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# POLITY & GOVERNANCE

## 1.1. CONSTITUTIONAL TORT

**Context:**

- **Recently**, Indian courts have reiterated the principle of constitutional tort while awarding monetary compensation in cases involving custodial deaths, illegal detention, and violation of fundamental rights by state authorities.

1. **Meaning of Constitutional Tort**
   - Constitutional tort refers to a **legal remedy under public law** in which the State is held liable to pay compensation for violation of fundamental rights of individuals by its officials or agencies.
   - Constitutional tort arises when there is an infringement of **rights guaranteed under Part III** of the Constitution, particularly Articles 14, 19, and 21.
2. **Legal Basis of Constitutional Tort in India**
   - The doctrine of constitutional tort in India is **not explicitly mentioned in the Constitution**, but it has been evolved by judicial interpretation.
   - The legal foundation of **constitutional tort** primarily rests on **Articles 32 and 226**, which empower the Supreme Court and High Courts to enforce fundamental rights, and **Article 21**, which guarantees the right to life and personal liberty.
3. **Evolution of Constitutional Tort in India**
   - Early Phase (Sovereign Immunity)

     Initially, the British doctrine of sovereign immunity prevailed, according to which the State could not be sued for the wrongful acts of its servants.
   - Shift Towards State Liability

     The Indian judiciary gradually diluted the doctrine of sovereign immunity by holding the State accountable for illegal acts affecting citizens' rights.
4. **Landmark Supreme Court Judgments**
   - **Rudul Sah v. State of Bihar (1983):** Compensation awarded under **Article 32** for illegal detention; recognized as a **public law remedy**.
   - **Bhim Singh v. State of J&K (1985):** Compensation for illegal arrest of an MLA; reinforced **Article 21** protection of personal liberty.
   - **Nilabati Behera v. State of Odisha (1993):** State held **strictly liable** for custodial deaths; compensation independent of civil/criminal proceedings.
   - **D.K. Basu v. State of West Bengal (1997):** Custodial violence guidelines issued; compensation recognized for custodial abuse.
   - **Common Cause v. Union of India (1999):** Reaffirmed **monetary compensation** as a remedy for constitutional violations by the State.
5. **Constitutional Tort vs Ordinary Tort**

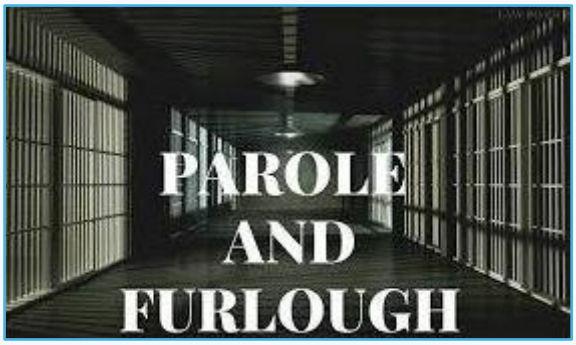
| Constitutional Tort | Ordinary Tort |
|---|---|
| It arises from violation of fundamental rights | It arises from violation of legal rights |
| It is governed by constitutional law | It is governed by civil law |

| | |
|---|---|
| It is enforced through writ jurisdiction | It is enforced through civil courts |
| Compensation is based on public law | Compensation is based on private law |
| Doctrine of sovereign immunity is diluted | Sovereign immunity may apply |

6. **Doctrine of Sovereign Immunity and Constitutional Tort**
   - The doctrine of sovereign immunity holds that the State cannot be sued without its consent.
   - However, in constitutional tort cases, Indian courts have consistently held that sovereign immunity cannot be used as a defense when fundamental rights are violated.
7. **Significance of Constitutional Tort**
   - Ensures **State accountability**, reinforcing the **rