europe via St Petersburg in Russia.

- **Connectivity hub-** It will ensure in the establishment of a politically sustainable connectivity between India and Afghanistan leading to better economic ties between the two countries.

- **Diplomatic engagement-** The port could be used as a point from where humanitarian operations could be coordinated.

7. INTERNATIONAL ISSUES

7.1 India's trade with Israel and Iran

Why in news?

India-Israel trade has doubled in the last five years, while the value of India-Iran trade came down in the same period.

What is the India-Iran-Israel trade dynamics?

Key aspects	India-Israel trade	India-Iran trade
Trade volume	<ul style="list-style-type: none"> • A robust growth has been experienced over the past 5 years, doubling from 5.56 billion dollars in 2018-19 to 10.7 billion dollars in 2022-23. 	<ul style="list-style-type: none"> • India's trade with Iran has seen fluctuations in recent years, with bilateral trade reaching 2.33 billion dollars in 2022-23.
Trade components	<ul style="list-style-type: none"> • Major exports to Israel- Diesel, diamonds, aviation turbine fuel, radar apparatus, Basmati rice, T-shirts, and wheat. 	<ul style="list-style-type: none"> • Major exports to Iran- It is primarily focused on agricultural goods and livestock products.

	<ul style="list-style-type: none"> • Major imports to India- Space equipment, diamonds, potassium chloride, mechanical appliances, turbo jets, and printed circuits 	<ul style="list-style-type: none"> • Major imports to India- Methyl alcohol, petroleum bitumen, liquified butanes, apples, liquified propane, dates, and almonds.
Trade surplus	<ul style="list-style-type: none"> • India maintains a <i>significant trade surplus</i> with Israel, with exports outweighing imports, resulting in a surplus of 6.13 billion dollars in India's favor in 2022-23. 	<ul style="list-style-type: none"> • India also maintains a trade surplus with Iran, with exports exceeding imports by about 1 billion dollars in 2022-23.
FDI	<ul style="list-style-type: none"> • Israel's FDI in India is relatively low, accounting for just 0.4% of total FDI inflows, while Indian firms have invested more in Israel. 	<ul style="list-style-type: none"> • Iran's FDI in India is minimal, recorded at just 1 million dollars, while India is involved in infrastructure development in Iran, particularly the <i>Shahid Beheshti Port</i> at Chabahar.

To know about Iran-Israel conflict click [here](#)

How could Middle East tensions impact the Indian economy?

- **Tension in Middle East-** Houthis, *Yemen*-based militants have fired at some ships passing through Red sea says it is in opposition to Israel's military action in the Gaza Strip, while Israel accuses Iran of backing the Houthis.
- **Red sea crisis-** Red sea is in conflict due to ongoing Gaza war impact that could lead to shipping disruptions, which might worsen India's trade issues.

Red Sea is a vital trade route connecting Europe and Asia, with about 12% of global trade passing through it.

- **Longer shipping route-** Due to the conflict, some ships have been forced to take longer routes around the Cape of Good Hope, which could potentially lead to higher oil and gas prices globally.
- **Trade disruption-** The conflict between Iran and Israel could exacerbate India's trade problems due to shipping disruptions in the Red Sea.
- **Higher transit time –** Trade with Europe, the U.S. east coast and to North Africa is taking the longer route and thus elongating both export and import cycles.
- **Increase in freight costs –** It may affect all consignments by up to 6-fold in some cases which may also be due to peak season surcharge and contingency surcharge.



- **Higher fuel burning –** Long route ships could burn a million dollars' worth of fuel per trip.
- **Impact on crude oil production-** While major crude oil producers like the USA, Russia, and North Sea operators are not directly involved in the conflict zone, disruptions in the Red Sea could affect global oil and gas prices.
- **Rise in petrol prices-** As per think tank *Global Trade Research Initiative (GTRI)*, there is unlikely to be any rise in petrol prices in India as a result of ongoing tensions in the Middle East.
- **Government intervention-** In India, any potential rise in petrol prices could be offset by government measures such as reducing taxes, minimizing the impact on consumers.
- **Halt in strategic developments-** India's development of the *Shahid Beheshti Port* in Iran, could also be affected by the ongoing tensions and conflicts in the region.

- **Delay in economic projects-** The instability in West Asia could delay or halt projects like the **Middle East-Europe Economic Corridor** (IMEC), affecting long-term economic plans and cooperation.

Quick facts

Middle East-Europe Economic Corridor	
• About-	It is a network of transport corridors that aims to foster connectivity and economic integration between South Asia, Arabian Gulf and Europe.
•	It is a part of the Partnership for Global Infrastructure Investment (PGII).
• Member countries	- India, the US, Saudi Arabia, the European Union, the UAE, France, Germany and Italy.
• Route	- IMEC will consist of 2 distinct corridors <ul style="list-style-type: none"> ○ Eastern corridor- It links India to the Arabian Gulf, ○ Northern corridor- It links the Arabian Gulf to Europe.
• Connectivity-	The corridor will include a rail link as well as an electricity cable, a hydrogen pipeline and a high-speed data cable.
• Green bridge-	The project is also called as “a <i>green and digital bridge</i> across continents and civilizations.”
• Significance	- It is being positioned as a <i>modern-day Spice Route</i> , and <i>alternative to China’s Belt and Road Initiative</i> .
•	The corridor also extends India’s reach to North Africa and North America.

7.2 India’s view on Middle East

Why in news?

For India, a US-Saudi Arabia pact and peace between Israel and Iran and Israel and Hamas could mean an opportunity to better harness the region’s potential.

What is the relation between India and Saudi Arabia?

- **Diplomatic relationship** - The two countries established diplomatic relations in 1947 and 2021-22 marked 75 years of establishment of diplomatic relations.
- **Strategic ties-**

Key initiatives	Outcome
Delhi declaration in 2006	• It was a watershed moment in India – Saudi Arabia relationship.
Riyadh declaration in 2010	• It elevated bilateral ties to a strategic relationship.
Strategic Partnership Council (SPC) Agreement in 2019	• It established a <i>high-level council</i> to steer the Indo-Saudi relationship.

- **Trade-** India is the *2nd largest trade partner* for Saudi, while Saudi is India’s *4th largest trade partner*.
- **Economic corridor-** India, Saudi Arabia, UAE and USA jointly announced the India-Middle East-Europe Economic Corridor (IMEC).
- **Energy cooperation-** Saudi is India’s *3rd largest crude and petroleum* products sourcing destinations in 2022-23.
- **Defence-** Two editions of the bilateral naval exercise, Al Mohed al Hindi, have been concluded so far.
- **Operation Kaveri-** Saudi Arabia supported in evacuation of Indian nationals stranded in Sudan through Jeddah.

IMEC is a massive infrastructure project that would connect India to Europe via West Asia, and could rival China’s Belt and Road Initiative.

- **Diaspora-** The Indian community is *more than 2.4 million* and is the largest expatriate community in the Kingdom.

What is the relation between India and Israel?

- **Political relations-** India recognised Israel in 1950 and full diplomatic relations were established after the opening of embassies in 1992.
- **Trade ties-** India is Israel's 2nd largest trading partner in Asia, and the 7th largest globally with a robust growth that has been experienced over the past 5 years.
- **Multilateral cooperation-** '*I2U2*' group, which has been called the "*West Asian Quad*", comprises of India, Israel, the U.S., and the UAE.
- **Operation Ajay-** It was launched by the Indian government to repatriate *Indians from Israel and Palestine* through special chartered flights.
- **Support for Kargil war-** Israel supported India with arms during the Kargil conflict in 1999.
- **Israel Hamas conflict-** India believes in its long-standing support for the establishment of a "sovereign, independent and viable" state of Palestine. India has expressed its support for Israel condemning the terrorist attack by Hamas.
- **Defence-** Israel has been a major supplier of defence equipment, as well as of high-tech communications systems that have helped meet some of India's security tech challenges.
- **Innovation partnership-** Israel is an important partner to India in the innovation ecosystem – smart irrigation systems being an example of cooperation in this field.



What are the potential for India in Middle East?

- **Strategic partnerships-** India has strengthened bilateral ties with countries in the region, including Saudi Arabia, Israel, and Turkey. Long-standing connections to Iran further enhance India's position.
- **India-Middle East-Europe Economic Corridor-** The ambitious project aims to foster connectivity and economic integration between Asia, the Persian Gulf, and Europe.
- **Look West policy-** India intensified its existing "Look West" policy focusing on the Arab Gulf countries, Israel and Iran, the goal was to strengthen economic ties, enhance strategic partnerships and foster regional stability.
- **Regional stability-** The US-Saudi mega deal would normalize relations between Saudi and Israel which could lead to a more stable Middle East, beneficial for India's regional interests and its diaspora in the Gulf countries.

US-Saudi mega deal involves US, Saudi Arabia and Israel to support Israel against Hamas and Iran, which could lead to significant shift in Middle East relations.

What are the challenges faced by India in Middle East?

- **Stalled project-** The ongoing Israel Hamas war has caused a stall in the plans for this ambitious connectivity project, which aims to link India with Europe via the Gulf.
- **Balancing relations-** India strives to maintain a delicate balance between supporting Israel and fostering strong ties with Arab nations but this has become more complex with the intensification of conflicts in the region.
- **Israel Hamas conflict-** The recent terrorist attacks by Hamas and the retaliatory military response from Israel have posed difficult challenges for India's diplomatic strategy, especially considering India's significant diaspora and trade relations in the region.
- **Lack of security presence-** India's lack of security presence in Middle East has led to costly evacuations of its diaspora during crises, such as the evacuation from Kuwait during the Gulf War.

INSTC is an initiative taken by India, Russia, and Iran, aiming to enhance trade and transport connectivity among countries along its route

- **Geopolitics of corridor-** IMEC involves US allies like the UAE and Saudi Arabia, which are economic powerhouses, whereas *International North-South Transport Corridor* (INSTC) involves Iran and Russia, which have been at odds with the US.

What lies ahead?

- India’s strategic choices must navigate geopolitical complexities and safeguard investments
- India will welcome a durable peace in the Middle East, with a stronger American presence in the region it considers its extended neighbourhood.
- The US-Saudi mega deal will provide India with an opportunity to better harness the region’s potential and foster a conducive environment for its strategic and economic goals.



G.S PAPER III

8. ECONOMY

8.1 Strengthening of Rupee

Why in news?

From 2014, the rupee has depreciated by 27.6% against the US dollar, from Rs 60.34 to Rs 83.38.

What is currency depreciation?

- **Currency depreciation-** It refers to a decrease in the value of a country's currency relative to other currencies in the foreign exchange market.
- It means that the currency can buy fewer units of another currency or goods and services in international markets.

Key aspects	Depreciation	Devaluation
About	• It implies the dip in the value of currency in relation to other currencies, due to market forces.	• It means the fall in international value of home currency in terms of other currencies due to government intervention.
System	• It exists under flexible exchange rate system	• It exists under fixed exchange rate system
Process	• Automatic	• Deliberate
Occurs due to	• Market demand and supply factors	• Government intervention

- **Trade imbalance-** If India's imports exceed exports, there is higher demand for foreign currencies (like the US dollar) to pay for these imports, this increased demand for foreign currency that can lead to depreciation of the domestic currency.
- **Differential inflation rates-** If India's inflation rate is higher than that of its trading partners, the purchasing power of the rupee decreases relative to other currencies.
- **Interest rate differentials-** If interest rates in the US are higher than in India, investors may seek higher returns by investing in US assets. This can increase demand for US dollars, causing the rupee to depreciate.
- **Market speculation-** Investor perceptions of India's economic and political stability, as well as global economic trends, can influence currency markets.

The types of effective exchange rate are Nominal Effective Exchange Rate (NEER) and Real Effective Exchange Rate (REER).

- **Capital flows**- In times of uncertainty or when there are better investment opportunities abroad, capital may flow out of India, increasing demand for foreign currencies and putting downward pressure on the rupee.
- **External factors**- Events such as changes in global oil prices, geopolitical tensions (Russia-Ukraine war, Israel Hamas conflict etc.) or monetary policy decisions by major central banks can also impact the value of the rupee against the US dollar.
- **Effective Exchange Rate (EER)**- India trades with countries other than US, hence the strength or weakness of rupee is a function of its exchange rate with not just US dollar but also with other global currencies.

How does effective exchange rate impact trade?

- The EER is an index of the weighted average of the rupee's exchange rates vis-à-vis the currencies of India's major trading partners.
- The currency weights are derived from the share of the individual countries to India's total foreign trade, just as the weights for each commodity in the CPI are based on their relative importance in the overall consumption basket.

NEER	REER
<ul style="list-style-type: none"> • It is a measure of the value of India's currency against a weighted average of several foreign currencies. • It is calculated using nominal exchange rates, which are the actual exchange rates in the foreign exchange market without adjusting for inflation. • It reflects changes in the external value of the currency relative to its trading partners • It is useful for understanding how a country's currency is performing in international trade without considering inflation differentials. 	<ul style="list-style-type: none"> • It adjusts NEER for inflation differentials between India and its trading partners • It takes into account both nominal exchange rates and relative price levels (<i>inflation rates</i>) between the India and its trading partners. • By factoring in inflation, REER provides a more accurate measure of a country's currency's real purchasing power in international markets • It helps assess whether a country's currency is overvalued or undervalued in real terms by comparing its current value to a base period value adjusted for inflation.

Impact on Exports

- **Depreciation**- A depreciation of the domestic currency (a decrease in its value relative to other currencies) can make *exports cheaper* for foreign buyers.
- This is because foreign buyers need to spend less of their own currency to purchase goods and services denominated in the depreciated currency.
- Therefore, a weaker exchange rate (both NEER and REER) tends to boost exports by enhancing their competitiveness in international markets.
- **Appreciation**- It can make *exports more expensive* for foreign buyers, potentially leading to a decrease in export competitiveness.

BASIS	DEPRECIATION	APPRECIATION
Meaning	It refers to decrease in the value of domestic currency in relation to foreign currency.	It refers to increase in the value of domestic currency in relation to foreign currency.
Causes	(1) Increase in demand (2) Decrease in supply	(1) Decrease in demand (2) Increase in supply
Effect on Exports	It leads to increase in exports because more goods can be purchased with the same amount of currency.	It leads to decrease in exports because less goods can be purchased with the same amount of currency.
Effect on Imports	It leads to decrease in imports because the domestic country needs to pay more to get the same amount of goods and services.	It leads to increase in imports because the domestic country will have to pay less to get the same amount of goods and services.

Impact on imports

- **Depreciation**- It makes imports more expensive for domestic consumers, this is because domestic consumers need to exchange more of their own currency to purchase goods and services denominated in foreign currencies.
- As a result, a weaker exchange rate (both NEER and REER) tends to reduce imports by increasing their costs for domestic consumers.
- **Appreciation**- It makes imports cheaper for domestic consumers, potentially leading to an increase in import levels.
- Overall, while both NEER and REER influence a country's trade balance by affecting the competitiveness of exports and the cost of imports, REER provides a more accurate assessment by considering inflation differentials.

8.2 Generalised System of Preferences

Why in news?

The US Generalised System of Preferences (GSP) have not been renewed since its expiration in 2020.

What is Generalised System of Preferences?

- **Preference receiving countries-** It is a preferential tariff system extended by developed countries to developing countries.
- **US GSP-** It is the largest and oldest United States trade preference programme, this arrangement allows *concessional or zero tariff imports* from developing countries into the US.
- **Aim-** To promote economic development by *eliminating duties on some products* it imports from the 120 countries designated as beneficiaries.
- **Procedure-** The US government selects a *group of poor countries* and a set of products and offers these countries lower-than-normal tariffs than it applies to imports from all other World Trade Organization countries.
- **USTR-** US Trade Representative makes *annual reviews* about the types of commodities to be selected under GSP and the countries to be benefited.

Developed countries including the US, EU, UK, Japan etc., gives GSPs to imports from developing countries.

What is the significance of GSP?

For Developing countries	For Developed countries
<ul style="list-style-type: none"> • Market access- It provides developing countries with preferential access to developed markets by reducing or eliminating tariffs on a wide range of products. • Economic growth- Increased exports can lead to higher production levels, job creation, and overall economic development. • Diversification- It encourages developing countries to diversify their economies by promoting the export of non-traditional goods and services, reducing reliance on a limited range of products or markets. • Investment attraction- Preferential access to developed markets can make beneficiary countries more attractive to foreign investors, who are drawn by the opportunity to produce goods for export under favourable conditions. • Capacity building- It often include criteria that encourage beneficiary countries to improve labour standards, environmental practices, and intellectual property rights. 	<ul style="list-style-type: none"> • Affordable imports- By lowering tariffs on imports from developing countries, GSP helps reduce costs for consumers and businesses in developed countries. • Supply chain diversification- It allows developed countries to diversify their supply chains, reducing dependency on a single source or country. • Strategic partnerships- It can strengthen diplomatic and economic ties between developed and developing countries, fostering better international relations and cooperation. • Promotion of standards- It encourages global improvement in labour rights, environmental protection and intellectual property that aligns with international standard and values. • Economic development- Supporting the economic growth of developing countries through GSP can contribute to global economic stability and reduce poverty, aligning with the broader goals of international development and cooperation.

What is the strategic benefits of renewing GSP?

- **Provide framework for negotiations-** With the renewal of GSP, the U.S. and India can negotiate terms that enhance trade in goods and services, enforce internationally accepted labour rights, restrict child labour, enforce environmental laws, and promote good regulatory practices.
- **Strengthen economic ties-** A renewed GSP could serve as a platform for *increased investments* in critical and emerging technologies, from smartphone manufacturing to semiconductor production, ensuring regulatory stability and business ease.
- **Enhance bilateral trade-** GSP renewal could significantly *elevate the U.S.-India trade* relationship from the current 200 billion dollars level.
- **Align strategic interests-** As both countries play collaborative roles in the *Indo-Pacific*, a strengthened trade relationship through GSP would underscore their mutual commitment to economic and strategic partnership.
- **Offset the absence of FTAs-** U.S. is reluctant to negotiate *Free Trade Agreements*, therefore GSP stands out as the most effective tool for advancing U.S.-India trade relations in the near term.

What lies ahead?

- Renewing the GSP program is not just about reducing tariffs but about sending a strong message of commitment to a deeper, more strategic economic partnership.
- It would provide the necessary framework to elevate U.S.-India trade to new heights, ensuring mutual benefits and reinforcing their roles as key collaborators in the global economy.

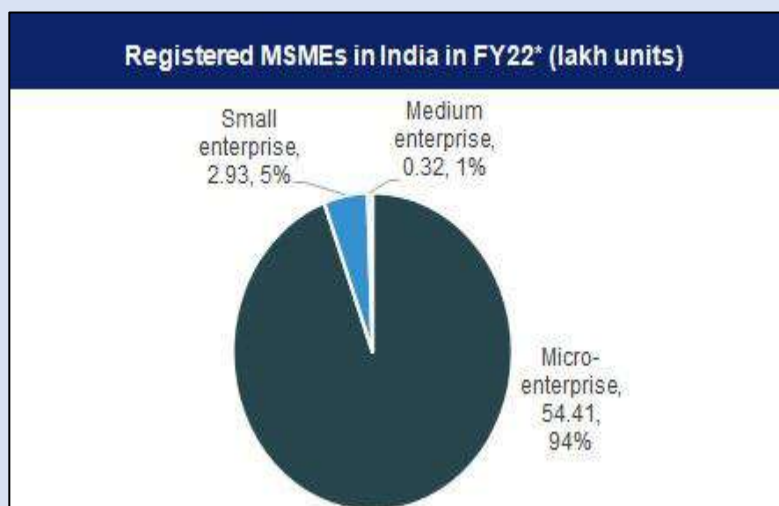
8.3 Challenges with MSME classification

Why in news?

The recent government order mandating timely payments to MSMEs has marginalized smaller enterprises in the shorter term

Status of MSME sector

- Micro Small and Medium Enterprises (MSMEs) serve as the ‘backbone of Indian economy’ and the ‘growth engines of the country’.
- **Increased growth**-The number of MSMEs in the country is expected to grow from 6.3 crore, to 7.5 crore in the coming times, growing at a projected CAGR of 2.5%.
- The top 5 states in Udayam registration is Maharashtra, Tamil Nadu, Uttar Pradesh, Gujarat, Rajasthan.
- **Women empowerment**- Women owned MSMEs constitute 20.5% of Udyam Portal registrations, contributing 18.73% to employment and 10.22% to turnover.
- **Significant contributor**-MSMEs contribute about 30% to India’s GDP and around 45% to the manufacturing output.
- **Employment generation**-They provide employment to over 110 million people, playing a vital role in job creation.
- **Export contribution**- MSMEs contribute around 48% to India’s total exports, boosting foreign exchange earnings.
- **MSME definition**- A revision was announced in Atmanirbhar Bharat package in 2020.



Classification	Investment in Plant and Machinery or Equipment	Annual turnover
Micro	Not more than Rs 1 crore	Not more than Rs 5 crore
Small	Not more than Rs 10 crore	Not more than Rs 50 crore
Medium	Not more than Rs 250 crore	Not more than Rs 250 crore

What is the issue with MSME definition?

- **Impact of revised definition**- It aimed to prevent firms from underreporting revenues to qualify for micro-enterprise benefits.
- **Skewed distribution**- National Sample Survey Organisation’s Unorganised Enterprise Survey 2016 found that 95% of surveyed enterprises still reported revenues under Rs 50 lakh per annum, highlighting a skewed distribution and the need for a more nuanced classification.
- **Need of sub-classification**- Annual Survey of Industries data also indicates that a significant majority of enterprises have annual revenues under Rs 50 lakh which demonstrates that most micro-enterprises are on the lower end of the revenue scale, highlighting the need for further sub-classification within the micro category.

- **Lack of clarity**- A comprehensive understanding of how micro-enterprises operate is lacking, making it difficult to design effective policies.
- **Failure to address diversity**- The current broad classifications under the MSME umbrella fail to capture the diversity within the micro-enterprise segment.
- **Data limitations**- Since 2016, systematic data collection on enterprises not registered under the Factories Act has been lacking.
- **Lack of specific details**- Udayam registration categorizes enterprises as micro, small, and medium, it does not provide detailed annual revenue information which limits the granularity needed for specific policy interventions.
- **GST data disparity**- The GST data from 2022 shows a rightward skew in the distribution of enterprises, with a majority with annual revenues below Rs 50 lakh and those between Rs 50 lakh to Rs 5 crore.

Annual Survey of Industries (ASI) primarily captures data from factories registered under the Factories Act, leaving out a significant portion of micro-enterprises.

What should be done?

- **Enhance data planning**- Implement regular and detailed surveys to capture the financial and operational metrics of micro-enterprises not covered by the Annual Survey of Industries.
- **Facilitate policy planning**- Encourage detailed revenue reporting in Udyam registration to facilitate better policy planning.

- **Separate micro-enterprise**- Parliamentary panel has suggested to separate micro-enterprises from the broader MSME category to better address their unique challenges.

- **Update definition**- The standing committee has recommended updating the definition of MSMEs every five years to reflect current economic realities.

- **Sub-classify microenterprise**- The micro-enterprise category must be sub-classified to address specific needs such as

Category	Revenue	Targeted intervention
1A	Up to Rs 10 lakh	Basic financial assistance, market access, and infrastructure development
1B	Between Rs 10 lakh- Rs 50 lakh	Emphasize technological upgrades, credit access, and formalization of operations.
2	Between Rs 50 lakh-Rs 5 crore	Support expansion, advanced technology adoption, and export promotion.

What lies ahead?

- The significant rightward skew in revenue distribution within the micro-enterprise category underscores the need for a more nuanced approach to classification and policy support.
- Enhanced data collection and further sub-classification can lead to more effective and targeted interventions, promoting sustainable growth and competitiveness in the MSME sector.

Quick facts

Steps taken by Government to promote MSME sector

- **Udyam registration portal**- It was launched in 2020 as a zero cost free registration to simplify the procedure for business owners to register their business under MSME.
- **RAMP Scheme**- Raising and Accelerating MSME Performance Programme is assisted by World Bank that enhances market and credit access, infrastructure, and skills development.
- **ASPIRE Scheme**- A Scheme for Promoting Innovation, Rural Industry & Entrepreneurship' (ASPIRE) is launched with the aim to create employment opportunities in the agro-rural sector.
- **Zero Defect Zero Effect (ZED)**- It encourages manufacturing with minimal defects and environmental impact.

- **CGTMSE-** Credit Guarantee for Micro and Small Enterprises was launched in 2000 to provides collateral-free credit to MSMEs.
- **Self-Reliant India fund-** It was launched to provide support for MSMEs across the country through equity infusion.
- **MSME SAMBANDH-** It was launched in 2017 to disseminate information on procurement done by various government departments, ministries and Public Sector Units.
- **MSME SAMADHAN-** An online delayed payment monitoring system governed by Micro and Small Enterprise Facilitation Council (MSEFC).
- **MSME SAMPARK-** A digital platform where both the job seekers skilled in MSME Technology Centres and the industries looking for skilled manpower can interact.
- **Prime Minister's Employment Generation program-** It was launched in 2006 which is a credit linked subsidy that provides employment opportunities through establishment of micro-enterprises in the non-farm sector.

8.4 Impact of US-China Trade War

Why in news?

The latest round of the tariff war between the US and its largest trade partner China, is set to present a significant opportunity for India.

What is the history of US-China trade war?

- **Trade deficit-** US's trade deficit with China and accusation of unfair subsidies have constrained the relationship leading to trade war
- **2018 trade war -** In 2018, US imposed a 25% tariff on Chinese imports of around 34 billion dollars and further tariffs in 2018 and 2019.
- US accused China for "unfair trade practices" and "technology theft".
- **Limitation on technology transfer-** The US has denied China both the knowledge and inputs for producing frontier goods and services as well as access to markets, affecting semiconductor production and 5G technology.
- **2023 trade war-** It encompasses 100% tariff on electric vehicles, a 50% tariff on semiconductors, and a 25% tariff on electric vehicle batteries imported from China.
- Increased tariff on medical gloves, syringes, needles, critical minerals, solar cells and aluminium.
- These measures aim to counteract China's perceived unfair trade practices and protect US industries from the influx of low-priced Chinese goods.

What will be the impact of US-China trade war on India?

Positive effects	Negative effects
<ul style="list-style-type: none"> • Opportunities for exporters- Indian exporters can capitalize on the void created by the US-China tariff conflict. • Strong market- India has a strong market presence in the US for products like face masks, syringes, medical gloves and natural graphite. • Metals and minerals- Higher tariffs on Chinese metals can benefit Indian exporters of these commodities, increasing their market share in the US. • Increase competitiveness- With the US imposing higher tariff on Chinese goods, Indian products in similar categories might become more competitive allowing Indian exporters to increase market share in the US. • China's retaliation- If China imposes retaliatory tariffs on US goods, Indian exporters could step in to supply products to both the US and Chinese markets. 	<ul style="list-style-type: none"> • Rise of dumping- Chinese products that face higher tariffs in the US could flood the Indian market, harming local manufacturers. • 2018 tariff hike- The tariff hikes in 2018 did not reduce China's exports as they merely shifted to other destinations or entered the US through third countries. • Electric Vehicle sector- The significant tariff hike on Chinese EVs, from 25% to 100% poses a risk as these vehicles might be redirected to other markets, including India which could disrupt the local market manufacturers. • Semiconductors and Li-ion batteries- essential components of various industries would potentially inundate Indian market with cheaper alternatives.

How India could potentially use this opportunity?

- **Anti-dumping measure**- India employs tools such as the Directorate General of Trade Remedies to impose anti-dumping duties on underpriced imports. However, the process can be slow due to delays in accessing and analysing trade data.
- **Enhanced monitoring**- To address these challenges more effectively, India could establish a dedicated department to monitor key import data daily. This would allow for quicker responses to potential dumping and unfair trade practices.
- **Review of EV policy**- Given the potential influx of cheap Chinese EVs, India might need to reassess its EV policies to protect domestic manufacturers and maintain a balanced market.
- **Strengthening trade policy**- India should develop a robust trade policy with China that supports its manufacturing sector and mitigates the adverse effects of the trade war.
- **China plus one strategy**- India should emphasize its potential as an attractive alternative manufacturing hub for companies looking to diversify away from China.

China plus one refers to a strategy in which companies avoid investing only in China and diversify their businesses to alternative destinations.

8.5 Status of Spices Exports in India

Why in news?

Recently Singapore and Hong Kong recalled certain spice mix products over the presence of a higher than prescribed level of sterilizing agent Ethylene Oxide

Why India uses Ethylene Oxide?

- **Contaminated spices**- It occurs during storage in mandies (auction yards) where spices are exposed to human, bird, reptile, and insect contact.
- **Need of sterilizing agent**- Contamination occurs during Large factories receive material from mandies, leading to high microbial levels and necessitating ETO sterilization.
- **Broad spectrum activity**- EtO exhibits broad-spectrum antimicrobial activity, targeting a wide range of microorganisms including bacteria, fungi, and viruses which makes it suitable for sterilizing diverse types of spices with varying microbial loads.
- **Industrial efficiency**- It can be carried out on a large scale in industrial settings, making it suitable for processing bulk quantities of spices efficiently.

Status of spice exports in India

- India is the world's largest spice producer. It is also the largest consumer and exporter of spices.
- In the fiscal year 2023-2024, India exported spices worth 4.4 billion dollars, marking a 12.3% increase from the previous year.
- India produces about 75 of the 109 varieties which are listed by the International Organization for Standardization (ISO).
- **Major exports**- Chilli, spice oils, oleoresins, curry powder, cumin, mint products, cardamom, and pepper are among the major exports.
- **Export markets**- China, Bangladesh, West Asian countries, and the U.S. are crucial markets for Indian spices.
- **Largest spice producing States**- Madhya Pradesh, Rajasthan, Gujarat, Andhra Pradesh, Telangana, Karnataka, Maharashtra, Assam, Orissa, Uttar Pradesh, West Bengal, Tamil Nadu and Kerala.

What are the steps taken by India to promote spice exports?

Export development and promotion of spices

- **By**- Spices Board of India
- **Aim**- To support the exporter to adopt high-tech processing technologies and upgrade the existing level of technology for the development of industry and to meet the changing food safety standards of the importing countries.
- **Benefits**- It provides benefits such as promoting Indian spice brands abroad, setting up infrastructure in the major spice growing centers, promoting organic spices and special programmes for north-eastern entrepreneurs.

Setting up and maintenance of infrastructure for common processing (Spices Parks)

- **By-** Spices Board has launched eight crop-specific Spices Parks in key production/market centers
- **Objective-** To facilitate the farmers to get an improved price realization and wider reach for their produce.
- **Purpose-** To have an integrated operation for cultivation, post-harvesting, processing, value-addition, packaging and storage of spices and spice products.
- **Benefits-** The common processing facilities for cleaning, grading, packing, and steam sterilization will help the farmers to enhance the quality of the produce, resulting in better price realization.

Spice complex Sikkim

- **Origin** - Spices Board submitted a project proposal to the state's cell for setting up a Spice Complex in Sikkim.
- **Need-** To seek financial assistance for facilitating and demonstrating common processing and value addition in spices to help farmers and other stakeholders in the state.

SPEDA

- **About-** India has notified the formation of an exclusive Committee to be known as 'Saffron Production and Export Development Agency (SPEDA).
- **Objective-** It is constituted for the overall development of the Saffron industry in Jammu and Kashmir.
- **Headquarters-** Srinagar.
- **Role-** SPEDA will assist and encourage creation of appropriate infrastructure for processing, packing, warehousing, research and establish quality evaluation laboratory for Saffron.

Prevention of ETO sterilization

- The Spices Board has issued protocols to prevent ETO contamination and initiated mandatory testing of spice consignments to affected countries.
- It's also advocating for uniform standards on ETO usage internationally.

What lies ahead?

- EtO issue could be used to undermine Indian spice trade, potentially leading to a significant decline in export volume.
- This highlights the urgency for swift action to address the situation and safeguard India's export interests.

Spice Board of India

- **Established year-** In 1987 under Spices Board Act 1986
- **Nodal agency-** Ministry of Commerce and Industry
- **About-** It is the India's regulatory and export promotion agency for Indian spices, spices are sold under the brand name 'Flavourit'.
- **Headquarters-** Cochin, Kerala
- **Regional lab-** Mumbai, Delhi, Tuticorin, Kandla and Guntur.
- **Spice Train-** It is an online campaign started to educate Indians about the country's rich spice heritage

8.6 India in Trade Deficit

Why in news?

India recorded a trade deficit with nine of its top 10 trading partners in 2023-2024.

What is the status of India's trade dynamics in 2023-24?

- **Increasing trade deficit-** India sees trade deficit with major countries like China, Russia, Korea and Hong Kong.
- **Narrowing trade deficit-** The trade gaps with the UAE, Saudi Arabia, Indonesia and Iraq have narrowed, indicating a potential shift or improvement in trade balances with these countries.
- **Bilateral trade-** China has become India's largest trading partner with a total value of 118.4 billion dollars surpassing the US which stands out at 118.28 billion dollars.
- **Free Trade Agreements (FTAs)-** India has FTAs with 4 of its top trading partners namely Singapore, UAE, Korea and Indonesia which could be influencing the trade dynamics with these countries.
- **Overall trade deficit-** India's total trade deficit has narrowed to 238.3 billion dollars in 2023-24 from 264.9 billion dollars in the previous fiscal year.
- **Trade surplus-** India has trade surplus with the US, UK, Belgium, Italy, France and Bangladesh.

- **Economic implications-** A rising trade deficit, even if driven by imports of raw materials and intermediates, can lead to currency depreciation.
- **Global Trade Research Initiative (GTRI)-** It emphasizes that while bilateral deficits may not be a major concern unless they lead to over-reliance on critical supplies, a rising overall trade deficit is detrimental to the economy.

How trade deficit affects Indian economy?

- **Currency depreciation-** Persistent trade deficits can put pressure on the Indian rupee, leading to depreciation against other currencies. Currency depreciation makes imports more expensive, contributing to inflationary pressures.
- **Over reliance on imports-** India's dependence on imports for certain goods, including petroleum, electronics, and machinery, contributes to the trade deficit.
- **Current account imbalance-** It contribute to a widening current account deficit (CAD), which measures the net flow of goods, services, and investments into and out of a country.
- **Pressure on FOREX-** Funding trade deficits requires continuous inflow of foreign capital, including foreign direct investment (FDI) and portfolio investments.
- **Debt accumulation-** Financing trade deficits through external borrowing can lead to an accumulation of foreign debt, increasing the country's debt servicing burden and exposing it to risks associated with changes in global interest rates and investor sentiment.
- **Structural constraints-** Issues such as inadequate infrastructure, bureaucratic inefficiencies, regulatory bottlenecks, and rigid labor laws can hamper export competitiveness and hinder efforts to address trade deficits effectively.
- **High inflation-** Trade deficit can lead to higher import bills, which in turn can contribute to inflationary pressures in the economy
- **Affects industrial growth-** It may indicate a lack of competitiveness in domestic industries, leading to sluggish industrial growth and job losses in sectors facing stiff competition from imports.
- **Macroeconomic instability -** Persistent trade deficits, coupled with widening CAD and currency depreciation, can undermine macroeconomic stability, leading to volatility in financial markets, reduced investor confidence, and capital outflows.
- **Trade protectionism-** It may provoke protectionist measures from trading partners, such as tariffs, quotas, and non-tariff barriers, which can further constrain export opportunities for Indian businesses.
- **Global economic conditions-** India's trade balance is influenced by global economic trends, including demand fluctuations, geopolitical factors, and supply chain disruptions.

A high CAD can make the economy vulnerable to external shocks and financing risks.

Steps taken by India to curb trade deficit

- **Merchandise Exports from India Scheme (MEIS)-** It is introduced to provide incentives to exporters of specified goods based on their export performance.
- **Export Promotion Capital Goods (EPCG) Scheme-** It is designed to facilitate import of capital goods for pre-production, production, and post-production at zero customs duty.
- **Interest equalization scheme-** It provides interest equalization on pre and post shipment rupee export credit, encouraging exporters.
- **RoDTEP scheme-** The Remission of Duties and Taxes on Exported Products (RoDTEP) scheme supports exporters by refunding duties and taxes.
- **FTA utilization-** A Common Digital Platform for Certificate of Origin facilitates trade and increases utilization of FTAs by exporters.
- **Districts as export Hubs-** Identifying export potential in each district and supporting local exporters/manufacturers generates employment and boosts exports.
- **Trade remedy options-** The timely use of trade remedy measures, such as anti-dumping duties and safeguard duties, helps protect domestic industries from unfair competition due to cheap imports.
- **Adoption of mandatory technical standards-** Ensuring that imported goods meet specific technical standards helps maintain quality and reduces reliance on foreign products.

How to address the raising trade deficit in India?

- **Quality Control Orders (QCOs)**- The Indian government is exploring ways to reduce cheap and non-essential imports through QCOs. By imposing quality standards on imports, India aims to curb unnecessary inflow of goods.
- **Boost local production**- Encouraging domestic manufacturing through schemes like the Production-Linked Incentive (PLI) can help substitute imports.
- **Diversify export**-India should explore new markets for its exports through this India can mitigate risks associated with dependence on specific countries.
- **Sector specific measures**- Reducing imports in sub-sectors like chemicals, automotive components, agro-based items, and consumer electronics could contribute to narrowing the trade gap.
- **Improve trade infrastructure**- Enhance transportation, logistics, and port facilities to streamline the movement of goods and reduce transaction costs for exporters.
- **Trade facilitation**- Simplify trade procedures, documentation requirements, and customs clearance processes to reduce red tape and bureaucratic hurdles.
- **Address non-tariff barriers**- Negotiate with trading partners to address non-tariff barriers such as technical standards, sanitary and phytosanitary measures, and intellectual property rights issues.
- **Currency management**- Monitor and manage currency exchange rates to ensure competitiveness of Indian exports.
- **Enhance human capital**- Invest in skill development and capacity building programs to enhance the quality and competitiveness of Indian workforce in key sectors.
- **Promote green exports**- Encourage industries to adopt green practices and standards to meet international environmental regulations and consumer preferences.

9. AGRICULTURE

9.1 Balanced Fertilisation

Why in news?

Capping consumption of urea and DAP to correct worsening plant nutrient imbalance is likely to be a key policy goal for the government post the Lok Sabha polls.

Why there is a need of balanced fertilisation?

- **Overutilization**- Fertiliser use has seen a tremendous increase in India and in other parts of the world with the spread of Green Revolution technology.
- **Imbalance use**- Over the years, the usage ratio of NPK (Nitrogen (N), Phosphorus (P), and Potassium (K)) has become more imbalanced, in 2012-13 it had raised to 8.2:3.3: 1 which indicates a higher use of N that can lead to reduced efficiency of fertilizer use and potential environmental issues.
- **Concerns with Nutrient Based Subsidy**- It aimed at promoting balanced fertilization, initially led to a decline in the consumption of certain fertilizers like DAP and MOP, but it failed to control urea consumption due to its exclusion from the subsidy scheme.
- **Price control**- Recent price controls on non-urea fertilisers have led to nutrient imbalances, with DAP becoming the “new urea” due to its lower price compared to other complex fertilisers.
- **Proper regulation**- Balanced fertilisation aims to encouraging the use of nutrients in correct proportions and discouraging excessive use of fertilisers like urea, di-ammonium phosphate (**DAP**) or muriate of potash (**MOP**).
- **Success of neem coated urea**- Neem oil acts as a *nitrification inhibitor* allowing more gradual release of nitrogen, this improved the nitrogen use efficiency and reduced the quantity of urea needed per acre.

India's urea consumption in 2024 is 16.9% higher than the urea consumption in 2013-14

The ideal NPK ratio, which stands for nitrogen (N), phosphorus (P), and potassium (K), is indeed considered to be 4:2:1 in India.

- **Increased usage-** Though the government has regulated urea usage through compulsory neem-coating and sulphur-coated urea (37% Nitrogen and 17% Sulphur) the consumption of urea has still continued to increase.
- **Import dependency** - India heavily relies on imports for fertilisers, including finished products and raw materials. Hence the change in price can impact India's foreign exchange outflow and the government's subsidy burden.
- **Drop in prices-** The price of urea, DAP and MOP has been dropped significantly in 2022-23 due to Russia-Ukraine war and Houthi rebel attacks in Red Sea.
- **Opportunity for India-** The cooling international prices provides flexibility for next government to rationalize MRPs of fertilizers, it could bring urea under NBS system and adjust subsidy rates for other nutrients.

Ships carrying DAP and rock phosphate from Morocco's Jorf Lasfar port now take 40 days instead of the usual 24-26 days to reach India.

Sulphur coated urea reduced the standard urea bag size from 50kg to 40kg with 12.5% price hike for optimizing nutrient utilization.

Nutrient Based Subsidy scheme

- **Launch year-** 2010
- **Aim-** To encourage soil-balanced fertilization and increase agricultural productivity
- It provides subsidies for *non-urea-based fertilizers* based on the nutrients (N, P, K, and S) they contain.
- **Administration-** Department of Fertilizer, *Ministry of Chemicals and Fertilizers*.
- **Coverage-** Phosphatic and Potassic (P&K) Fertilizers.
- **Subsidy-** A fixed amount of subsidy is decided on annual basis, is provided on subsidised P&K fertilizers depending on their nutrient content.
- **MRP-** It is fixed by fertilizer companies as per *market dynamics* at reasonable level which is monitored by the Government
- **Objectives-**
 - To promote balanced use of fertilizers.
 - To reduce subsidy burden on the Government.
 - To improve availability of fertilizers to farmers.
 - To encourage competition among fertilizer companies
- **Features-** It considers the domestic and international cost of fertilizers, the country's inventory levels, and the currency exchange rate.
- **Additional subsidies-** It is provided for fertilizers that are enriched with secondary and micronutrients like zinc and molybdenum (Mo).
- **New guidelines-** The Department of Fertilisers has issued detailed guidelines for the evaluation of "reasonableness" of the MRPs for all non-urea fertilisers covered under NBS.

What lies ahead?

- Establishing a proper price hierarchy among fertilizers is essential to incentivize balanced fertilization. This could involve pricing DAP higher, MOP lower, and complexes in between to reflect their nutrient content and encourage optimal usage.
- Promoting the use of complex fertilizer (mix of nutrients in balanced proportion) can help provide a balanced nutrient profile tailored for a wider range of crops and soil types.
- Exploring innovative fertilizers like sulphur-coated urea can offer additional options for balanced fertilization as they provide a gradual release of nutrients, reducing the risk of leaching and optimizing nutrient uptake by plants.
- The government can encourage farmers to adopt more sustainable and efficient fertilization practices, leading to improved crop yields, reduced environmental impact, and greater resilience in the agriculture sector.

9.2 Carbon Farming

Why in news?

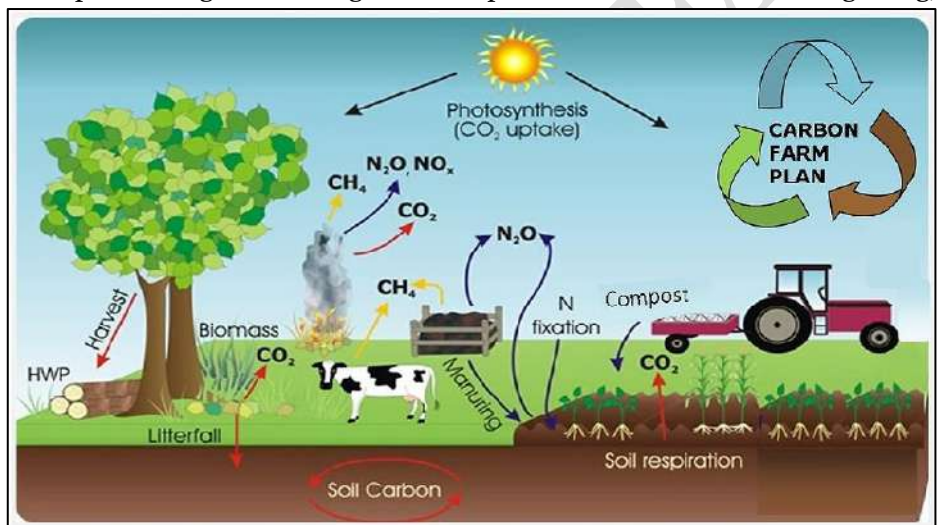
Carbon farming offers a multifaceted approach to address climate change while simultaneously enhancing agricultural productivity and ecosystem health.

What is carbon farming?

- **About-** It is an *integrated approach* to enhance *carbon sequestration* in agriculture.
- **Objective-** The primary goal of carbon farming is to *reduce the net carbon content* in the atmosphere, this is achieved by increasing the rate at which carbon is sequestered into soil and plant materials.
- **Agroecosystem processes-** It involves adopting farming practices that increase the rate of CO₂ capture from the atmosphere and its storage in plant matter and soil organic matter.
- **Whole farm approach-** It is a comprehensive strategy that applies to all aspects of farm's operations with the goal to maximize the removal of CO₂ from the atmosphere.

What is the significance of carbon farming?

- **Regenerative practices-** It incorporates regenerative agricultural practices such as rotational grazing, agroforestry, conservation agriculture, integrated nutrient management, agro-ecology, livestock management, and land restoration.
- **Ecosystem resilience-** The regenerative practices restore ecosystem health, improve soil fertility, and enhance carbon storage in agricultural landscapes.
- **Diverse techniques-** It encompasses a wide range of techniques suitable for various agro-climatic zones such as silvopasture, alley cropping, zero tillage, crop rotation, cover cropping, and livestock management strategies like rotational grazing.
- **Mitigate climate change-** By sequestering carbon in vegetation and soil, carbon farming helps mitigate climate change by reducing greenhouse gas emissions.
- **Enhance soil health-** Carbon farming practices, such as cover cropping, conservation agriculture, and organic farming, improve soil health by increasing organic matter content, enhancing soil structure, and promoting microbial activity.
- **Biodiversity conservation-** Many carbon farming practices, such as agroforestry and crop diversification, promote biodiversity by providing habitat and resources for a wide range of plant and animal species.
- **Water management-** Some carbon farming practices, such as agroforestry and soil conservation techniques, help improve water management by reducing soil erosion, enhancing water infiltration, and minimizing runoff.



Global carbon farming schemes

- **Carbon trading initiative-** It is followed in countries like the U.S., Australia, New Zealand, and Canada where the carbon credits generated in agricultural practices that reduce GHG emission or increase carbon sequestration are traded in the market.
- **Chicago climate exchange-** It was a voluntary, legally binding greenhouse gas reduction and trading system operated from 2003 to 2010, it was created for emission sources and offset projects in North America and Brazil
- **Carbon farming initiative in Australia-** It allows farmers and land managers to earn carbon credits by storing carbon or reducing greenhouse gas emissions on the land, which can then be sold to offset emissions.
- **Kenya's agricultural carbon project-** Supported by the World Bank, this project aims to sequester carbon through sustainable agricultural land management practices in Western Kenya, providing carbon revenue streams to smallholder farmers.

- **'4 per 1000' initiative-** It is launched during the COP21 climate talks in 2015, this initiative aims to increase carbon storage in agricultural soils by 0.4% each year to help mitigate climate change and enhance food security.

What are the challenges of carbon farming?

- **Geographical variability-** The *Indo-Gangetic plains* and the *Deccan Plateau* are well-suited for carbon farming, while the *Himalayan region* and coastal areas face challenges due to terrain and salinization.
- **Water scarcity-** Carbon farming can be challenging in hot and dry areas where water availability is limited.
- **Limitations of cover cropping-** Practices like cover cropping may not be viable due to increased water demand, hindering plant growth and carbon sequestration.
- **Financial barriers-** The adoption of carbon farming practices may require financial assistance for farmers, especially in developing countries where small-scale farmers lack resources.
- **Market access-** Lack of market infrastructure, certification standards, or buyers willing to pay a premium for carbon-neutral products can limit the economic viability of carbon farming.
- **Lack of awareness-** Limited awareness, inadequate policies, and technological barriers can hinder adoption efforts.

What are the opportunities for India?

- **Climate resilience-** As climate change intensifies, climate-resilient agricultural practices like carbon farming can benefit from adaptation strategies in India.
- **Economic benefits-** Agro-ecological practices in India have the potential to generate significant economic benefits, with estimates suggesting billions of dollars in value from adopting sustainable agricultural practices.
- **Carbon credit system-** It can incentivize farmers in India by providing additional income through environmental services, these systems can bridge the gap between feasible emissions reductions and climate stabilization while enhancing food security.
- **Technology adoption-** Advancements in agricultural technology, including precision farming, remote sensing, and data analytics, can support the adoption and monitoring of carbon farming practices in India.
- **Multi-stakeholder approach-** Collaboration between government agencies, research institutions, civil society organizations, and the private sector is essential to promote carbon farming in India.

What lies ahead?

- India needs to address challenges such as limited awareness, inadequate policy support, technological barriers and creating an enabling adoption environment.
- Despite these challenges, promoting carbon farming aligns with India's interests in mitigating climate change, improving soil health, enhancing biodiversity and creating economic opportunities for farmers.

9.3 Need of Export-Import Policy

Why in news?

A rational agricultural import and export policy is required, as India needs to balance the interests of the both.

Status of India's agricultural trade

- **Exports-** It fell 8.2% in FY ended March 2024 on the back of shipment curbs on a host of commodities, from cereals and sugar to onions.
- As per Department of Commerce data the value of farm exports declined from 48.82 billion in 2023-24 to 53.15 billion of 2022-23.
- From 2013-14 to 2019-20 the exports declined with increase in imports.
- **Imports-** The decrease in overall agricultural imports in 2023-24 was mainly attributed to lower imports of edible oils, driven by a decline in global prices.
- However, *imports of pulses surged*, indicating a shift in consumption patterns or domestic production inadequacy.
- **Import dynamics-** The trend suggests a *trade imbalance*, where imports outpaced exports, potentially due to factors such as domestic demand, import dependencies, or trade agreements.

Why India needs a rational export-import policy?

- **Decline in exports-** Restrictions on the export of key commodities such as sugar, rice, wheat, and onions have contributed to the decline in agricultural exports.
- **Policy paralysis-** Government's export bans and duty impositions can hinder investment climate and undermine ease of doing business, particularly in the agricultural sector.
- **Political impact-** During election season measures such as subsidies, loan waivers etc., may have short-term benefits but can also strain fiscal discipline and impact the economic health of the agricultural sector.
- **Concern of import policy-** The removal of import duties on certain agricultural products aims to reduce consumer prices and promote trade but it raises concerns about the impact on domestic production and crop diversification.
- **Impact on farmers-** A reduction in onion prices, for example, can lead to significant revenue losses for farmers, impacting their livelihoods.
- **Trade diversification-** By facilitating a diverse range of imports and exports, India can reduce its dependence on specific markets or commodities, thus mitigating risks associated with fluctuations in global demand or prices.
- **Foster global relations-** A coherent import-export policy strengthens India's position in international trade negotiations and fosters positive relations with trading partners, leading to mutual benefits and opportunities for collaboration.
- **Global uncertainty-** A rational import-export policy is needed to tackle issues such as [Russia-Ukraine war](#), COVID-19 etc., which disrupted global supply chains and trade flows, impacting agricultural imports.

Restrictions imposed by India on Agricultural exports

- **Sugar-** India, the world's second producer of sugar has banned its export for the first time in 7 years as lack of rain has cut cane yields.
- **Non-basmati rice-** A ban on white non-basmati rice exports since along with a 20% export duty on parboiled grain shipments, resulted in a reduction of non-basmati rice exports.
- **Selective ban on rice export-** It is due to various factors such as
 - Decline in rice production due to deficient monsoon rainfall
 - Low rice stock could pose a threat on [PMGKY](#) and public distribution system.
 - Possibility in yield reduction due to a new virus that has caused dwarfing of paddy plants in Punjab and Haryana.
 - To curb threat of inflation and to divert broken rice for India's ethanol production.
- **Wheat-** Export restrictions is aimed at preventing the speculative trading in wheat to stabilise the agriculture sector.
- **Onion-** The exports were banned in 2023 to ensure adequate availability for local consumption against the backdrop of estimated lower Kharif and Rabi crops in 2023-24 compared to the previous year and increased demand in the international market

What lies ahead?

- A more *balanced approach* is needed, considering the interests of both producers and consumers, as well as the short-term and long-term goals of the agricultural sector.
- *Temporary tariffs* could be considered as an alternative to outright bans or quantitative restrictions, providing a more predictable regulatory environment for stakeholders.
- The creation of buffer stocks for essential commodities is proposed as a means of market intervention to manage price volatility.

9.4 Status of Agriculture Import

Why in news?

The Reserve Bank of India needs to be complimented for broadly containing the consumer price inflation within its mandated range of 4+/- 2%.

What is the status of agriculture imports?

- **Decline in agriculture imports-** India's agriculture imports in 2023-24 decreased by 8% compared to the previous year.

- **Import value-** Agriculture import value has dropped from 35.7 billion dollars to 32.8 billion dollars.
- **Edible oil-** The decline in import value was primarily due to edible oils, which plummeted by 28.5%.

• **Import of edible oil-** However, the quantity of edible oil imports remained stable. India imports around 55-60% of its edible oil consumption, with palm oil being the dominant type.

• **Price impact-** The principal factor behind the decline in import values is the decrease in palm oil prices in international markets.

• **Pulses-** Lentils, pigeon pea and chickpeas saw a sudden increase in imports in 2023-24 doubling from 1.9 billion dollars to 3.7 billion dollars.

• **Price impact-** The sudden surge in both production and imports led to glut in the market, consequently domestic prices of many pulse fell below the MSP.

• **Import tariff-** To address this issue, Centre imposed 30% import tariff on lentils, pigeon pea and chickpeas along with quantity restrictions.

• **Inflation-** Import restrictions, coupled with slow domestic growth, have contributed to high inflation in pulses.

• **Import liberalization-** The government's recent decision to liberalize pulse imports by imposing zero import duty until the end of 2024-25 aims to control consumer prices.

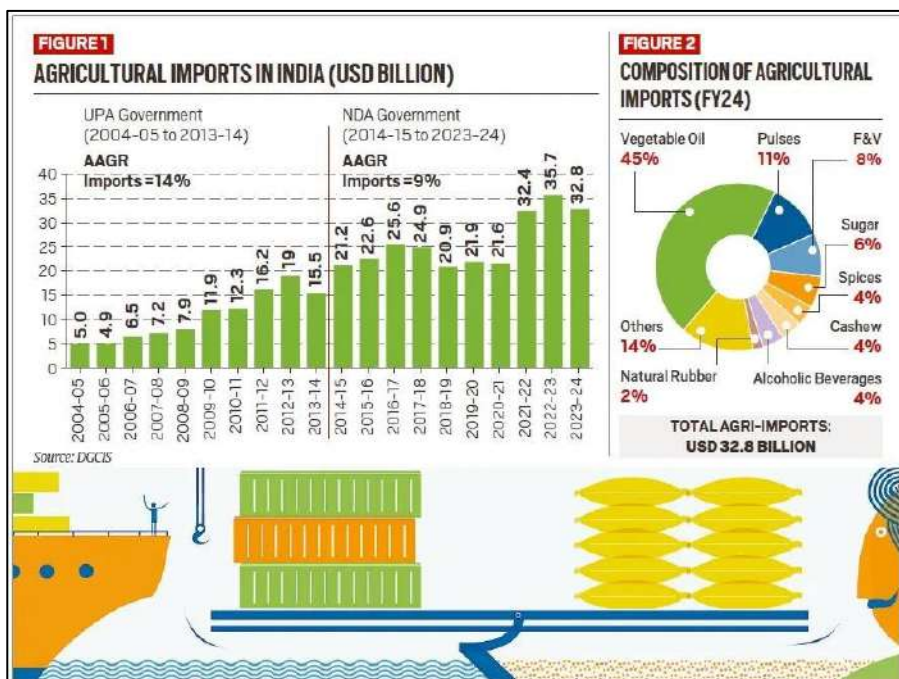
• **Impact on farmers-** This move may impact farmers, highlighting a consumer bias in policy decisions.

• **Top crop producing States-** West Bengal, Uttar Pradesh, Punjab, Gujarat, Haryana, Madhya Pradesh, Assam, Andhra Pradesh, Karnataka and Chhattisgarh.

• **Wheat production-** It comes from Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Bihar, and Gujarat.

• **Sugarcane production-** Uttar Pradesh is the largest producer of sugarcane in India contributing about 48%, followed by Maharashtra and Karnataka at 23% and 9% of the total production respectively.

• **Trade policy integration-** Trade policy especially import liberalization should be well-integrated with the Minimum Support Price (MSP) policy.



National Edible Oil Mission-Oil Palm

- Launch year-**2021
- Aim-** To augment the availability of edible oil in the country by harnessing area expansion, increasing crude palm oil production with the aim to reduce the import burden.
- Special focus-** North east region and the Andaman and Nicobar Islands
- Strategy-** Increasing production of seedlings by establishment of seed garden, nurseries of oil palm to assure domestic availability of seedlings as per target fixed under NMEO-OP

How to formulate a rational trade policy that aligns with domestic Minimum Support Price?

Key aspect	About	Benefits
Calibrated Import duty reductions	Instead of abruptly reducing import duties to zero, a more gradual approach could have been taken.	This would allow for better adjustment and minimize market shocks.
Landed price above MSPs	The government should ensure that the landed price (including import costs) of	This protects the interests of farmers and maintains price stability.

	major pulses does not fall below the Minimum Support Price (MSP).	
Edible oil	The landed price of edible oils should not be below the domestic MSP of oilseeds converted to oil.	This will help realize the vision of self-reliance in edible oil through the National Edible Oil Mission- Oil Palm (NEOM-OP).
Buffer stocks	If domestic prices drop below the MSP, the National Agricultural Cooperative Marketing Federation of India (NAFED) should step in and undertake large-scale procurement at MSP	This helps build buffer stocks to stabilize prices during shortages.


To know about the need of export-import policy click [here](#)

10. ENVIRONMENT

10.1 Coral Bleaching in the Lakshadweep

Why in news?

The ICAR-Central Marine Fisheries Research Institute (CMFRI) has found that coral reefs in the Lakshadweep Sea have undergone severe bleaching due to prolonged marine heatwaves since October 2023.

Lakshadweep Islands	
<ul style="list-style-type: none"> Lakshadweep means 'a hundred thousand islands' in Sanskrit and Malayalam. Capital- Kavaratti. Geography-Lakshadweep consists of 36 islands, which are scattered across approximately 32 square kilometers of the Arabian Sea. Subgroups- These islands are grouped into three geographical subgroups. <ul style="list-style-type: none"> Amindivi Islands, Laccadive Islands, and the Uninhabited Minicoy Island. Minicoy - It is the southernmost atoll of the Lakshadweep archipelago. 	 <p style="font-size: small;">Distances are from Kochi. Map not to scale. Map information: Lakshadweep UT Administration</p>

What is coral reefs?

- Nature**- They are *largest living structures* on Earth crucial for underwater ecosystems formed by skeletons of colonial marine invertebrates known as coral polyps.

Types of coral reefs	
Types	About
Hard coral	<ul style="list-style-type: none"> They are reef building corals, they extract calcium carbonate from seawater to build their hard exoskeleton.
Soft coral	<ul style="list-style-type: none"> They lack rigid structures and have a more plant-like appearance which attach themselves to existing structures.

- **Formation of coral reefs-** Over thousands and millions of years, the stony skeletons of hard corals accumulate and form the complex structures known as coral reefs.
- These reefs are among the most diverse ecosystems on the planet, hosting thousands of marine species and supporting vibrant marine life.
- **Sessile Nature of Corals-** Corals are *stationary marine animals* that permanently attach themselves to the ocean floor. This sessile lifestyle allows them to form colonies and build intricate structures over time.
- **Symbiotic relationship-** Corals have a symbiotic relationship with single-celled algae called *zooxanthellae* which provide corals with food and nutrients through photosynthesis, while corals offer shelter and nutrients to the algae. This symbiotic relationship offers vibrant colour to corals.
- **Rainforests of sea-** Coral reefs are often referred to as the "rainforests of the sea" due to their high biodiversity and ecological significance.
- They provide habitat and shelter for a vast array of marine organisms, including fish, invertebrates, and algae.
- **Ecosystem services-** They provide services such as coastal protection, shoreline stabilization, and support for fisheries and tourism.
- **Lakshadweep's coral atolls-** The majority of the islands in the Lakshadweep archipelago are coral atolls, characterized by low-lying islands surrounded by coral reefs.
- The soil composition of these islands is largely derived from the accumulation of coral skeletons over time, highlighting the close relationship between the islands and the surrounding coral reef ecosystems.
- **Coral bleaching-** It occurs when corals experience stress due to factors such as changes in temperature, pollution or high levels of ocean acidity.
- **Warm temperature-** Coral bleaching occurs when water temperatures become too warm, leading corals to expel the microscopic algae, known as zooxanthellae, which live within their tissues.
- **Consequences-** Without their algae, corals' tissues become transparent, revealing their white calcium carbonate skeleton. While bleached corals are not immediately dead, they are at risk of starvation and disease. Without intervention, bleached corals can ultimately die.

Zooxanthellae algae are essential for the corals' survival as they provide them with nutrients through photosynthesis.

DHW values above 4°C-weeks cause significant coral bleaching.

Why there is coral bleaching in Lakshadweep?

- **Thermal stress-** Corals experience thermal stress when sea surface temperatures exceed the maximum mean temperature by 1°Celsius, prolonged high temperature exacerbates this stress.
- **Degree Heating Week (DHW)-** It is used to measure accumulated heat stress over 12 weeks which sums temperatures exceeding the bleaching threshold calculated in Celsius-weeks.
- **Lakshadweep sea-** It has been experiencing temperatures 1°C above the norm since October, 2023 which has led to significant coral bleaching surpassing events in 1998, 2010 and 2015.
- **Marine heatwaves-** They are driven by various factors, including excessive atmospheric heat due to global warming and shifts in ocean currents.
- These heatwaves are becoming more frequent and severe in the Indian Ocean region, with significant implications for coral reef ecosystems.
- **Study by IITM (Pune)-** A study by the Indian Institute of Tropical Meteorology (IITM), Pune, reported an increase in marine heatwaves in the Indian Ocean.
- The western Indian Ocean region, including areas near the Lakshadweep islands, has experienced a significant rise in marine heatwaves, leading to widespread coral bleaching events
- **Impact beyond Lakshadweep-** Coral bleaching events are not limited to Lakshadweep alone but affect coral reef ecosystems throughout the Indian Ocean region.
 - For example, the *Gulf of Mannar* near the *Tamil Nadu* coast experienced extensive coral bleaching after a marine heatwave in 2020, underscoring the widespread nature of the problem.
- **Consequences-** The heat waves threaten livelihoods of coastal communities, tourism and fisheries sectors, and critical marine habitats, including seagrass meadows.

- **Ecological impact-** The degradation of seagrass meadows and kelp forests can have cascading effects on marine ecosystems, affecting species interactions, food webs, and overall ecosystem resilience.

What lies ahead?

- Lakshadweep is formed by coral reefs and hence the health of reefs are important for the very structure of the islands.
- Coral reef health is intertwined with the health of the entire marine ecosystem hence the coral reef must be protected for ecosystem resilience and biodiversity conservation.

10.2 Role of wildlife corridors in tiger conservation

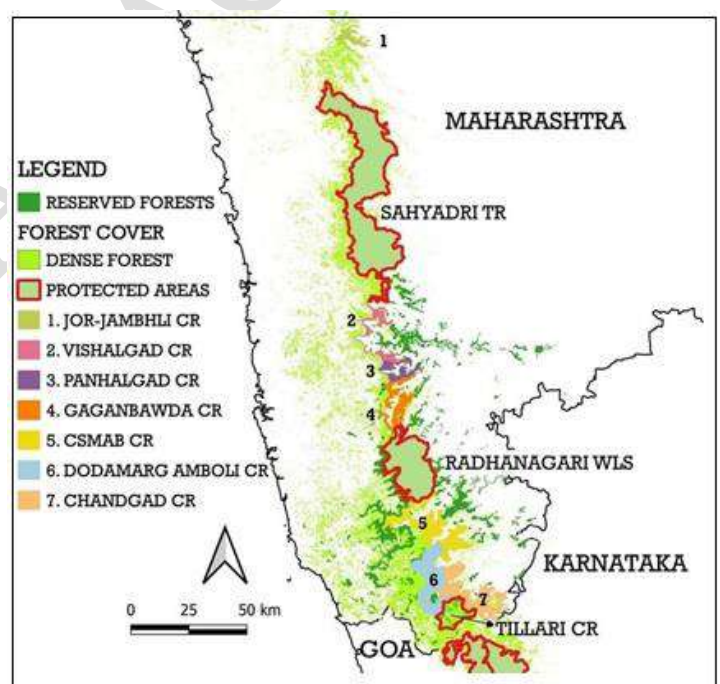
Why in news?

Sahyadri-Konkan wildlife corridor will play a crucial role in translocating tigers from Tadoba-Andhari Tiger Reserve to Sahyadri Tiger Reserve in Maharashtra.

Why Maharashtra plans to translocate tigers to Sahyadri Tiger Reserve (STR)?

- **Historical challenges-** Tiger population in Sahyadri region has faced many challenges such as poaching, habitat loss, and a depleted prey base, have led to a decline in tiger numbers.
- **Need of intervention-** Despite the establishment of Sahyadri Tiger Reserve, the tiger population has not increased significantly.
- **Population stagnation-** The reserve has struggled to attract breeding tigers, further exacerbating decline in population.
- **Occasional evidence-** The reserve has limited evidence of tiger presence such as pugmarks indicates a small number of tigers moving within the reserve this underscores the urgency of action to revitalize the tiger population within the reserve.
- **Improve genetic diversity-** Translocation of tigers presents a strategic opportunity to infuse new genetic diversity into the population and potentially catalyse breeding efforts.
- **Sahyadri-Konkan wildlife corridor-** The corridor must be secure enough and free from human disturbance to achieve the objective of translocation.

STR comprises of Chandoli National Park and Koyna Wildlife Sanctuary.



What role do wildlife corridors play in conservation?

- **Facilitate gene flow-** It enable tigers to traverse human-dominated landscapes safely, minimizing the risk of human-wildlife conflicts and increasing their chances of successful dispersal and breeding.
- **Sustainable infrastructure-** Measures such as the construction of underpasses, wildlife crossings, and overpasses are increasingly implemented to safeguard tigers and other wildlife from the impacts of linear infrastructure projects that fragment habitats.
- **Preserve migratory routes-** The construction of overpasses on NH-7 between Kanha and Pench Tiger Reserves, ensures the safe passage of tigers and other wildlife underneath the elevated stretches, preserving their migratory routes.
- **Mapping of corridors-** *National Tiger Conservation Authority* and *Wildlife Institute of India's* mapping of 32 major tiger corridors is a significant step towards understanding and preserving these essential habitats.

What can be done for tiger recovery?

- **Habitat improvement-** It involves restoring degraded habitats to enhance their quality and resilience in activities such as reforestation, soil conservation, water management, and invasive species control.

- **Prey base enhancement-** Increasing the populations of natural prey species like deer and wild boar creates a healthier ecosystem.
- **Mitigate human-tiger conflict-** Increasing the natural prey would reduce the need for tigers to venture into human settlements for food, enhancing both human safety and the ecological integrity of the forest.
- **Corridor strengthening-** Wildlife corridors are crucial for allowing tigers to move between habitat patches, which can aid in recolonization of areas where tigers have become locally extinct and help maintain genetic diversity.
- **Anti-poaching measures-** Implementing rigorous anti-poaching efforts such as increased patrolling, enforcement of wildlife protection laws and collaboration with law enforcement agencies to combat illegal hunting and trade of tigers and their prey species.
- **Community engagement-** Engaging local communities in tiger conservation efforts through education, awareness programs, and livelihood support initiatives can foster greater support and participation in conservation activities.
- **Research-** Conducting scientific research to better understand tiger ecology, behaviour, and population dynamics is essential for informing conservation strategies and monitoring the effectiveness of conservation efforts over time.
- **Project tiger-** It is a flagship conservation program launched in 1973 aimed at conserving and increasing tiger population in India
- **International cooperation-** Collaborating with neighbouring countries and international organizations to address transboundary conservation challenges is crucial for ensuring the long-term survival of tigers.
- **Translocation-** It should be considered as a last resort, it should be based on thorough scientific assessments and community consultations.

Sahyadri-Konkan wildlife corridor
<ul style="list-style-type: none"> • Coverage- Maharashtra, Goa and Karnataka • Crucial habitat- It connects the Sahyadri Tiger Reserve in Maharashtra and Kali Tiger Reserve in Karnataka serving as a crucial habitat for <i>tigers, sloth bears and dholes</i>. • Large carnivore occupancy- A study by Wildlife Conservation Trust shows an increase in tiger and dhole occupancy, while tiger and leopard numbers remain stable. • This indicates improved landscape management since the Sahyadri Tiger Reserve's declaration since 2010.

Successful translocation	Setbacks in translocation
<ul style="list-style-type: none"> • <i>Sariska Tiger Reserve</i> and <i>Panna Tiger Reserve</i>, have helped restore tiger populations in areas where they had become locally extinct. • These projects have demonstrated that translocation can be effective in replenishing tiger populations and restoring ecological balance in suitable habitats. 	<ul style="list-style-type: none"> • <i>Satkosia Tiger Reserve</i>, Odisha has faced challenges and setbacks in tiger reserve project. • Poor planning, inadequate community engagement, and unforeseen conflicts with local residents can lead to failure of translocation initiatives, causing harm to both humans and tigers.

10.3 Constructed Wetlands

Why in news?

Constructed wetlands emerge as a promising approach for wastewater treatment.

What is constructed wetland?

- **Artificial wetlands-** Constructed wetlands are *engineered ecosystems* that are constructed to treat sewage, greywater, storm water runoff or industrial wastewater.
- **Mimic natural wetlands-** They use vegetation, soil and water to *purify wastewater* through physical, chemical, and biological processes.

Types	
Subsurface Flow	Surface Flow

<ul style="list-style-type: none"> The wastewater is directed through gravel beds or porous media promoting microbial activity that degrades organic matter. 	<ul style="list-style-type: none"> It demonstrates their aesthetic appeal above the water's surface with gently flowing streams and lush vegetation.
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- Pollutant removal-** They act as *biofilters*, removing pollutants such as organic matter, nutrients (nitrogen and phosphorus), pathogens, and heavy metals from water.
- Fosters biodiversity-** They welcome a diverse array of life forms ranging from microorganisms to aquatic plants and even birds to engage in the purification process.
- Botanical superheroes-** Plants like cattails, bulrushes, and sedges can be grown due to their significant role in absorbing nutrients.
- Hospitable habitats-** The roots of plants like cattails, sedges and bulrushes provide a hospitable environment for bacteria, which are essential for breaking down complex molecules into simpler, less harmful compounds.

What is the significance of constructed wetland?

- Cost-Effectiveness-** It offer a more economical option than traditional treatment facilities as construction and maintenance requires minimal energy consumption and lower operational expenses.
- Versatility-** They can be customized to address diverse forms of industrial wastewater thus effectively managing a broad spectrum of pollutants and contaminants.
- Eco-friendly-** They promote biodiversity conservation and contribute to ecosystem services such as flood control and carbon sequestration further enhancing their ecological significance.
- Scalability-** Constructed wetlands are flexible in scalability, able to be adjusted to fit various industrial operations and spatial limitations.
- Adaptability-** They accommodate both centralized and decentralized wastewater treatment methods, providing adaptability in their deployment.

What are the steps taken by India to promote constructed wetlands for wastewater treatment?

Location	Constructed wetland
Asola Bhatti Wildlife Sanctuary, Delhi	A constructed wetland system here purifies sewage from nearby settlements and supports regional biodiversity conservation.
Chennai, Tamil Nadu	The constructed wetlands (Perungudi and Kodungaiyur) are part of a decentralized wastewater treatment strategy, reducing the load on centralized facilities and lowering pollutant levels.
Kolkata East Wetlands, West Bengal	It is recognized as a Ramsar site, these wetlands treat wastewater from Kolkata, providing livelihood opportunities for locals through fishing and agriculture.
Palla village, Haryana	The constructed wetland in this village treats wastewater from Delhi before it enters the Yamuna River, improving water quality and reducing downstream pollution.
Auroville, Tamil Nadu	The international township has decentralized wastewater treatment systems, including constructed wetlands, reflecting its commitment to sustainability and ecological stewardship.
Sariska Tiger Reserve, Rajasthan	The reserve uses constructed wetlands to treat wastewater from nearby villages, supporting local sanitation needs and wildlife habitat conservation.

What are the challenges?

- Policy incentives-** There is a lack of clear policy and regulation that encourage the adoption of constructed wetlands in industrial wastewater treatment.
- Lack of incentives-** There is no sufficient incentives and subsidies for industries to invest in sustainable wastewater management practices.
- Limited awareness-** There is a lack of awareness among industry professionals, regulators and local communities for implementation and operation of constructed wetlands.

- **Research-** India needs to optimise design parameters and addressing emerging challenges such as new contaminants and the impacts of climate change.
- **Community engagement-** There is a lack of active participation from community members which is essential for the success of constructed wetland projects

What lies ahead?

- India's rich biodiversity and abundance of wetland ecosystems make it an ideal location for the adoption of constructed wetlands.
- The decentralized nature of many industries in India also makes these systems an appealing option for on-site or cluster-level wastewater treatment.
- With appropriate policies, capacity-building initiatives, and community involvement, constructed wetlands can significantly contribute to sustainable industrial progress and the preservation of water resources for future generations.

10.4 Biomedical Waste

Why in news?

Growing medical waste is causing serious ecological consequences before and after the covid-19 pandemic.

What is a Bio-medical waste?

- **About-** It refers to any solid and/or liquid waste produced during the diagnosis, treatment, or vaccination of human beings or animals.
- **Hazard-** Biomedical waste poses threat primarily due to two reasons such as infectivity and toxicity.
- **Sources-** Government hospitals, private hospitals, nursing homes, dispensaries etc.,
- **Category-** Biomedical Waste Management Rules 2016 categorizes the bio-medical waste generated from the health care facility into 4 categories based on the segregation pathway and colour code.
- **Color code-** The bio medical waste are further assigned to each one of the categories, as Yellow Category, Red Category, White Category, Blue Category.
- **India-** It generates around 700 Tonnes Per Day (TPD) of biomedical waste approximately and about 640 TPD is treated, despite the combined treatment capacity available being 1,590 TPD.

Hazardous waste	Non-hazardous waste
<ul style="list-style-type: none"> • It contains around 75-90% of the biomedical waste similar to domestic waste and it is non-risky in nature. • It mainly results from the organization and maintenance of hospitals and healthcare centres 	<ul style="list-style-type: none"> • Remaining 10-25% includes infectious and toxic components. • They are classified as infectious waste, pathological waste, pharmaceutical waste, genotoxic waste (drugs used in cancer therapy) and chemical waste

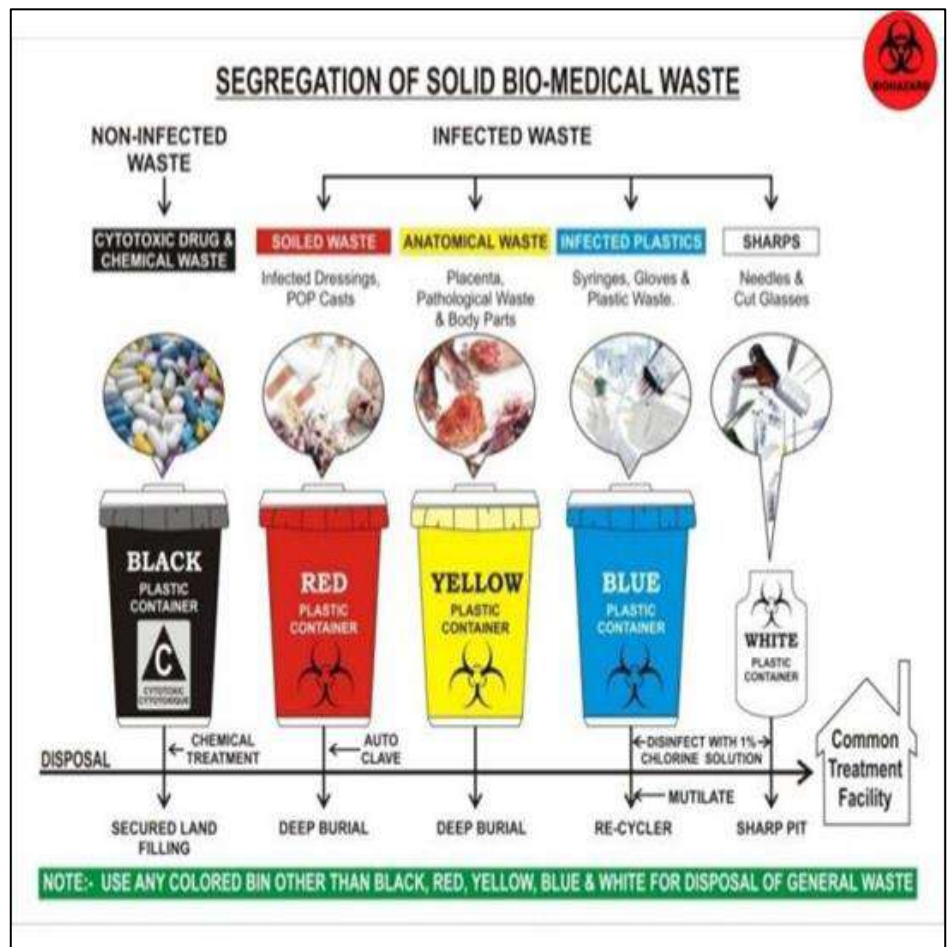
What are the challenges?

- **Lack of segregation-** The waste from hospitals and residences of COVID-19 patients was treated in the same way as municipal solid waste (MSW) during the pandemic which potentially caused secondary infections in humans.
- **Increase in waste-** India's biomedical waste management market is expected to grow at a compound annual growth rate of 7-8% which will poses challenges if gaps and leakages are not effectively managed.
- **Inadequate treatment facilities-** The country faces a shortage of adequate treatment facilities to handle the volume of biomedical waste generated, especially during health crises like the COVID-19 pandemic.
- **Insufficient monitoring and enforcement-** The biomedical waste management regulations are often insufficient, leading to non-compliance and increased risks.
- **Improper disposal methods-** It is sometimes disposed of inappropriately, leading to environmental pollution and health hazards.
- **Limited awareness-** There is an inadequate understanding of the health risks associated with healthcare waste among the personnel involved in its management.

- **Insufficient training-** Personnel handling biomedical waste often *lack proper training*, contributing to shortcomings in effective waste management practices.
- **Absence of management systems-** *Comprehensive waste management and disposal systems* are often absent, exacerbating the issue of biomedical waste management.
- **Multiple gaps-** It exist in the present system and there have been complaints about illegal transfer of waste, improper incineration and disposal methods.

What should be done?

- **Analysis by SPCBs-**All State Pollution Control Boards (SPCBs) need to conduct the gap analysis to estimate the leakages and use their discretion, so newer Common Biomedical Waste Treatment Facilities can be constructed and their operational radius can be determined.
- **Capacity verification-**Elaborate probing is required to check the actual vs reported capacities and the system's compliance with the mandated rules.
- **Strict monitoring-** Authorization of Healthcare Facilities (HCF) and strict monitoring of Online Continuous Emission Monitoring Systems (OCEMS) needs to be done.
- **Holistic tracking-** All stakeholders from the user to the occupier to the processors need to be tracked so any premeditated leakages can be avoided.
- **Widen barcoding-**The ambit of barcoding should be extended to the recyclers of biomedical waste, so there is a check on the manufacturing, distribution and consumption of those recycled products.
- **District-level monitoring-** Building a waste facility for every district in India is not practically or financially viable, hence SPCBs must determine the correct number of facilities, proprietors, and techniques required to manage waste effectively.
- **Zero waste to dumpsites-** The ultimate goal is to challenge system setbacks and ensure that no form of medical or bio-hazardous waste reaches India's dumpsites.



Quick facts

Biomedical Waste Management Rules 2016

- **Notified by-** Ministry of Environment, Forest and Climate Change.
- **Expansion of scope-**The rules now cover a broader range of healthcare activities, including vaccination camps, blood donation camps, and surgical camps.
- **Mandate-**To *phase out chlorinated* plastic bags, gloves, and blood bags within two years.
- **Waste pre-treatment:** Laboratory waste, microbiological waste, blood samples, and blood bags must be disinfected or sterilized on-site as prescribed by WHO or National Aids Control Organization.
- **Healthcare workers-** All healthcare workers must receive regular training and immunization.

- **Bar-code system-** A bar-code system for biomedical waste bags or containers is to be established for better tracking and disposal.
- **Reporting accidents-** Facilities must report major accidents involving biomedical waste.
- **Waste classification-** Biomedical waste has been reclassified into 4 categories instead of 10 to improve segregation at the source.
- **Simplified authorization-** The authorization process has been simplified, with automatic authorization for bedded hospitals and one-time authorization for non-bedded HCFs.
- **Stricter standards-** New rules set more stringent standards for incinerators to reduce environmental pollutant emissions.
- **Role of State governments-** They are responsible for providing land for common biomedical waste treatment and disposal facilities.
- **Proximity regulation-** No on-site treatment and disposal facility is to be established if a common biomedical waste treatment facility is available within 75 kilometers.
- **Role of operators-** Operators of common biomedical waste treatment facilities must ensure timely waste collection from HCFs and assist in training conduct.

10.5 India's Arctic imperative

Why in news?

India's first winter experience at the Arctic came to a successful end recently.

What is the history of India's involvement in the Arctic?

- **Svalbard Treaty, Paris-** India is a signatory to this treaty which recognizes the sovereignty of Norway over the archipelago of Svalbard and grants equal rights to all parties to engage in economic activities, such as mining and fishing in the region and its territorial waters.
- **Research mission-** In 2007, India undertook its first research mission to investigate Arctic microbiology, atmospheric sciences, and geology.
- **Himadri research station-** India's permanent Arctic research station is inaugurated in 2008 which located at Spitsbergen, Svalbard in Norway.
- **1st winter expedition-** Himadri research station had hosted missions only in summer, this winter expedition will give a major boost to the country's research around global climate, sea levels and biodiversity.
- **Observer status-** India has granted 'observer' status by the *Arctic Council* in 2013.
- **Infrastructural base-** India has since set up a multi-sensor moored observatory (2014) and an atmospheric laboratory (2016) in Svalbard, focusing on Arctic ice systems, glaciers, and their impact on the Himalayas and the Indian monsoon.
- **Arctic Policy of 2022-** It mentions that the country's approach to economic development of the region is guided by UN Sustainable Development Goals

Arctic region is the region, which is above the Arctic Circle and includes the Arctic Ocean with the North Pole at its centre.

India is the only developing country aside from China to have research base in Arctic which is located at International Arctic Research base, Ny-Alesund.

Why the winter arctic expedition is significant for India?

- **China's involvement** - China's growing investments in the Arctic have raised India's strategic interests in the region.
- **Russia-Ukraine war-** Russia's decision to grant China expanded access to the Northern Sea Route has intensified concerns, especially amid rising geopolitical tensions following the Russia-Ukraine conflict.
- **Economic route-** The opening of Arctic sea routes, such as the Northern Sea Route, presents potential economic benefits for India such as reduction in shipping costs, transit time, fuel consumption, and enhance security for Indian trade.

- **Scientific imperatives**-The accelerated warming of the Arctic has profound implications for global and regional climates. India's research in the Arctic aims to understand these changes and their effects on Indian weather patterns, particularly the monsoon.
- **Polar studies**- The polar regions, Arctic and Antarctica, offer pristine environments for scientists to study a range of natural phenomena for atmospheric, oceanic, biological, geological, glaciological and earth sciences research.
- **Economic value**- The Arctic has many natural resources such as crude oil, gold and industrial metals, and diamonds which are presently being extracted now, still much of the Arctic's potential for natural resources is unknown
- **Study cosmic dawn**- For the first time researchers will undertake the characterization of the radio frequency environment in the Svalbard region of the Arctic, it will help astronomers assess the suitability of this uniquely located region.
- **Unique study**- It will allow researchers to conduct unique scientific observations during polar nights, where there is no sunlight for nearly 24 hours and sub-zero temperatures (as low as -15°C).

Pillars of India's Arctic Policy

- Science and Research
- Climate and Environmental Protection
- Economic and Human Development
- Transportation and Connectivity
- Governance and International Cooperation
- National Capacity Building

What are the challenges?

- **Radio silence** - The Arctic station is located in a "radio silent" zone, meaning the use of all wireless devices, including mobile phones, WiFi and Bluetooth, is prohibited.
- **Extreme cold**- Temperatures in the Arctic can drop below -40 degrees Celsius in winter, posing significant risks to human health and equipment functionality.
- **Extreme weather condition**- The absence of sunlight for weeks in winter (polar night) and continuous daylight in summer can disrupt circadian rhythms and complicate scheduling and operations.
- **Remote locations** – The Arctic is one of the most remote regions on Earth, making transportation and supply delivery expensive and time-consuming.
- **Limited resources** - The remote locations of some Arctic research stations are difficult to access essential supplies and resources.
- **Climate change**- Rapid changes due to global warming are altering the Arctic environment, complicating long-term studies and necessitating continuous adaptation of research methods.
- **Health risks**- Researchers face risks from hypothermia, frostbite, and other cold-related health issues, as well as potential encounters with dangerous wildlife like polar bears.



What lies ahead?

- The 1st winter expedition realizes the India's vision of making it a developed nation by 2047, as it is committed to expanding scientific activities and international cooperation and collaboration.
- As global geopolitical tensions are also mounting in the Arctic, finding constructive and non-sensitive ways to alleviate pressure will be in the interest of both India and Norway.

10.6 Sundarbans Wildfire

Why in news?

Recently fire erupted in Bangladesh's Sundarbans which took almost four days to extinguish.

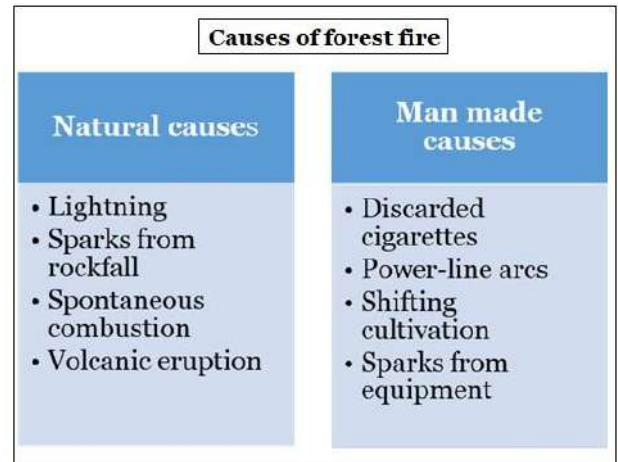
What is forest fire?

- **Wildfire**- It is an uncontrolled fire in an area of combustible vegetation that occurs in the countryside or rural area.
- Wildfires can burn in vegetation located both in and above the soil.

- **Ground fires**- It ignites in soil, thick with organic matter that can feed the flames, like plant roots.
- **Surface fires**- It typically burns in dead or dry vegetation that is lying or growing just above the ground. Parched grass or fallen leaves often fuel surface fires.
- **Crown fires** -It burns in the leaves and canopies of trees and shrubs.

Why Sundarbans is more prone to forest fire?

- **Dry seasons**- The Sundarbans experience pronounced dry seasons, particularly in the summer months. During this period, water bodies within the mangroves, such as ponds and canals, tend to dry up, especially in elevated areas which makes them more prone to forest fire.
- **Reduced water level**- Elevated regions in the Sundarbans, such as the area stretching from Katakhal to Daser Bharani, retain low water levels except during the monsoon, creating dry conditions conducive to fires.
- **Natural siltation**- It has turned some rivers and canals into mere channels that dry up during low tide, contributing to the overall dryness of the region. This reduction in water availability increases the susceptibility of the forest to fires.
- **Silt formation**- Rivers and canals, such as the Kharma river, have gradually filled up with silt, reducing water flow. During low tide, these water bodies often dry up, leaving the surrounding forest dry and more vulnerable to fires.
- **Drying water resources**- The drying up of these critical water sources, particularly outside the monsoon season, deprives the mangroves of essential moisture needed to prevent fires.
- **Climate change**- The region is experiencing severe heatwaves, insufficient rainfall, and drought conditions, all of which contribute to the drying out of vegetation and increase the risk of forest fires.
- **Unique tidal ecosystem**- The forest land sinks and floats with the tides, has been disrupted in areas affected by fires. This disruption hampers the natural fire resistance of the mangrove ecosystem.
- **Elevated areas**- They do not get inundated regularly by tides and are particularly prone to drying out, thus becoming fire hazards.
- **Anthropogenic factors**- Honey collectors and fishermen frequently visit the Sundarbans, and sometimes their activities inadvertently start fires. Discarded cigarettes or small cooking fires can easily ignite dry vegetation.
- **Illegal activities**- Poaching or collecting forest resources, may also lead to intentional or accidental fires.
- **Inadequate forest management**- The forest department in Bangladesh struggles with limited manpower, budget constraints, and insufficient equipment, making it difficult to effectively monitor and control fire outbreaks.



What can be done to resist forest fires?

- **Clearing canals and ponds**- The primary suggestion is to clear 40 kilometers of canals and three ponds to restore water flow.
- **Increasing manpower**- Hiring more staff for the forest department to improve fire response capabilities.
- **Enhanced patrols**- Improving patrols by forest guards to monitor and prevent fire incidents.
- **Observation towers**- Building 3 observation towers and installing a nylon rope fence along a 35-kilometer stretch of the Chandpai area to prevent human-wildlife conflicts.
- **Fire stations**- Constructing a river fire station and dredging the Bhola river, which has silted up near the forest, to improve water availability.
- **Holistic approach**- There is a need for a holistic and cooperative approach to manage the Sundarbans.

What lies ahead?

- The Sundarbans' ecosystem, characterized by its tidal dynamics, is essential for both environmental balance and local livelihoods.

- Effective management, involving updated legislation, better resource allocation, and community engagement, is crucial for the protection and sustainability of this vital mangrove forest.

Quick facts

Sundarbans ecosystem

- **About-** The Sundarbans contain the world's largest mangrove forests and one of the most biologically productive of all natural ecosystems.
- **Location-** At the mouth of the Ganges and Brahmaputra Rivers between India and Bangladesh.
- **Sundri-** The ecosystem is named after the dominant mangrove tree species, *Heritiera fomes*, known as “sundri” in Bengali, the term “Sundarbans” itself literally means “beautiful forest” in Bengali.
- **Sundarbans delta-** The ecosystem is formed by the confluence of South Asia’s largest rivers, the Ganges, Hooghly, Padma, Brahmaputra and Meghna.
- **UNESCO World Heritage Sites-** Sundarbans West (Bangladesh), Sundarbans South (Bangladesh), Sundarbans East (Bangladesh) and Sundarbans National Park (India).
- **Flora-** The most abundant tree species are sundri (*Heritiera fomes*) and gewa (*Excoecaria agallocha*).
- **Fauna-** Mugger crocodile, salt-water crocodile, shark, Gangetic dolphin, tiger, water monitor lizard, pangolin etc.,
- **Water monitor lizard-** It can grow up to 9 feet in length and is the second largest lizard in the world.
- **Mudskippers-** It is an air-breathing fish that climbs out of the water into mudflats and even climbs trees.



10.7 Human-Induced Disease

Why in news?

The study "A meta-analysis on global change drivers and the risk of infectious disease," published in Nature, provides a comprehensive look at how human-induced global changes impact the spread of infectious diseases across the globe.

What are the key highlights of the study?

- **Spike in disease outbreak-** Human-induced environmental changes are spiking the risk of disease outbreaks.
- **Human induced global changes-** As per the study biodiversity loss, introduction of non-native species, climate change, and chemical pollution are the leading drivers of disease spread not just among humans but also plants and animals.
- **Biodiversity loss-** It emerged as the most significant driver of disease spread.
- **Dilution effect hypothesis-** The study supports the dilution effect hypothesis, as biodiversity diminishes the prevalence of common host species increases, escalating the risk of disease outbreaks.
- **Rise in Lyme disease-** In US, the reduction in larger mammals due to habitat destruction has led to an increase in white-footed mice which are prolific carriers of the disease.
- **Climate change-** It affects the distribution and behaviour of various species, often forcing them into new areas where they encounter different species and pathogens potentially leading to new outbreaks.
- **Migration pattern-** The altered migration patterns due to climate change can expose species to new areas and pathogens.

The 'dilution effect' hypothesis suggests that the net effects of biodiversity (including host and non-host species) reduce the risk of certain diseases in ecological communities.

- **Mosquito borne diseases-** This dynamic in climate change is particularly evident in the altered distribution patterns of mosquitos and the spread of diseases like *malaria and dengue*.
- **Chemical pollution-** Pollution can weaken the immune system of various species, making them more susceptible to infections. Pollutants can create environment that facilitate the proliferation of certain pathogens.
- **Introduction of non-native species-** It can bring along new pathogens, leading to outbreaks in previously unaffected regions.
 - For example- The *Asian tiger mosquito's* arrival in Europe has introduced diseases like dengue and chikungunya.
- **Habitat loss-** When a habitat is no longer able to a particular species, or group of species it appears to reduce the disease spread.
- **Urbanization-** The reason of habitat loss could be the rapid pace of urbanisation, which reduces habitat for wild hosts and parasites, and urban areas with better sanitation and health infrastructure can mitigate disease transmission.
- **Limitations-** The study primarily examined individual global change drivers, but in reality, these factors often interact.
- For instance, climate change and chemical pollution can jointly lead to habitat changes and biodiversity loss, these combined effects can significantly impact disease spread.
- **Future research-** To understand disease dynamics comprehensively, future research should explore how these factors interact.
- Researchers need to investigate whether these interactions add, subtract, or multiply the risk of infectious disease outbreaks.

What lies ahead?

- Future research needs to explore interactions among the global change drivers to understand their combined impact on disease dynamics comprehensively.
- Policymakers and public health officials should consider environmental factors in their strategies to prevent and respond to disease outbreaks.

Quick facts

Dengue

- Dengue (break-bone fever) is a viral infection and is the world's fastest-growing vector borne disease.
- **Caused by** – Dengue virus (DENV), a RNA virus
- **Vector** - Aedes aegypti mosquito (which also spreads Chikungunya and Zika virus)
- **Treatment** - No specific treatment but early detection and access to proper medical care greatly lower fatality rates of severe dengue.
- **Vaccines** – Dengvaxia and Qdenga
- **Dengvaxia** –It is the 1st vaccine for dengue to receive a nod in 2015. It has been licensed in 20 countries but not licensed in India.

Malaria

- **Caused by-** Plasmodium parasite
- **Vector-**It is usually transmitted by the bite of infected *female Anopheles mosquitoes*.
- **Species-** The severity of malaria varies based on the species of Plasmodium – Plasmodium falciparum and Plasmodium vivax are fatal
- It is both *preventable and curable*.

10.8 Mangrove Ecosystem

Why in news?

The recent global assessment conducted by the IUCN paints a concerning picture for the world's mangrove forests.

Key findings of the study

- **IUCN**- International Union for Conservation of Nature (IUCN) Red List of Ecosystems recently conducted the first global mangrove assessment.
- **Distribution**- Mangrove ecosystems cover approximately 150,000 square kilometers along tropical, subtropical, and warm temperate coastlines, representing about 15% of the world's coastlines.
- **Threats**- The analysis reveals that more than 50% of these vital ecosystems are on the verge of collapse due to a combination of human activities and climate change.
- **Regions at risk**-
 - **Critically Endangered**- South India, Sri Lanka, Maldives, North West Atlantic
 - **Endangered**- Agulhas, Central Pacific, East Coral Triangle, east central and southeast Australian shelf, Red Sea, Gulf of Aden, South China Sea
- **Ecosystem health**- 50% of the assessed mangrove ecosystems are classified as vulnerable, endangered, or critically endangered, with a high risk of collapse by 2050.
- **Impact of climate change**- About 33% of mangrove systems are threatened by climate change impacts.

What is the significance of mangroves?

- **Carbon sequestration**- It sequester large amounts of carbon dioxide from the atmosphere, storing it in their biomass and soil.
- **Water filtration**- It helps filter pollutants and sediments from the water, improving water quality.
- **Natural barrier**- Their dense root systems stabilize shorelines and reduce the impact of waves and extreme weather events such as tsunamis, storm surges etc., protecting inland areas and communities.
- **Flood mitigation**- By absorbing and slowing down the flow of water, mangroves help mitigate coastal flooding.
- **Support for fisheries**- Mangroves support commercial and subsistence fisheries by providing critical habitat for fish and shellfish populations.
- **Adapt to climate change**- Healthy mangrove ecosystems can keep pace with sea-level rise by accumulating sediment and organic matter, helping to maintain coastal land elevation and providing resilience against rising sea levels.
- **Cultural value**- For many indigenous and local communities, mangroves hold cultural, spiritual, and historical significance.

To know about the role of mangroves in averting climate change click [here](#)

What are the challenges faced by mangroves?

- **Deforestation**- Coastal development for housing, tourism, and infrastructure leads to the clearing of mangrove forests.
- **Land use change**- Conversion of mangrove areas into rice paddies, palm oil plantations, and shrimp farms results in significant habitat loss.
- **Pollution**- Chemical pollutants from industries, agricultural runoff and waste disposal affects mangrove health.
- **Sea level rise**- Increasing sea levels can submerge mangroves, especially if they are unable to migrate inland due to natural or man-made barriers.
- **Dam construction**- Dams and other water management structures upstream can alter freshwater inflows to mangrove areas, affecting their salinity balance and health.
- **Water extraction**- Excessive withdrawal of groundwater can lead to subsidence and increased salinity in mangrove soils.
- **Invasive species**- It outcompete native mangrove species, altering ecosystem dynamics and reducing biodiversity.

- **Limited awareness**- Lack of awareness among local communities and policymakers about the importance of mangroves can result in poor conservation practices.

Steps taken by India to promote mangrove ecosystem

- **Mangrove Initiative for Shoreline Habitats & Tangible Incomes (MISHTI)**- To promote and conserve mangroves as unique, natural eco-system having very high biological productivity and carbon sequestration potential, besides working as a bio shield.
- **Conservation and Management of Mangroves and Coral Reefs” scheme**- It aims to safeguard and improve mangrove forests in coastal States and Union Territories.
- **Magical mangroves**- It is a awareness campaign that focuses on Maharashtra, Goa, Gujarat, Andhra Pradesh, Tamil Nadu, Kerala, Odisha, West Bengal and Karnataka.
- **Andhra Pradesh**- The State have established *Eco-Development Committees* and *Van Samrakshan Samithi* to implement conservation projects in mangrove areas.
- **Maharashtra**- It has established a *Mangrove Cell* dedicated for mangrove conservation, and the State has also created *Marine Biodiversity Conservation Foundation* is created to enhance mangrove cover.
- **Gujarat**- It has its own "Mangrove Conservation Cell" and afforestation projects in the Gulf of Kutch.

What lies ahead?

- The assessment recommends that countries utilize national or sub-national assessments for more precise conservation efforts.
- Maintaining healthy mangroves is crucial for mitigating the effects of climate change, such as combating sea-level rise and providing protection from extreme weather.
- Protecting and restoring mangroves can enhance their resilience against climate change impacts.

10.9 Challenges of Plastic Degradation

Why in news?

Microplastics and nanoplastics are an emerging threat to cardiovascular health

How plastics are degraded?

- Plastics are everywhere, from our oceans to the air we breathe. They've infiltrated every corner of our planet due to their widespread use.
- Plastics can contaminate the environment through ocean currents, atmospheric winds, and terrestrial processes, leading to their widespread dispersion.
- Once released into nature, plastics undergo degradation, resulting in the formation of
 - Microplastics (particles smaller than 5 millimetres) and
 - Nanoplastics (particles smaller than 1,000 nanometres).
- **Process**-It can be categorized into photodegradation (UV light from the Sun), thermal degradation, chemical degradation, and biodegradation.
- Both microplastics and nano plastics (MNP) induce various toxic effects.

What are the challenges of MNP?

- **Detection**- MNPs range from visible particles to those on the nanoscale, making detection and quantification difficult.
- **Slow degradation**- MNPs persist in in the environment due to their slow degradation rates, thier long lasting presence poses risks to ecosystems and living organisms.
- **Diverse sources**- Both originate from various sources, including plastic waste, fragmentation of larger plastics and unintentional release during production and use.
- **Biological effects**- Both can harm etabolic, morphological, physiological, and behavioral processes in organisms, their impacts occurs at both cellular and ecosystem levels.

- **Lack of standardization-** Assessing the risks of NPs for human health is challenging due to the lack of a comprehensive framework.
- **Ecosystem disruption-** Accumulation of MPs and NPs affect ecosystem functions including nutrient cycling, food webs and biodiversity, their presence disrupts natural processes.
- **Lack of awareness-** Consumers may lack awareness of MNP-containing products and their potential health and environmental implications, highlighting the need for transparent labeling practices.

What are the impacts of MNP?

- **Ingestion by marine organisms-** MNP is ingested by a wide range of marine organisms, from tiny plankton to large fish and mammals.
- **Chemical toxicity-** It can adsorb and concentrate harmful chemicals from the water, such as pesticides, heavy metals, and persistent organic pollutants (POPs), which then can be ingested by marine organisms.
- **Biomagnification-** The accumulation of MNPs in smaller organisms can lead to biomagnification, where higher concentrations of MNPs and associated toxins are found in larger predators up the food chain, including humans.
- **Soil health-** It can alter soil structure and function, affecting water retention, nutrient availability, and soil microbial communities.
- **Wildlife exposure-** Terrestrial animals, including insects, birds, and mammals, can ingest MNPs through contaminated soil, water, and food sources, leading to similar health issues as observed in marine life.
- **Human health-** It can enter the human body via ingestion, inhalation, and skin contact which result in cardiovascular dysfunction, gut health issues, hormonal interference etc.,

What lies ahead?

- As plastics continue to infiltrate our environment, mitigating their impact on human health must become a top priority.
- Addressing the global challenge of MNPs requires international cooperation and coordination among governments, industry, academia, and civil society.
- Harmonizing standards, sharing data and best practices, and promoting collaboration are essential for effective MNP management.

11. SCIENCE & TECHNOLOGY

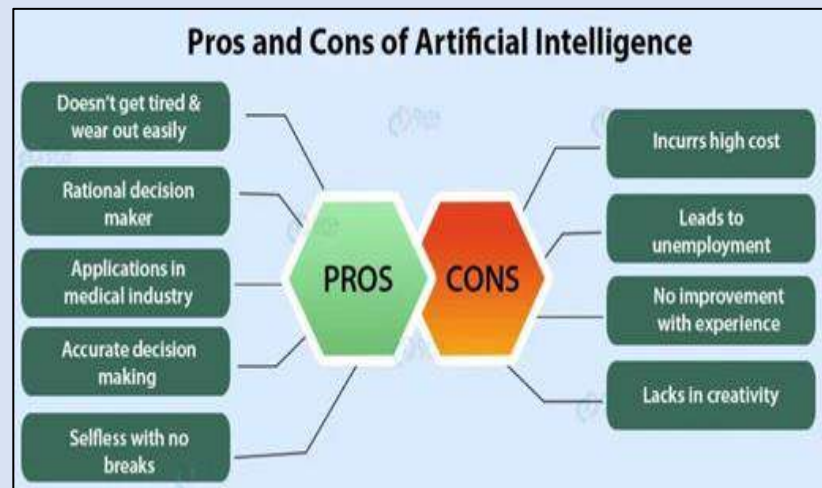
11.1 Dark Side of Artificial Intelligence

Why in news?

A recent study by Yale School of Environment sheds a darker light on the new-age technology's energy use, especially in terms of immediate environmental impact.

Artificial Intelligence

- Artificial Intelligence (AI) refers to the development of computer systems of performing tasks that require *human intelligence*.
- AI aids, in processing amounts of data identifying patterns and making decisions based on the collected information.
- **Techniques**-AI can be achieved through techniques like Machine Learning, Natural Language Processing, Computer Vision and Robotics.
- **Range of abilities**- It includes learning, reasoning, perception, problem solving, data analysis and language comprehension.
- **Ultimate goal**- To create machines that can emulate capabilities and carry out diverse tasks, with enhanced efficiency and precision.



What are the key highlights of the study on AI's carbon footprint?

- **Impact on environment**- The unregulated carbon footprint of artificial intelligence (AI) could significantly undermine the progress towards Sustainable Development Goals (SDGs) and emission reduction targets.
- **Reverse global efforts**- The unchecked growth of AI could lead to increased energy and resource consumption, potentially reversing global efforts to combat climate change.
- **Hinders SDG**- The energy intensive nature of training and operating AI models contribute to GHG emissions, which if not managed properly can hinder the achievement of SGGs, particularly those related to
 - **SDG 7**- Affordable and clean energy
 - **SDG 13**- Climate action
 - **SDG 12**- Responsible consumption and production
- **Excessive water consumption**- There is a need of substantial water usage by AI computing systems, particularly for cooling purposes and to generate electricity for AI.
- **Use of clean water**- The larger the AI system, the greater the need for water to maintain operational temperatures and functionality.
- **Water usage by tech giants**- . In 2022, Google's water consumption for cooling its data centres reached nearly 20 billion litres, this was a 20% increase from the previous year. Similarly, Microsoft's water usage rose by 34%.
- **Impact on India**- As the number of data centres by such tech giants around the world increases and AI is expected to be embedded in all aspects of life, the freshwater stock is likely to be gravely hit, especially in countries like India.
- **World Water Development report, 2023**- The UN states that the world is looking at an "*imminent risk of global water shortage*" with two to three billion people worldwide fighting the issue.
- **Environment cost**- The carbon emissions from the energy required to run these centres, and the environmental toll of manufacturing and disposing of electronic waste, the overall impact is indeed significant.
- **Energy consumption**- According to the International Energy Agency, the data centres (around 9000 to 11,000 in the world) electricity consumption by 2026 will reach up to 1,000 terawatts roughly equivalent to Japan's current total electricity consumption.
- **Lack of transparency**- The lack of comprehensive data and the absence of standardized regulations make it challenging to develop effective measures to monitor and manage AI's energy use.

The study states that 10 to 50 responses from ChatGPT-3 use up around half a litre of water.

What are the consequences of AI's carbon footprint?

- **Climate change-** AI's carbon footprint contribute to GHG emissions, this can lead to more frequent and severe weather events, disruption to ecosystems and adverse effects on human health and livelihoods.
- **Resource depletion-** The energy and resources required to train and deploy AI models contribute to resource depletion, including water, minerals, and fossil fuels.
- **Economic costs-** The environmental impact of AI's carbon footprint can lead to economic costs associated with climate mitigation and adaptation efforts.
- **Social inequities-** The consequences of climate change disproportionately affect vulnerable populations including low income communities and marginalized group.
- **Technological lock-in-** Heavy reliance on energy-intensive AI models and infrastructure can create technological lock-in, making it challenging to transition to more sustainable alternatives.

As per London-based International Electrotechnical Commission (IEC) by 2027, the AI industry could be using up as much natural resources and energy as a country the size of the Netherlands.

What lies ahead?

- **Sustainable AI-** Policies and regulations must incentivize the adoption of sustainable AI practices such as investing in renewable energy sources and energy-efficient technologies.
- **Promote transparency-** There are calls for the establishment of standards for measuring AI's environmental impact and creating a voluntary reporting framework for AI developers.
- **Holistic approach-** The need of the hour is fostering interdisciplinary collaboration and promoting awareness of the environmental impacts of AI can help drive positive change towards a more sustainable future.
- **Google's 4M approach-** The approach (Model, Machine, Mechanization and Map optimization) is commendable and eco-friendly approach to reduce carbon and energy footprints of AI.
- **Informed decisions-** International Electrotechnical Commission (IEC) and the International Organisation for Standardization (ISO) are set to release this year the world's first report with international standards for sustainability in AI.'
- **India's approach-** It's initiative to subsidize private companies for setting up AI compute capacity is undoubtedly aimed at boosting technological development, but it's crucial to ensure that this growth is sustainable, considering India's significant water stress.
- **Innovative solutions-** Balancing technological advancement with environmental stewardship will be key for India and other nations facing similar challenges.

11.2 Artificial General Intelligence

Why in news?

Is the development of machines capable of human-like thought and learning a boon to society, or does it pose a risk to our very existence?

What is Artificial General Intelligence?

- **AGI-** It refers to a machine or a software that can perform any intellectual task that a human can do.
- **Origin-** The idea of AGI first emerged in the 20th century with a paper written by Alan Turing, widely considered to be the father of theoretical computer science and artificial intelligence.
- **Turing test-** It is a means to evaluate machine intelligence, the test suggests that if a machine can engage in a conversation with a human in such a way that the human cannot distinguish whether they are conversing with another human or a machine, then the machine can be considered to possess human-like intelligence.
- **Aim-** To emulate human cognitive abilities such that it allows it do to unfamiliar tasks, learn from new experiences, and apply its knowledge in new ways.
- **Functions-** AGI performs reasoning, common sense, abstract thinking, background knowledge, transfer learning, ability to differentiate between cause and effect, etc.,
- **Learn from experience-** AGI can adapt to new situations, and acquire new knowledge and skills without explicit programming for each task.

Artificial General Intelligence (AGI) also commonly known as Strong AI or Deep AI is basically the hypothetical intelligence of machines.

- **Problem solving**- AGI can understand complex problems, reason through them using logic or intuition, and generate solutions or make decisions based on available information.
- **Understand natural language**- AGI can comprehend and generate human language, enabling effective communication and interaction with users.
- **Creativity**- AGI may exhibit creativity by generating novel ideas, solutions, or artifacts beyond what they have been explicitly programmed for.
- **Autonomy**- AGI has a degree of autonomy in decision-making and problem-solving, capable of operating independently within its defined scope.

Key aspects	Narrow AI (common form of AI)	AGI
Scope of functionality	They are designed and trained for <i>specific, singular or limited task</i> such as image recognition, natural language processing, playing games or autonomous driving.	It aims to possess a broad range of cognitive abilities, similar to those of humans allowing them to perform wide <i>variety of tasks</i> across multiple domains
Level of generalization	Their capabilities are limited to the specific context for which they are designed, and they cannot generalize their knowledge or skills beyond that context.	AGI systems possess the ability to generalize knowledge, skills, and problem-solving approaches across different tasks and domains.
Adaptability	They require large amounts of labelled data and extensive training to achieve optimal performance within their predefined task.	AGI systems exhibit greater adaptability and learning capabilities, enabling them to acquire knowledge and skills from diverse sources, learn new tasks with limited supervision, and apply their understanding to novel situations.
Degree of autonomy	It operate within well-defined parameters and rely on explicit instructions or algorithms to perform their tasks.	AGI systems have a higher degree of autonomy, capable of making decisions, solving problems, and learning independently within a broader range of contexts

What are the applications of AGI?

- **Healthcare**- AGI could revolutionize the medical field by integrating and analysing *extensive datasets* to improve diagnostics, treatment planning, and personalized medicine.
- **Finance**- It could automate complex processes and *enhance decision-making* by providing real-time analytics and accurate market predictions, potentially transforming industries with its advanced computational abilities.
- **Education**- It has the potential to transform educational systems by creating adaptive learning platforms tailored to individual student needs which could *democratize education*, making personalized learning accessible to students worldwide, regardless of their location or background.
- **Autonomous systems**- It could enable the development of highly advanced autonomous systems, including self-driving cars, drones, robots, and smart infrastructure
- **Scientific research**- It could accelerate scientific research by analysing vast amounts of data, conducting simulations, this could aid scientists in solving complex problems in fields such as physics, chemistry, biology, and astronomy.
- **Sustainability**- AGI could play a crucial role in addressing global challenges such as climate change, resource management, and environmental conservation by analysing environmental data, optimize energy usage, and develop sustainable solutions for mitigating environmental impact.
- **Existential threat**- Stephen Hawking said, “The development of full artificial intelligence could spell the end of the human race.”

What are the challenges of AGI?

- **Environmental impact**- The immense computational power required for AGI development raises concerns about its environmental impact, particularly in terms of energy consumption and the generation of electronic waste.
- **Employment disruption**- AGI’s potential to automate tasks across various sectors could lead to significant job displacement, potentially exacerbating socio-economic disparities.

- **Power imbalance**- The concentration of power in the hands of entities that control AGI raises concerns about socio-economic inequality and the potential for misuse or exploitation.
- **Security risks**- The development of AGI may introduce unforeseen security vulnerabilities, posing risks to data privacy, cybersecurity, and even national security.
- **Ethical considerations**- AGI's unprecedented capabilities raise ethical questions regarding its impact on human society, autonomy, and values.
- **Loss of human control**- The possibility that AGI could outpace human understanding and control, leading to unpredictable or undesirable outcomes.

What lies ahead?

- There is a need for robust regulation, international cooperation and interdisciplinary research to ensure that AGI development proceeds responsibly and in alignment with human values and safety standards.
- It's essential to approach AGI development with a comprehensive understanding of its potential risks and benefits, prioritizing the well-being of humanity as a whole.

11.3 All about Auroras

Why in news?

A crimson glow lit up the dark sky in parts of Ladakh in a rare stable auroral red arc event at the Hanle Dark Sky Reserve in the high Himalayas due to the strong solar magnetic storms launched towards Earth.

What is Auroras?

- **Polar lights**- An aurora is a natural light display that is predominantly seen in high-latitude regions around the Arctic and Antarctic.
- **Formation**-These lights occur due to interactions between solar winds—streams of charged particles ejected from the Sun—and the Earth's magnetosphere, a region dominated by Earth's magnetic field.
- When these charged particles collide with atoms and molecules in the Earth's upper atmosphere, they produce light.
- **Solar storms**- They are caused by Coronal Mass Ejections (CMEs), which are significant releases of magnetic particles and plasma from the Sun's corona.
- **Visibility**-Auroras are only visible at night, and usually only appear in lower polar regions.
- **Vibrant colour**-
 - **Oxygen**- It gives off green and red light.
 - **Nitrogen**- It gives blue and purple.
- **Strongest auroras**- It occur during periods of high solar activity, such as solar storms or solar flares.

Region	Known as
<ul style="list-style-type: none"> • In north (Arctic circle) it is called as northern lights 	Aurora borealis
<ul style="list-style-type: none"> • In south (Antarctic Circle) it is called as southern lights 	Aurora australis

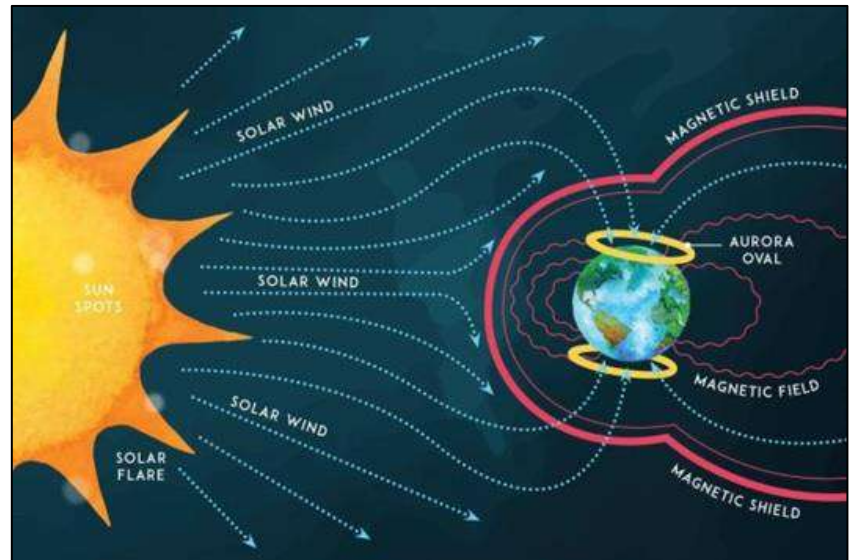
Auroras visibility is seen in regions about 66.5° north and south of the Equator.

How are auroras formed?

- **Solar winds**- The Sun emits a continuous stream of charged particles, primarily electrons and protons, known as the solar wind. These particles travel through space and can sometimes interact with Earth's magnetic field.
- **Interaction with Earth's Magnetosphere**- When these charged particles from the solar wind reach Earth, they encounter the Earth's magnetosphere.
- **Magnetosphere disturbances**- Some solar wind particles, particularly during periods of heightened solar activity (such as solar flares and coronal mass ejections), can disturb the magnetosphere. These disturbances can cause particles to become trapped in the Earth's magnetic field lines.

The magnetosphere is a protective magnetic field that surrounds our planet and deflects most of the solar wind particles.

- **Movement toward the poles-** The Earth's magnetic field lines guide these trapped particles toward the polar regions. This is because the magnetic field is weaker and more concentrated at the poles, providing a path of least resistance for the particles.
- **Collisions in the atmosphere-** As the charged particles spiral along the magnetic field lines and enter the Earth's upper atmosphere (the thermosphere and ionosphere), they collide with atoms and molecules of gases, primarily oxygen and nitrogen.
- **Excitation-** These collisions transfer energy from the charged particles to the gas atoms and molecules, exciting them to higher energy states.



- When these excited atoms return to their normal state, they release energy in the form of light. This light is what we see as auroras.

Why auroras are seen in Ladakh?

- **Heightened solar activity:** The solar storms were unusually intense and multiple CMEs struck Earth in quick succession, greatly disturbing the usual space weather.
- **High intensity of CMEs-** The CMEs that reached Earth were particularly intense, traveling at speeds up to 815 km/second . This high intensity meant that a large number of charged particles were directed towards Earth, significantly disturbing the magnetosphere.
- **Magnetic latitude-** Although auroras are typically confined to high-latitude regions near the poles, the intensity of these solar storms allowed auroras to be visible at lower latitudes, such as Ladakh.
- **Enhanced Auroral oval-** During intense solar storms, the auroral oval (the ring-shaped region around the poles where auroras are typically visible) can expand towards lower latitudes. This expansion brought the auroral activity into regions like Ladakh.
- **Clear sky-** Ladakh's high altitude and clear skies provided optimal conditions for observing the auroras. The region's lack of light pollution also made it easier to see the faint auroral displays.

Quick facts

Hanle Dark Sky Reserve (HDSR)

- **Organised by-** Indian Institute of Astrophysics (IIT) in collaboration with Department of Wildlife Protection, UT Ladakh to observe the optical phenomenon in the sky.
- **1st dark sky region-** It is India's 1st dark sky region notified by UT of Ladakh comprising an area of radius roughly 22 km around Hanle.
- **Objectives-**
 - It preserves the dark skies by *reducing light pollution* in the surrounding areas.
 - It uses these dark skies to *promote astrotourism* as a means to further enhance socio-economic development in the area.
- **Significance of Dark Sky** – To observe stars, star clusters, nebulae, and galaxies (such as Milky Way, Andromeda and the Triangulum) with the naked eye.
- **Bortle scale-** HDSR comes under Bortle Class 1 skies, it helps to measure the night sky's brightness at a given location.
- **Range-** The Bortle scale ranges from Class 1 (darkest skies available over the earth) to Class 9 (pale, light-marred skies over the insides of cities).

11.4 AI Regulatory Sandbox

Why in news?

Recently governments and regulatory bodies are turning to “AI regulatory sandboxes” to balance fostering AI innovation with ensuring responsible development.

What are regulatory sandboxes?

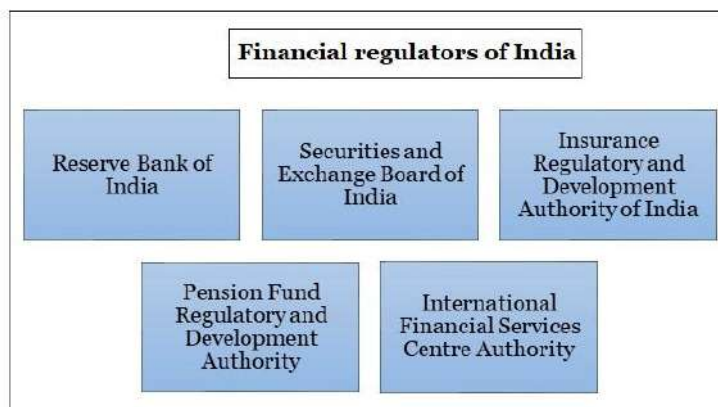
- **About-** Regulatory sandboxes allow businesses to test and experiment with new and innovative products, services, or business models.
- **Safe space-** These experiments occur under the supervision of a regulator within a controlled environment.
- **Dual purpose-** To facilitate
 - **Business learning-** Development and testing
 - **Regulatory learning-** Formulating experimental legal regimes.
- **2019 OECD AI principles-** It recommended the governments to consider using experimentation to provide a controlled environment in which AI systems can be tested and scaled up.
- **Status-** As per World Bank in 2020 there were approximately 73 regulatory sandboxes, both announced and operational, within the financial sector across 57 jurisdictions.

Global regulatory landscapes on AI regulatory sandbox

- **UK-** The *first formal regulatory sandbox* is formed by establishing Financial Conduct Authority.
- **Japan-** It encourages *experimentation with new technologies* like blockchain, AI and Internet of Things (IOT).
- **Norway-** It established a regulatory sandbox as *part of its national AI strategy* it focuses on providing guidance on personal data protection for both private and public companies.
- **European Union-** *Artificial Intelligence Act* envisages setting up coordinated AI 'regulatory sandboxes' to foster innovation in artificial intelligence (AI) across the EU

What are the steps taken by India to promote AI regulatory sandboxes?

- **Financial regulators-** All financial sector regulators in India have launched their respective regulatory sandboxes.
- **RBI regulatory sandbox-** It allows fintech entities to test new financial products and services in a controlled environment, where the central bank may allow certain regulatory relaxation.
- **Karnataka-** It has gone beyond finance by enacting the **Karnataka Innovation Authority Act, 2020**, establishing an *Innovation Authority* dedicated to promoting and regulating innovative technologies through a regulatory sandbox model.
- **Telecommunications Act 2023-** It proposes a regulatory sandbox in the field of telecommunications that aims to promote and facilitate one or more regulatory sandboxes specifying the manner and duration for their implementation.
- **Draft National Strategy on Robotics-** It recommended the usage of regulatory sandbox.



What are the benefits of AI regulatory sandbox?

- **Promotes innovation-** It enables the development of AI technologies without the immediate risk of violating laws or regulations, thus reducing the ‘time to market’ for innovations
- **Quick response-** Sandboxes can quickly adapt to new technological developments, unlike traditional legislation which can be slow and outdated by the time it’s implemented.
- **Consumer protection-** They provide a safe testing ground to identify and mitigate potential risks, ensuring AI systems are safe for consumer use.

- **Collaboration**- Sandboxes encourage collaboration between regulators, businesses, and stakeholders, leading to more effective regulations that balance innovation with public safety.

What are the challenges of regulatory sandboxes?

- **Inefficient implementation**- Concerns about the rapid growth of fintech regulatory sandboxes without proper assessment of feasibility, demand, and potential outcomes, leading to unanticipated impacts on competition and regulation.
- **Scalability issues**- Sandboxes designed for small-scale testing may face pressure to expand as companies recognize the competitive advantage of participating, which could require automation of some processes.
- **Regulatory fragmentation**- Diverging policies and international competition could lead to lenient conditions in some sandboxes, causing regulatory arbitrage and the need for a harmonized international legal framework for cross-sandbox compatibility.
- **Risk of misuse**- Regulatory sandboxes can potentially be misused by participants who may exploit the relaxed regulatory environment to test products that could pose risks to consumers or the broader market.
- **Unforeseen consequences**- Innovative technologies can have unexpected impacts such as market disruptions, ethical issues or social implications that are difficult to predict within the controlled environment of a regulatory sandbox.
- **Lack of consistency**- Inconsistent application and enforcement of regulations within sandboxes can create uncertainty and reduce their effectiveness.

What lies ahead?

- A regulatory sandbox should not be viewed as an approach to directly govern AI, but rather as a progressive step preceding formal legislation.
- It serves as a preparatory measure tailored to India's specific circumstances, paving the way for future regulatory actions aligned with the country's needs and developments in the AI landscape.

Quick facts

Steps taken by India to promote AI

- **NITI Aayog's National Strategy for AI**- It led to creation for National Portal for AI serving as a central repository for AI resources, research, and developments in India.
- **AI Innovation Report, 2023**- It is released by Ministry of Electronics and Information Technology (MeitY) which outlines India's AI vision through 7 working groups focused on different aspects of AI deployment and development.
- **Digital India Act, 2023**- It includes provisions for regulating AI through a dedicated set of laws and regulations, addressing the unique challenges and opportunities presented by AI technologies.
- **Global Partnership on AI**- India is a member country, it adopted *GPAI New Delhi Declaration* on advancing safe, secure, and trustworthy AI and commitment to supporting the sustainability of GPAI projects.
- **AIDef**- Artificial Intelligence in Defence is a symposium held in 2022 that showcased cutting edge AI enabled solutions developed by industry, start-ups etc.,
- It includes Defence AI Council and Defence AI Project Agency that facilitates AI integration in defence.
- **AIRAWAT**- AI Research, Analytics and knowledge Assimilation will be based on the recommendations of the National Strategy for Artificial Intelligence (NSAI), which has identified areas that are hampering the growth potential of AI in India.

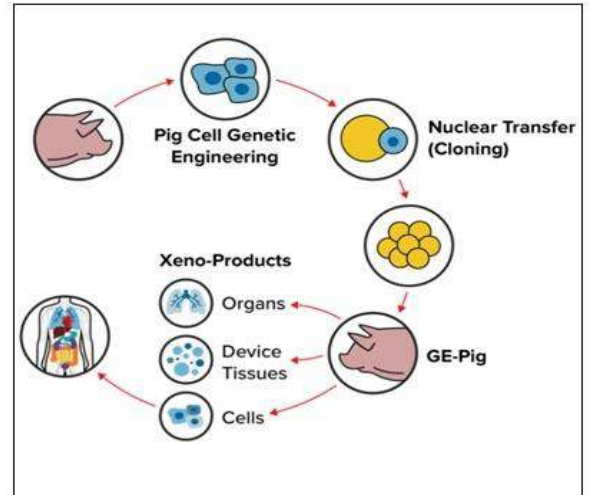
11.5 Xenotransplantation

Why in news?

Recently, the first recipient of a modified pig kidney transplant passed away around two months after the surgery was carried out.

What is Xenotransplantation?

- **About-** It is any procedure that involves the transplantation, implantation or infusion into a human recipient of either
 - Live cells, tissues, or organs from a nonhuman animal source, or
 - Human body fluids, cells, tissues or organs that have had ex vivo contact with live nonhuman animal cells, tissues or organs.
- **Cross species transplantation-**It is a process that involves the transplantation, implantation or infusion into a human recipient from a non-human animal source.
- **Genetic modification-** It is the critical step to reduce the likelihood of rejection of the animal organ by the human immune system.



Genetic editing	Genetic modification
<ul style="list-style-type: none"> • It involves <i>making precise changes</i> to the DNA of an organism. 	<ul style="list-style-type: none"> • It is also known as <i>genetic engineering</i>, involves altering the genetic material of an organism by adding, deleting, or modifying genes.
<ul style="list-style-type: none"> • Techniques like <i>CRISPR-Cas9, TALENs, and ZFNs</i> are commonly used for this purpose 	<ul style="list-style-type: none"> • Techniques like <i>recombinant DNA technology</i>, where DNA from different sources is combined, are often used.
<ul style="list-style-type: none"> • It uses <i>engineered nucleases</i> to introduce cuts at specific locations in the DNA, these cuts are repaired by cell's natural repair mechanisms, which can result in the insertion, deletion, or replacement of DNA sequences 	<ul style="list-style-type: none"> • It can include the <i>introduction of new genes</i> from other species (transgenic modification), the deletion or silencing of genes, or the modification of existing genes
<ul style="list-style-type: none"> • It specifically refers to <i>precise changes</i> at specific sites in the genome. 	<ul style="list-style-type: none"> • It is a <i>broader term</i> that includes any alteration of genetic material,
<ul style="list-style-type: none"> • It is particularly useful for <i>correcting genetic defects</i> and studying specific genes. 	<ul style="list-style-type: none"> • It is commonly used to <i>introduce new traits</i> from other species.

Why pigs are focused on Xenotransplantation?

- **Anatomical similarity-** The pig's anatomical and physiological parameters are similar to that of humans organs in size and function.
- **Availability-**Pigs are widely bred on farms, making them an accessible and affordable source.
- **Variety of breeds-**Different pig breeds provide opportunities to match the size of harvested organs to human recipients' needs.
- **Proven track record-**Pig heart valves have been used to replace damaged human valves for *over 50 years*.

Xenotransplantation involving the heart was first tried in humans in the 1980s.

What is the significance of xenotransplantation?

- **Organ transplantation-** It is seen as an alternative to the clinical transplantation of human organs whose demand around the world exceeds supply by a long distance.
- **Reduce organ waiting list-** In human-human organ transplantation many people die while waiting to receive transplant from a human organ donor, Xenotransplantation shortens the organ waiting time.
- **Enhance longevity-** Xenotransplantation, if found compatible in the long run, could help provide an alternative supply of organs to those with life-threatening diseases.
- **Research on animals-** Scientists may save countless human lives by doing stem cell research on animals rather than human embryos.
- **Tissue transplants-** Along with cells and organs, tissues can also be transplanted into human bodies. These could include corneal transplants to encourage healthier vision and bone transplants.

- **Pattern of gene expression**- Continued research may reveal patterns of gene expression and antigen T-Cell response.
- **Valuable asset**- *Developmental biology* has been vital for human health and providing researchers with the tools they need will only help them make life better
- **Prevent black market**- The use of animal organs as an alternative could help to reduce the exploitative black market trade that sells human organs.

What are the challenges of xenotransplantation?

- **Zoonotic disease**- The main risk is transmission of animal viruses or diseases to humans, which could cause new pandemics.
- **Infection risk**- The risk of infection from an animal organ may be higher than the risk from a human organ as the animal organ may contain animal-specific germs.
- **Organ farming**- Animal rights would be violated and humans may begin the practice of “organ farming”.
- **Genetic manipulation**- Further research may lead to genetic manipulation.
- **Organ rejection**- Another challenge is the rejection of animal organs by the human immune system, which could lead to organ failure or inflammation.
- **Ethical concerns**- Some people criticize xenotransplantation because of religious beliefs, such as that mixing species is against God’s will.
- **Constant monitoring**- Post-surgery, patients require continuous monitoring to check the body's response to the transplanted organ.
- **Less longevity**- The animal organs does not last for long period in human bodies as their average life expectancy is less than human.
 - Example- The average life expectancy of pigs is 15 to 20 years whereas for humans it is around 72 years.

What lies ahead?

- Xenotransplantation holds promise for addressing the shortage of human donor organs, but it requires overcoming significant medical and ethical challenges.
- Worldwide harmonization of regulatory guidelines for oversight is needed to address the infectious risks associated with xenotransplantation.
- Genetic modifications, infection risks, and immune response management are critical areas needing continuous research and development.
- Despite the hurdles, the progress in xenotransplantation offers hope for patients awaiting transplants and could eventually provide a viable solution to the organ shortage crisis.

11.6 Space Tourism

Why in news?

Entrepreneur and pilot Gopi Thotakura is set to become the first Indian to venture into space as a tourist on the NS-25 mission of Blue Origin.

What is space tourism?

- Space tourism is a section of the aviation sector which seeks to provide tourists with the opportunity to become astronauts and experience space travel for recreational, leisure, or business purposes.

Types of space tourism	
Sub-orbital	<ul style="list-style-type: none">• A suborbital flight is one that goes up into space, which is somewhat arbitrarily defined as either 50 miles or 100 kilometers in altitude but does not achieve orbit.• The spacecraft comes right back down to Earth.
Orbital	<ul style="list-style-type: none">• An orbital flight is one that achieves orbit.

- That is a state where the spacecrafts forward momentum balances out the pull of Earth's gravity so that it remains in that state, without requiring any further propulsion, indefinitely.

- **NS-25 mission-** It is fully reusable sub-orbital mission of Blue Origin which takes the passengers much further than the Karman line.

What is the significance of space tourism?

- **Space democratization-** It aims to make space more accessible to a broader range of people beyond trained astronauts and scientists.
- **Economic growth-** It has the potential to create new industries, generate revenue, and stimulate economic growth.

Karman Line lies nearly 100 kilometres above our heads and is considered to be the boundary between Earth's atmosphere and outer space.

- **Advancements in space technology-** Advancements in lightweight materials, life support systems, and re-entry technology benefit not only tourists but also astronauts and scientific missions.

- **Environmental awareness-** Experiencing space firsthand can lead to a greater understanding of the fragility and interconnectedness of earth's ecosystems.

- **Promote education-** It can inspire people of all ages to pursue careers in science, technology, engineering, and mathematics (STEM).

- **Cultural exchange-** It has the power to promote cultural exchange and understanding by bringing together people from diverse backgrounds and nationalities.

- **Space as shared resource-** International cooperation in space tourism can pave the way for joint scientific missions, knowledge sharing, and peaceful exploration.

ISRO's space tourism

- Indian Space Research Organisation (ISRO) has announced plans to launch a space tourism program by the year 2030.
- **Sub-orbital space travel-** The program is expected to include sub-orbital space travel, which involves a spacecraft reaching the edge of space and providing a brief period of low gravity before returning to Earth.
- **Cost-** The estimated ticket cost for a space tourist is projected to be around Rs 6 crore.
- **Reusable module-** ISRO is working on a space tourism module that is both safe and reusable, which is crucial for the economic viability of space flights.
- **Gaganyaan program-** The development of technologies through the Gaganyaan program, India's maiden human spaceflight program, is contributing to the building blocks necessary for human space missions.

What are the challenges?

- **High-cost** - Currently, space tourism is expensive. A passenger generally has to pay at least a million dollars to reach outer space.
- **Safety concerns-** The inherent risks associated with space travel, such as launch failures and space debris, necessitate stringent safety protocols and risk mitigation strategies.
- **Regulatory issues-** The lack of comprehensive regulatory frameworks poses challenges for the space tourism industry. Establishing clear regulations is essential for ensuring safety and managing liability.
- **High costs-** The high cost of entry remains a significant barrier as a passenger generally has to pay at least a million dollars to reach outer space.
- **Technological limitations-** Current technology limits the frequency and capacity of space flights.
- **Environmental impact-** The environmental sustainability of space tourism is a concern, particularly regarding the carbon footprint of rocket launches and potential space debris.
- **Medical risks** - Space tourism can cause health issues from microgravity, increased radiation exposure, and extreme acceleration.
- **Psychological challenges** - Long journeys and living in space can cause psychological problems, such as worrying about connecting with Earth and adapting to harsh conditions.

11.7 AI in Drug Development

Why in news?

The advent of Artificial Intelligence (AI) has opened up a world of possibilities with respect to fast-tracking drug development.

What is the process of developing the drugs?

- The process of developing a drug starts with identifying and validating a target.
- **Target** - A target is a biological molecule (usually a gene or a protein) to which a drug directly binds in order to work.
- **Druggable proteins** - Proteins are mainly used as targets, proteins with ideal sites where drugs can go and dock to do their business are druggable proteins.
- **Discovery phases** - Target proteins are identified in the discovery phase, wherein a target protein sequence is fed into a computer which looks for the best-fitting drug out of millions in the library of small molecules.
- **Pre-clinical phase** - In pre-clinical phase potential drug candidates are tested outside a biological system, using cells and animals for the drug's safety and toxicity.
- **Human trial**- After this, as part of the clinical phase, the drug is tested on a small number of human patients before being used on more patients for efficacy and safety.
- **Approval phase** - Finally, the drug undergoes regulatory approval and marketing and post-market survey phases.
- **Computational phase**- These methods avoid the need for preliminary laboratory experiments, which are often time-consuming, costly, and have high failure rates. Once a suitable drug-target interaction is identified, the process moves to the pre-clinical phase.

Approximately 3% of astronauts died during their space flight which is quite a high fatality rate.

How does AI can help this process?

- **Accelerated target discovery**- AI models can process vast amounts of data quickly, identifying potential targets and predicting their interactions with drugs much faster than traditional methods.
- **Enhanced accuracy**- AI tools, such as AlphaFold and RoseTTAFold, developed by DeepMind and the University of Washington respectively, have made significant strides in predicting the three-dimensional structures of proteins.
- **Forecast dynamic interactions**- The latest versions, AlphaFold 3 and RoseTTAFold All-Atom, go beyond predicting static structures to forecasting dynamic interactions, including those involving small molecules, DNA, RNA, and ions.
- **Increase in accuracy**- In comparative tests, AlphaFold 3 demonstrated a 76% accuracy in predicting interactions between targets and small molecule drugs, significantly higher than the previous versions.
- **Generative diffusion based architecture**- These AI models improve the prediction of structural complexes, enhancing the understanding of how drugs interact with their targets.

AI in drug development

- **Alpha Fold**- It predicts the 3D structure of proteins based on their amino acid sequence, it can predict protein shape with atomic accuracy almost instantly.
- **RoseTTAFold**- It is a "three track" neural network, meaning it simultaneously consider patterns in protein sequences, how a protein's amino acids interact with one another and protein's possible three-dimensional structure
- **AlphaFold 3**- It goes beyond proteins to a broad spectrum of biomolecules including DNA, RNA, and even small molecules, also known as ligands, which encompass many drugs.
- **RoseTTAFold All-Atom**- It is a neural network that can biomolecular assemblies that contain proteins, nucleic acids, small molecules, metals and covalent modifications.
- It is faster than other models which can make accurate predictions for protein-small molecule complexes and covalent changes to proteins.

What are the advantages?

- **Target identification** - Computer searches a library of small molecules for the best-fitting drug to a target protein sequence.

- **Assay development** - It can help identify targets and develop assays to test compounds.
- **Preclinical testing** - It can help determine the effectiveness of compounds in preclinical testing.
- **Drug delivery** - It can help develop more efficient drug delivery systems and select formulation approaches to improve drug solubility and absorption.
- **Molecular structure prediction** - Generative AI can train models to generate new molecular structures, which scientists can use to predict potential drug candidates.
- **Saving the time & Money** - It can increase the accuracy of prediction of interaction between a drug and its target, and saving money.

What are the limitations?

- **Accuracy limitations**- AI tools can provide up to 80% accuracy in predicting interactions and the accuracy comes down drastically for protein-RNA interaction predictions.
- **Limited scope** - The tools can only aid a single phase of drug development, target discovery and drug-target interaction.
- **Model hallucinations**-AI models, particularly those based on diffusion architectures, can sometimes produce incorrect or non-existent predictions due to insufficient training data.
- **Restricted accessibility**- Unlike AlphaFold, DeepMind has not released the code for AlphaFold 3, restricting its independent verification, broad utilisation and use.
- **Skilled workforce**- There is a shortage of skilled AI scientists in India compared to countries like the U.S. and China, this gap hinders the ability to capitalize on AI advancements in drug development.
- **Computing infrastructure**- Developing sophisticated AI tools requires robust computing infrastructure, particularly high-speed GPUs. These are expensive and quickly become outdated as new models are released.

What lies ahead?

- India has a growing pharmaceutical industry and a rich history in structural biology fields like protein X-ray crystallography and modeling.
- With investment in infrastructure and training, India has the potential to become a leader in applying AI tools for drug discovery and testing.

11.8 Europe's AI convention

Why in news?

Recently Council of Europe has adopted 1st international treaty on artificial intelligence.

What are the key provisions of framework convention?

- **Protocols**- Framework convention is a type of legally binding treaty that establishes broad commitments and objectives, while leaving the setting of specific targets to subsequent agreements.
- **Need**-This approach allows for flexibility and adaptability, enabling parties to meet the objectives in ways that suit their capacities and priorities.
- **Foundational document**- The Framework Convention on AI serves as a foundational document, from which more detailed and specific protocols can be developed in the future.
- **Aim**- To ensure that AI system's lifecycle activities are consistent with human rights, democracy and the rule of law.
- **Scope**- The convention includes activities by both public authorities and private actors, especially those acting on behalf of public authorities.
- **Compliance options**- It offers 2 compliance options for parties when regulating the private sector.
 - Direct obligation by the convention's provisions or
 - Alternative measures that respect human rights, democracy and the rule of law reflecting the diversity of global legal systems.
- **Flexibility**- Parties are encouraged to go beyond the commitments and obligations specified in the convention, indicating a willingness to adapt and strengthen AI governance measures over time.
- **Human rights protection**- It ensures AI systems do not infringe on existing human rights.

- **Democratic integrity**- It protects the integrity of democratic processes against potential AI misuse.
- **Risk assessment**- The parties must assess risks associated with AI and implement measures to mitigate them.
- **Transparency**- It is tailored to specific contexts and risks, including identifying AI-generated content.
- **Legal remedies**- There are legal remedies for victims of human right violations related to AI and procedural safeguards including notifications about interactions with AI system.
- **Exemptions**- The convention offers broad exemptions concerning national security interests, research, development and testing, and national defense.

What lies ahead?

- The implementation of AI convention will face challenges, especially as AI regulation regime are still evolving.
- Despite this, the convention seeks to harmonize AI development with human rights, acknowledging the need for responsible AI deployment.

Quick facts

Council of Europe

- **Year**- 1949
- **Aim**- To promote human rights, democracy and the rule of law in Europe.
- **About**- It is distinct from the European Union, though the two organizations work closely together and share some member states.
- **Member states**- 46 member states, which include almost all European countries.
- This membership extends beyond the EU and includes countries like Russia (though it was expelled in 2022), Turkey, and the United Kingdom.
- **Observer States**- It also includes observer states such as the Holy See, Japan, the United States, and Canada.
- **Human rights**- The COE is best known for its work in promoting and protecting human rights. It created the European Convention on Human Rights (ECHR) in 1950, which is enforced by the European Court of Human Rights (ECtHR).
- **Democracy**- It promotes democratic governance and political processes across its member states.
- **Rule of law**- It works to ensure that the rule of law is upheld in its member states, providing guidelines and support to strengthen judicial systems and legal frameworks.

11.9 Challenges in Cyber Security

Why in news?

India's rapid adoption of digital technology over the past decade has introduced new challenges, particularly for policymakers and the security apparatus.

What are the challenges posed by cybercrime?

- **Deep fake videos**- These are manipulated videos that could cause havoc during elections and other sensitive events.
- **Privacy violation**- Cybercriminals can impersonate individuals and engage in identity theft.
- **Financial scams**- The Cambridge Analytica data scandal involved harvested social media data for election advertising.
- **Financial fraud**- It is originated from 3 contiguous Southeast Asian countries: Myanmar, Laos, and Cambodia.

Categories of cyber fraud

- **I4C**- Indian Cyber Crime Coordination Centre has identified four main categories of cyber frauds.
- **Trading scam**- Fraudsters post advertisements on social media offering free trading tips, often using images of well-known stock market experts and fake news articles.
- **Digital arrest**- Victims receive calls informing them that they are implicated in crimes involving illegal goods or contraband.
- **Investment scam**- Victims receive WhatsApp messages from overseas numbers offering work-from-home opportunities to earn money by boosting social media ratings.
- After completing initial tasks and receiving small payments, they are asked to participate in pre-paid tasks requiring larger deposits.
- **Dating scam**- Male victims are targeted by fraudsters posing as foreign women interested in relationships or marriage

What are the steps taken by India to prevent cyber-attack?

- **Indian Computer Emergency Team (CERT-In)** - It is the national nodal agency for responding to computer security incidents as and when they occur.
- **Indian Cyber Crime Coordination Centre (I4C)** - It is launched to deal with all types of cybercrime in the country, in a coordinated and comprehensive manner.
 - National Cyber Forensic Laboratory
 - National Cyber Crime Reporting Portal
 - Citizen Financial Cyber Fraud Reporting and Management System
- **National Cyber Forensic Laboratory (Investigation)** - It has been established at **New Delhi** to provide early stage cyber forensic assistance to Investigating Officers.
- **National Cyber Crime Reporting Portal**- It has been launched to enable public to report incidents pertaining to all types of cyber crimes, with special focus on cybercrimes against women and children.
- **Citizen Financial Cyber Fraud Reporting and Management System**- It has been launched for immediate reporting of financial frauds and to stop siphoning off funds by the fraudsters.
- **National Cyber Forensic Laboratory (Evidence)** - It has been set up at **Hyderabad** to provide the necessary forensic support in cases of evidence related to cybercrime, preserving the evidence and its analysis in line with the provisions of Information Technology Act and Evidence Act.
- **National Cyber Security Coordinator** - It is under the National Security Council Secretariat, coordinates with different agencies at the national level on cybersecurity issues.
- **Cyber Swachhta Kendra** - It is a Botnet Cleaning and Malware Analysis Centre that has been launched for detection of malicious software programmes and to provide free tools to remove them.
- **Centre for Financial Literacy Project**- It was launched by Reserve Bank of India in 2017 as a pilot project on financial literacy with an objective to adopt community led innovative and participatory approaches.
- **Massive Open Online Courses (MOOC) platform**- 'CyTrain' portal has been developed under I4C, for capacity building of police officers/judicial officers through online course on critical aspects of cyber crime investigation, forensics, prosecution etc., along with certification.
- **Awareness generation**- Dissemination of messages through SMS, I4C social media account.
 - Example- CyberDostI4C in Facebook, Radio campaign, Cyber Safety and Security Awareness weeks etc.,

Institutional framework

- **MeitY**- The Ministry for Electronics and Information Technology handles policies related to IT, electronics, and the Internet, including cyber laws.
- **Internal security**- The Ministry of Home Affairs (MHA) is responsible for internal security,
- **Cybersecurity wing**- MHA has created the Cyber and Information Security Division, which includes the cybercrime and cybersecurity wings.

Legislative framework for cybersecurity

- The Bharatiya Nagarik Suraksha Sanhita (BNSSS), Bharatiya Nyaya Sanhita, and Bharatiya Sakshya Adhiniyam (BSS) were enacted to update India's legal system.
- **Electronic FIRs**- The BNSSS allows for the registration of electronic First Information Reports (FIRs) and recognizes electronic evidence as primary proof.
- **Data collection**- The BNSSS permits data collection for criminal identification, enhancing the ability to track and prosecute cybercriminals.
- **Digital trials**- All trials, inquiries, and proceedings can be conducted electronically, streamlining legal processes and reducing delays.
- **Classification of electronic records**- The BSS classifies electronic records as primary evidence, expanding the definition to include information stored in various digital devices.

What lies ahead?

- The surge in financial frauds over the Internet underscores the need for heightened cybersecurity measures and public awareness.
- The government and cybersecurity agencies must continue to strengthen their efforts to combat these sophisticated scams and protect citizens from falling prey to cybercriminals.

11.10 AI usage in Judicial Process

Why in news?

High Courts in India have varying stances using AI, including ChatGPT as a part of the legal process.

ChatGPT

- **About**-It is a large language model developed by OpenAI that can be used for natural language processing tasks such as text generation and language translation.
- **GPT model**- It is based on GPT-3.5 (Generative Pretrained Transformer 3.5) model and uses deep learning algorithms to generate text responses to prompts.
- **Technology**- It uses natural language processing technology to understand and generate responses to questions and statements that it receives.



What is the stand of High Courts (HC) on AI usage?

- **Manipur HC**- A petitioner who is a former Village Defense Force (VDF) personnel challenged his dismissal in Manipur HC.
- **Usage of AI**- The court used ChatGPT to research and understand the VDF's role.
- **Court verdict**- The court ultimately set aside petitioner's dismissal based on 2022 memorandum that required an opportunity for dismissed VDF personnel to explain alleged charges.
- **Punjab and Haryana HC**- It used ChatGPT to deny bail in a case involving assault.
- **Delhi HC**- It ruled against using ChatGPT to deny bail in a case involving assault.

International practices on AI usage for legal cases

- **USA-** Manhattan federal court fined a lawyer for submitting a brief with fictitious case law generated by ChatGPT, highlighting the dangers of relying on AI for legal research.
- **Singapore-** AI is mostly used for speech translation system.
- **Robots-** In countries like Russia, Mexico and China, robots are used to provide legal advice to citizens and help judges to determine if pensions should be granted.
- **UK-** The judiciary has issued guidelines allowing the use of generative AI for administrative tasks but cautioned against using it for legal research or analysis, reflecting a balanced approach to AI in legal settings.

What are the advantages of using ChatGPT in legal cases?

- **Rapid Legal Research-** It can quickly process and retrieve relevant legal information, case law, statutes, and precedents, significantly speeding up legal research.
- **24/7 availability-** It can provide assistance at any time, offering legal information and support outside of regular court hours, which is particularly beneficial for urgent matters.
- **Uniform response-** It ensures that the information provided is consistent, reducing the variability that can arise from human interpretation and oversight.
- **Reduction of human error-** Automated systems can minimize errors that might occur due to human fatigue, oversight, or bias.
- **Comprehensive analysis-** It can analyze large volumes of legal texts and case law, providing comprehensive insights that can support judicial decision-making.
- **Multilingual capabilities-** It can process and generate text in multiple languages, facilitating communication in multilingual jurisdictions and assisting non-native speakers.
- **Judicial training-** It can be used as a tool for training new judges and legal professionals, providing instant access to legal knowledge and case studies.
- **Technology integration-** The use of AI in judicial proceedings encourages the integration of advanced technologies in the legal field, promoting innovation and modernization.

What are the challenges of using ChatGPT in legal cases?

- **Inaccuracy-** It can generate responses that sound correct but are faulty incorrect or misleading which poses a significant risk when legal decisions rely on accurate and precise information.
- **Erroneous legal arguments-** There have been instances where ChatGPT produced entirely fictitious legal precedents, which can lead to erroneous legal arguments and judgements.
- **Complexity of legal reasoning-** Legal cases often require a deep understanding of nuanced legal principles, precedents and statutory interpretations which ChatGPT might not grasp fully.
- **Context sensitivity-** Legal decisions depend heavily on the specific context and details of a case, which an AI might not consider adequately.
- **Ethical concerns-** AI models, including ChatGPT, can inadvertently perpetuate biases present in the data they were trained on which could lead to biased legal outcomes, undermining the fairness of judicial processes.
- **Lack of accountability-** It can be challenging to pinpoint responsibility when an AI's suggestion leads to a controversial or incorrect legal outcome.
- **Lack of transparency-** AI models like ChatGPT operate as black boxes, providing outputs without transparent reasoning processes.
- **Regularity issues-** India does not have specific guidelines regulating the use of AI in judicial processes, this can lead to arbitrary legal verdicts.

What lies ahead?

- While AI can assist legal research, its limitations and potential inaccuracies must be considered.
- India needs clear and standardized guidelines to harness AI's capabilities responsibly and effectively within the legal system.

12. INTERNAL SECURITY

12.1 India extends ban on LTTE

Why in news?

The Indian government has extended the ban on the Liberation Tigers of Tamil Eelam (LTTE) for another 5 years under the Unlawful Activities (Prevention) Act.

What is LTTE?

- **Established year**-In 1976 by Velupillai Prabhakaran.
- **Goal**- To create an independent Tamil Eelam out of Sri Lanka.
- **India and LTTE**- India has initially supported the guerrillas, the relationship significantly deteriorated after India deployed the Indian Peacekeeping Force (IPKF) to Sri Lanka.
- **High profile assassination**- Former Prime Minister of India Rajiv Gandhi has been assassinated by an LTTE suicide bomber in 1991, Sri Lankan President has also been assassinated in 1993.
- **Territory control**- It controlled significant territories in Sri Lanka utilizing women and children in combat before being defeated in 2009.
- **Terrorist designation**- LTTE was designated as a terrorist organization by 32 countries.
- **India's ban on LTTE**- India first banned the LTTE after the assassination of Rajiv Gandhi, the ban was last extended for five years in 2019.

US designated the LTTE as a Foreign Terrorist Organization (FTO) in 1997.

What does a 'ban' on an organisation mean?

- **Declaration of an organisation**- The UAPA gives powers to the government to declare an organisation an "unlawful association" or a "terrorist organisation".
- **Terrorist organisation**- The UAPA defines "terrorist organisation" as an organisation listed in the Schedule to the UAPA, or an organisation operating under the same name as an organisation so listed in the Schedule.
- **Schedule 1**- It currently lists 42 organisations as terrorist organisations.
- **Criteria**- The law states that an organisation shall be deemed to be involved in terrorism, if it,
 - Commits or participates in acts of terrorism, or
 - Prepares for terrorism, or
 - Promotes or encourages terrorism, or
 - Otherwise involved in terrorism
- **Removal of an organisation from the Schedule**- An application can be made to the central government by the organisation itself or any person affected by inclusion of the organisation in the Schedule.
- **Review committee**- It is headed by a sitting or former judge of a High Court is appointed to judicially review the application.

Section 3 of the UAPA deals with the declaration of an association as unlawful.

What is a UAPA tribunal?

- **Procedure**- After the Centre's declaration of an organisation as unlawful, its notification must reach the tribunal within 30 days to adjudicate whether or not there is sufficient cause for the move.
- **Give notice**-The tribunal then calls upon the association, by notice in writing, to show cause within 30 days why it should not be declared unlawful.
- **Inquiry**-It then holds an inquiry and decides the matter within 6 months.
- **Constitution**- The tribunal consists of only one person who has to be a High Court judge.
- **Staff requirements**- The Centre will provide the necessary staff to the tribunal for the discharge of its functions.
- **Fund**- All expenses incurred for the tribunal are borne out of Consolidated Fund of India.
- **Power of tribunal**- The tribunal has power to regulate its own procedure, including the place at which it holds its sittings.

The tribunal has the same powers as vested in civil court under the Code of Civil Procedure, 1908 in certain matters as specified.

What are the consequences of such declaration?

- **Association of individuals** - The association of individuals with a terrorist organisation is punishable with imprisonment for a term not exceeding 10 years.
- **Exemption**- If the individuals have been members before declaring it as terrorist organisation and did not take part in any activities of the organisation at any time during its inclusion in the Schedule.
- **Punishment**- UAPA prescribes punishment for
 - Being member of terrorist gang or organisation
 - Holding proceeds of terrorism.
- **Funding** - Funding a terrorist organisation is also criminalized under the UAPA Act.

Membership, support, or association with these organizations is prohibited.

Quick facts

Key provisions of Unlawful Activities (Prevention) Act, 1967

- **Aim**- To prevent unlawful activities associations in the country.
- **Objective**- To provide the necessary legal framework for dealing with activities that are considered threats to the integrity and sovereignty of India.
- **Definition of unlawful activities**- Actions intended to disrupt the sovereignty and territorial integrity of India.
- **Definition of terrorist acts**- Actions that threaten the unity, integrity, security, or sovereignty of India or cause terror among the people or a section of people.
- **Unlawful associations**- Any organization could now be termed as 'unlawful' by the government subject to judicial review.
- **Terrorist organizations**- The government can designate organizations as terrorist organizations and list them in the First Schedule of the Act.
- **Penalty**- The Act prescribes severe penalties for various offenses, including membership in terrorist organizations, funding terrorism, and committing terrorist acts.
- **Investigation** - Law enforcement agencies have enhanced powers to investigate and arrest individuals suspected of involvement in unlawful activities or terrorism.
- **Detention**- The Act allows for the detention of suspects for up to 180 days without charge, with court permission.
- **Forfeiture of property**- Property used for or derived from terrorist activities can be forfeited under the Act.
- **Admissibility of evidence**-The Act allows for the admissibility of electronic evidence and intercepted communications in court.
- **Special courts**- The Act provides for the establishment of special courts to conduct trials for offenses under the UAPA.
- **Bail provisions**- The UAPA has [stringent bail provisions](#), making it difficult for individuals accused of terrorism-related offenses to secure bail.
- **International Cooperation**- The Act facilitates cooperation with foreign countries and international organizations in matters related to terrorism, including extradition and mutual legal assistance.

12.2 NIA vs NSCN

Why in news?

National Investigation Agency (NIA) has filed a chargesheet against 5 individuals linked to the National Socialist Council of Nagaland's "China-Myanmar module".

Manipur

- **Ethnic composition**- Manipur is home to three main ethnic groupings

- Meitei-The largest community, constituting about 53% of the state's total population.
- Naga- They make up 17% of the population.
- Kuki-Zo- This group also includes the Mizo and constitutes 26% of the population.

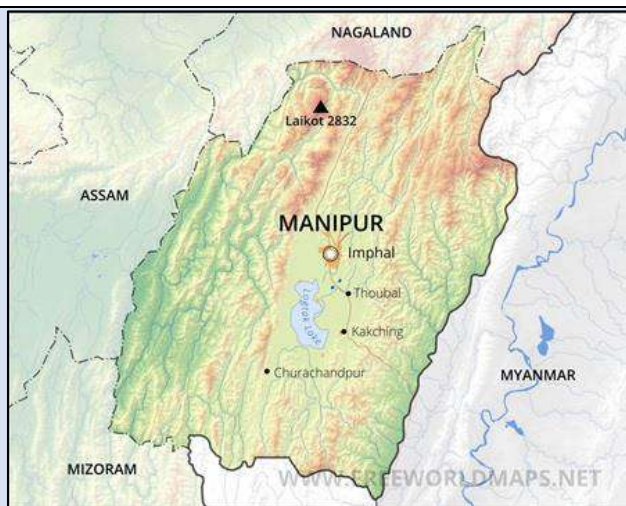
● **India-Myanmar border-** The two countries share a 1,643 km border, with 398 km along Manipur.

● **Free Movement Regime-** It was established in 1968 which allowed people to cross the border without documents or passports.

● **Border fencing-** India decided to fence the entire border with Myanmar and end the FMR, it aims to curb illegal activities and infiltration, addressing security concerns exacerbated by the ongoing ethnic unrest in the region.

● **Insurgent groups**

- Meitei insurgent groups- It include the People's Liberation Army (PLA) and others, advocating for the secession of Manipur from India.
- Naga Insurgent groups- It is primarily represented by the National Socialist Council of Nagaland (NSCN), which has factions like NSCN-IM.
- Kuki-Zo insurgent groups- It includes groups under the United Peoples' Front (UPF) and the Kuki National Organisation (KNO), which signed a suspension of operations pact with the government.



What is the issue?

- The NIA's chargesheet is significant as it is the first official document linking the NSCN-IM with Meitei insurgent groups amid the current ethnic crisis.
- The accused were identified as a trained cadre of People's Liberation Army, one of the most violent Meitei insurgent groups.
- After the NIA findings were reported, the NSCN-IM accused Indian security forces of aiding Kuki militant groups against Meitei groups in Myanmar.
- The NSCN-IM, which has been in peace talks with the Indian government since 1997, distanced itself from the violence in Manipur, stating that no ethnic blood should flow in Naga areas due to the Meitei-Kuki-Zo conflicts.

Who are NSCN?

- **About-** National Socialist Council of Nagaland is a Naga nationalist insurgent group operating primarily in the northeastern region of India.
- **Factions-** NSCN-IM (Isak-Muivah faction) and NSCN-K (Khaplang faction).
- **NSCN-IM-** It was formed in 1980 after splitting from the Naga National Council (NNC) following the Shillong Accord of 1975, which was seen as a betrayal by many Nagas.
- **Objective-** The establishment of a sovereign Naga state called "Nagalim" or "Greater Nagaland," which would include all Naga-inhabited areas in Northeast India and parts of Myanmar.
- **Demand-**They have been demanding a separate Naga flag and constitution as part of any final agreement with the Indian government.
- **Ceasefire agreement-** NSCN-IM signed a ceasefire agreement with the Government of India in 1997 marking a significant development in the Naga peace process.
- **Framework agreement-** It was signed in 2015 which aimed at finding a political solution to the Naga issue.

What lies ahead?

- The ongoing unrest poses significant challenges to peace and stability in the region, exacerbated by historical grievances, demands for autonomy, and the strategic interests of neighbouring countries like Myanmar and China.
- The Indian government's move to fence the border reflects an attempt to enhance security and manage the complex dynamics of cross-border ethnic ties.

Quick facts

National Investigation Agency

- **Established** - It is a statutory body constituted in 2009 under NIA Act 2008.
- **Need**- The agency is established on the wake of 26/11 Mumbai terror attack.
- **About**- It is the Central counter terrorism law enforcement agency in India.
- **Administrative control**- Ministry of Home Affairs
- **Headquarters**- New Delhi
- **Branch offices**- Hyderabad, Guwahati, Mumbai, Lucknow, Kochi, Kolkata, Jammu and Raipur.
- **TFFC Cell**- Terror Funding and Fake Currency cell deals with the subject of fake currency notes and terror funding.
- **Scheduled offences**- It includes the offences under laws that are mentioned such as Narcotic Drugs and Psychotropic Substances Act, UAPA Act, Explosives Act, Atomic Energy Act etc.,

13. DEFENCE

13.1 Technological Absorption in Defence Sector

Why in news?

The Indian Army observing 2024 as the 'Year of Technology Absorption', this underscores the Army's steadfast focus on embracing technology to transform itself.

What is Disruptive Technology (DT)?

- **Disruptive technology**- It is an innovation that significantly alters the way that consumers, industries, or businesses operate.
- **DT in Defence**- Disruptive technology in defense refers to innovations that significantly alter or replace existing technologies, processes, or capabilities within military operations.
- **Need**-These technologies can dramatically change the landscape of warfare by providing new methods and tools that offer substantial advantages over traditional systems.
- **Artificial Intelligence**- AI applications in defense range from autonomous weapon systems and drones to intelligence analysis, decision-making support, and predictive maintenance of equipment.
- **Autonomous weapon system**- It can operate independently or with minimal human intervention.
 - **Example**- Unmanned aerial vehicle (UAVs), ground robots and autonomous naval vessels.
- **Hypersonic weapons**- They travel at speeds greater than Mach 5 (five times the speed of sound), making them extremely difficult to detect and intercept.
- **Cyber warfare capabilities**- Advanced cyber tools and techniques such as hacking, cyber espionage etc., enable nations to conduct offensive and defensive operations in cyberspace.
- **Quantum technology**- It can revolutionize encryption and decryption, significantly enhancing secure communications and complex problem-solving capabilities.
- **Directed energy weapons**- These weapons use focused energy, such as lasers or microwaves, to disable or destroy targets. They offer precision targeting with minimal collateral damage and are effective against a wide range of threats, including drones and missiles.
- **Advanced materials**- Innovations in materials science, such as lightweight composites and nanomaterials, improve the durability, strength, and stealth capabilities of military platforms.
- **Biotechnology**- It includes advances in medical treatments, genetic engineering, and synthetic biology to enhance soldier performance, resilience, and recovery.

India is the world's largest defence equipment importer and is expected to spend around USD 220 Billion in the coming decade to modernize its armed forces.

- **Internet of Military Things**- It involves the integration of various devices, sensors, and systems in the battlefield, creating a networked environment that enhances situational awareness, decision-making, and operational efficiency.

What are the steps taken by India to promote technological absorption?

- **IDEX (innovation for Defence Excellence)** – It aims at creation of an ecosystem to *foster innovation and technology* development in Defence and Aerospace by engaging Industries including MSMEs, start-ups, individual innovators, R&D institutes & academia.
- **DISC (Defence India Start-up Challenge)** – It aimed at supporting Startups/MSMEs/Innovators to create prototypes and/or commercialize products/solutions in the area of National Defence and Security.
- **Defence Artificial Intelligence Council** - It is led by *Ministry of Defence* to provide overall guidance and support for projects involving cutting-edge technologies.
- **Defence AI Project Agency** - As per *Chandrasekaran committee* recommendation it was launched with an annual budget of 100 crores for AI programs to provide necessary guidance and structural support.
- **Project SAMBHAV**- It is an indigenous, secure, end-to-end mobile ecosystem operates on *5G technology* developed by the Indian Army.
- **Aero India 2023**- It is held at Bengaluru which emphasized on two major shifts within the Indian Armed Forces.
 - The move towards 'Atmanirbharta' or self-reliance
 - Critical and Emerging Technologies (CET)

Pillars of technology absorption identified by Indian Army

- Aligning and synergizing technology with existing systems for enhanced effectiveness.
- Mapping Futuristic Technologies to stay ahead in technological readiness.
- Strengthening the defense technology eco-system through collaboration with industry, academia, and government bodies.
- Modernizing acquisition and procurement processes for rapid technology integration.
- Training techno warriors and commanders to leverage new technologies efficiently.

What are the challenges in adopting DT in defence?

- **Lethality issues** – Incorporating new technologies into existing systems have made the modern battlefield more lethal.
- **Cybersecurity risks**- Maintaining the integrity and security of data is riskier, particularly when using AI and autonomous systems.
- **Fund deficit**- India has budgetary constraints that can limit the extent and pace of technology adoption.
- **Less industrial base**- Limited industrial base for advanced technology manufacturing can hinder the production and integration of disruptive technologies.
- **Regulatory constraints**- Lengthy and complex defense procurement procedures can slow down the acquisition and deployment of new technologies.
- **Lack of R&D** - Indian Defence Industry with strong R&D base and Defence R&D establishments are needed for the critical technology into products and systems needed by defence.
- **Low overall researcher density** – The researchers per million was negligible in India(156) compared to other countries such as Israel (8255), China (1133) Countries GDP contribution on R&D
- **License issues** – It is found that the technology concerned is subject to approval of the foreign government and hence obtaining latest technology becomes difficult.
- **Manpower shortage**- There is a shortage of skilled professionals with expertise in advanced technologies such as AI, robotics, and cyber warfare.
- **Regional security dynamics**- Navigating the complex security dynamics in the region, especially with neighbors like China and Pakistan.
- **Ethical issues**- The use of autonomous weapons raises ethical questions about accountability and decision-making in life-and-death situations.

What lies ahead?

- As technology continues to grow by leaps and bounds there is an incessant need for adopting it to innovate and develop new systems with greater potential in the future.
- Technology absorption will also necessarily include several macro level aspects such as organisational restructuring, the management of human resources and cultivating specialists at execution levels.

14. DISASTER MANAGEMENT

14.1 Fire Safety Rules

Why in news?

The recent fires at a gaming zone in Rajkot, Gujarat, and a children's hospital in Delhi, have brought attention to fire safety regulations in India.

Status of fire accidents in India

- As per latest Accidental Deaths and Suicides in India (ADSI) report released by the National Crimes Records Bureau as many as 7,435 people were killed in over 7,500 fire accidents in 2022.
- The data indicates that fire accidents continue to cause heavy casualties, with no lessons learnt from the 1997 Uphaar Cinema tragedy or the Kumbakonam fire that killed 90 schoolchildren in 2004.
- As per Localcircles survey, despite the frequent occurrence of such fire accidents, 8 out of 10 Indians acknowledge that their homes and workplaces do not adhere to fire safety standards.
- Merely 18% of respondents claim that the fire safety equipment in their homes is checked annually, while only 27% report the same for their workplaces.
- 27% claimed that compliance to fire safety was never done at their home.
- **Fire safety** –It is primarily a state responsibility in India, as fire services fall under municipal functions per the 12th Schedule of the Constitution.

What are the fire safety regulations followed in India?

National Building Code

- **About-** It is published by the Bureau of Indian Standards (BIS) which is the central framework for fire safety in the country that provides comprehensive guidelines on the construction, maintenance, and fire safety of buildings.
- **Building classifications-** Categorizing buildings based on use and occupancy to apply specific fire safety measures.
- **Material specifications-** Recommending non-combustible materials for construction to mitigate fire risks.
- **Fire safety systems-** Mandating systems like automatic fire detection, alarm systems, sprinklers, emergency lighting, and exit signage.
- **Electrical safety-** Requiring flame retardant properties for wiring and cables, proper earthing, and separate conduits for different voltage levels.
- **Escape routes-** Ensuring properly identified and adequately lit escape routes for safe evacuation.

Model Building Bye Laws, 2016 (MBBL)

- **About-** It is issued by the Ministry of Housing and Urban Affairs to ensure safe, sustainable and efficient urban development with a significant focus on fire safety.
- **Implementation-** It provides a uniform set of guidelines for all States and UTs to ensure consistency in building regulations across the country.
- **Safety and sustainability-** It enhances safety, sustainability and resilience of buildings especially against fire hazards.
- **Modernization-** Incorporate modern construction practices and technologies to improve building safety and efficiency.

- **Uniformity**- It integrates extensive fire safety measures aligned with NBC with the aim to minimizing fire risks and ensuring quick and safe evacuation in case of emergencies.

Guidelines of National Disaster Management Authority

- **About**- It supports States in framing their building byelaws and fire safety norms.
- **Fire risk assessment**: Conduct regular fire risk assessments to identify potential hazards and vulnerabilities within buildings and premises.
- **Hospital**- Install fire detection and suppression systems in critical areas such as operation theaters, intensive care units (ICUs), and laboratories. Ensure that all medical staff are trained in fire safety protocols.
- **Schools**- Ensure that schools have adequate fire safety equipment, conduct regular fire drills, and educate students about fire safety practices.
- **Public buildings**- Equip public buildings with comprehensive fire safety measures, including alarm systems, sprinklers, and clearly marked evacuation routes.

What are the challenges of fire safety in India?

- **Non-uniform legislation**- Different states and municipalities have varied levels of adoption and enforcement of the NBC and MBBL.
- **Outdated infrastructure**- Many buildings, especially in older urban areas, were constructed before modern fire safety standards were established and lack the necessary infrastructure to combat fires effectively.
- **High rise buildings**- The increasing number of high-rise buildings poses significant fire safety challenges due to the complexity of evacuation and firefighting operations in tall structures.
- **Urban congestion**- High population density in urban areas increases the risk and potential impact of fires, complicating evacuation and firefighting efforts.
- **Fund deficit**- There is a lack of initiatives and funding for retrofitting older buildings with modern fire safety equipment and systems.
- **Lack of compliance**- Many establishments, particularly commercial ones, flout basic safety norms and fail to obtain necessary certifications, such as No-Objection Certificates (NOCs) from fire departments.
 - Example- Rajkot gaming zone fire and Delhi hospital fire incident noted that these structures was set up without proper NOCs and lacked adequate fire-fighting equipment.
- **Inadequate audits**- Fire safety audits are not conducted regularly or rigorously, leading to non-compliance going unchecked.
- **Staff shortages**- Fire services often suffer from a lack of personnel, exacerbating the problem of insufficient enforcement.

What should be done?

- **Strict enforcement**- Implement uniform fire safety legislation across states to ensure consistent application of the NBC.
- **Regular audits**- Conduct regular and rigorous fire safety audits to ensure compliance.
- **Awareness generation**- Increase community awareness and resilience through education and training on fire safety measures.
- **Resource allocation**- Address staff shortages and equip fire services with adequate resources and training.
- **Encouraging technological adoption**- There is a need to provide incentives for the adoption of advanced fire safety technologies and ensure their regular maintenance.
- **Fund support**- The government should offer financial assistance or subsidies to economically weaker sections to implement necessary fire safety measures.

14.2 All About Cyclone

Why in news?

Cyclone Remal, after its landfall over the West Bengal-Bangladesh coast turned into a cyclonic storm and affected large parts of North East India.

What is a cyclone?

- **About-** As per National Disaster Management Authority (NDMA), cyclones result from atmospheric disturbances surrounding a low-pressure area characterised by rapid and often destructive air circulation
- **Air circulation-** The air circulates inward in an anticlockwise direction in the Northern Hemisphere and clockwise in the Southern Hemisphere.
- **Occurrence-** Cyclonic winds move across nearly all regions of the Earth except the equatorial belt.

Types of cyclone	About
Tropical cyclone	• They form over warm ocean waters near the equator and are characterized by a low-pressure center, strong winds, and heavy rain.
Extratropical cyclone	• They are also known as <u>mid-latitude cyclones</u> , form outside the tropics and typically occur between 30° and 60° latitude.
Subtropical cyclone	• They have characteristics of both tropical and extratropical cyclones, they typically form in the subtropics, between 20° and 35° latitude,
Polar lows	• They are also known as <u>Arctic or Antarctic hurricanes</u> , are small, intense, short-lived cyclones that form over the ocean in polar regions.
Mesocyclones	• They are <u>smaller-scale cyclonic circulations</u> associated with severe thunderstorms. They occur within a convective storm and can lead to the development of tornadoes.
Medicanes	• <u>Mediterranean hurricanes</u> , are rare tropical-like cyclones that occur in the Mediterranean Sea.

- **Conditions of the cyclone-**
 - Large and continuous supply of warm and moist air that can release enormous latent heat.
 - Strong Coriolis force that can prevent filling of low pressure at the centre (absence of Coriolis force near the equator prohibits the formation of tropical cyclone between 0 -5 latitude).
 - Unstable condition through the troposphere that creates local disturbances around which a cyclone develops.
 - Absence of strong vertical wind wedge, which disturbs the vertical transport of latent heat
- **Cause-** By atmospheric disturbances around a low-pressure area distinguished by swift and often destructive air circulation.
- **Eye of the cyclone-** Low-pressure center of the cyclone
- The lower the pressure in the eye, the more intense is the cyclone.
- **Eye-wall-** Surrounds the eye with the strongest winds and heaviest rain and is the most destructive part of the cyclone.
- **Storm surge-** The abnormal rise in sea level due to cyclonic storms.
- **Cyclone prone areas-** India's east and west coasts are affected by cyclones annually, mostly in pre-monsoon and post-monsoon seasons.
- **Indian tropical storms-** Climatologically, about 5 cyclones develop in the North Indian Ocean basin comprising the Bay of Bengal and the Arabian Sea every year.
- **Cyclone Remal-** It is a severe cyclonic storm that was moderately intense and deadly tropical cyclone which affected West Bengal and Bangladesh.

Remal was named by Oman following standard conventions of naming tropical cyclones, in arabic remal means "Sand".
- It was the first depression and the first cyclonic storm of the 2024 North Indian Ocean cyclone season.
- Heavy rains caused by the cyclone triggered landslides in several places in Meghalaya, Mizoram, Assam, and Nagaland.

What are the impacts of cyclone?

- **Heavy rainfall-** Cyclones typically bring heavy rainfall, leading to flooding in low-lying areas.

- **Disrupt livelihood-** The heavy rainfall causes flooding which result in damage to homes and businesses, loss of crops, and disruption of transportation networks.
- **Storm surges-** The combination of strong winds and low atmospheric pressure associated with cyclones can generate storm surges, which are elevated sea levels that inundate coastal areas.
- **Displacement-** It can result in the displacement of large numbers of people as homes are destroyed and areas become uninhabitable due to flooding and other damage.
- **Loss of life-** It can cause loss of life, both directly through the destruction caused by the storm itself and indirectly through factors such as flooding, landslides, and the disruption of essential services.
- **Environmental impact-** Cyclones can have significant environmental impacts, including the destruction of habitats, contamination of water sources due to flooding, and damage to ecosystem.

What are the steps taken by India to mitigate the impacts of cyclone?

- **National Cyclone Risk Mitigation Project (NCRMP)-** It was launched in 2011 funded by World Bank, it's aim is to reduce vulnerability to cyclones and other hydro-metrological hazards.
- **Categories-** NCRMP classifies States based on vulnerability namely
 - Higher vulnerability States i.e. Andhra Pradesh, Gujarat, Odisha, Tamil Nadu and West Bengal.
 - Lower vulnerability States- Maharashtra, Karnataka, Kerala, Goa, Lakshadweep, Daman and Diu, Andaman and Nicobar Islands
- **Web-CRA-** Web based Composite Risk Atlas uses deterministic hazard and vulnerability analysis modelling based on historical cyclone event.
- **HmRAP-** Hydro-meteorological Resilience Action Plan is developed in 6 cities namely Panaji (Goa), Ratnagiri (Maharashtra), Mangalore (Karnataka), Kochi (Kerala), Porbandar (Gujarat) and Bidhan Nagar (West Bengal).
- **CMhRFS -** Comprehensive Multi-hazard Risk Financing Strategy establishes a robust Disaster Risk Financing Strategy for the targeted States (namely Uttarakhand, Odisha, Kerala & Gujarat) and develops Multi-State Disaster Risk Insurance Pool

15. ENERGY

15.1 Significance and Challenges of Hydropower Energy

Why in news?

Recent droughts in Colombia and Ecuador have severely hampered energy supplied by hydropower.

What is the significance of hydropower energy?

- **Renewable source-** It's a renewable form of energy, relying on the water cycle, which is driven by the sun, ensuring sustainability.
- **Clean energy-** Hydropower uses water as its fuel, making it a clean energy source that doesn't produce air pollution or toxic byproducts.
- **Energy independence-** It allows for domestic energy production, reducing dependence on imported fuels and enhancing energy security.
- **Flexibility-** Hydropower plants can quickly adjust their output to match demand, providing essential backup power during electricity outages.
- **Scalability-** Hydropower projects can range from small-scale systems suitable for powering individual homes or communities to large-scale projects that provide electricity for entire regions or countries.
- **Multipurpose use-** Hydropower projects often involve the construction of dams and reservoirs, which can serve multiple purposes such as water storage for irrigation, flood control and recreational activities like boating and fishing.

Hydropower functions by harnessing the movement of water flowing through a turbine, which generates electricity as it spins.

To limit global temperature increases to 1.5°C, hydropower capacity needs to double by 2050.

- **Combat weather change-** Hydropower plants are built to respond to changes in the weather such as storing water in the rainy season to use when it becomes dry.
- **Cost-effective-** It provides low-cost electricity and has a long lifespan, which can offset initial construction costs.
- **Supports other renewables-** Hydropower can be used in conjunction with other renewable sources, like wind and solar, to provide stable energy supply.
- **Eco-friendly-** Hydropower is a key element in creating secure and clean electricity supply systems and reaching global net-zero targets.
- **Expansion potential-** Hydropower is expected to expand because it provides cheap power at a large scale.
- **Renewable leadership-** While wind and solar energy are on the rise, the International Energy Agency acknowledges that hydropower will remain the world's largest source of renewable electricity generation through the 2030s.

A study from 2022 indicates that over a quarter of hydropower dams are located in areas at risk of water scarcity by 2050.

What are the challenges faces by hydropower energy?

- **Global decline-** Hydropower, despite being the *world's largest renewable electricity source*, experienced a historic 8.5% drop in global output in the first half of 2023.
- **Climate change vulnerability-** Climate change poses a significant threat to hydropower infrastructure, as altered precipitation patterns, increased temperatures, and more frequent extreme weather events can affect water availability and hydrological cycles.
- **Drought impact-** A drought fuelled by the [El Nino](#) weather phenomenon has reduced reservoir water levels in hydropower plants, which Ecuador and Colombia rely on for most of their electricity.
 - **Ecuador-** The country declared a state of emergency and instituted power cuts.
 - **Colombia-** The water has been rationed in the capital and the country has halted electricity exports to Ecuador.
- **Impact on China-** China, which is the largest producer of hydroelectric power, saw significant power shortages due to droughts, leading to electricity rationing.
- **Over reliance-** Countries with a high dependence on hydropower, like those in *Africa* (around 80% of energy), are especially vulnerable to the impacts of climate change, which can cause severe droughts and affect electricity generation.
- **Limited alternatives-** Many of the over-reliance countries *lack sufficient capacity* for alternative power generation and have limited infrastructure to import power.
- **Environmental impacts-** Constructing dams and reservoirs alters the natural environment as it can disrupt ecosystems, impact wildlife migration, and change water quality.
- **Water allocation-** Water is a finite resource, and competing demands for water use, including agriculture, industry, and ecosystem needs, can create conflicts over water rights and allocation.
- **Social disruptions-** Large scale hydropower projects often involve the resettlement of communities living in the project area, leading to loss of livelihoods and cultural heritage.
- **Cultural impact-** Indigenous peoples may have spiritual or cultural connections to the affected rivers and lands where the dam would be built, leading to conflicts over land and resource rights.
- **Geological hazard-** Hydropower infrastructure is vulnerable to geological hazards such as landslides, earthquakes, and volcanic eruptions, which can damage dams, tunnels, and other structures, leading to safety risks and operational disruptions.
- **Joshimath slide-** A sanctioned hydropower project in *Dhaultiganga-Alaknanda basin* punctured an aquifer in 2009 that resulted in Joshimath slide.
- **High cost-** While hydropower is considered cheap, building large-scale hydroelectric plants is expensive and resource-intensive.

What lies ahead?

- The *International Hydropower Association (IHA)* promotes a combination of water, wind, and sun to achieve sustainable energy goals.
- *Ghana* and *Kenya* are successfully moving from high reliance on hydropower towards a more “robust portfolio of technologies”.

- There's significant potential in placing *floating solar panels* on reservoirs in hydropower plants, it is already explored by countries like China and Brazil.
- There is a need to move away from mega dams toward medium-scale plants, it can help mitigate climate risks associated with overdependence on large infrastructure project.

SHANKAR IAS ACADEMY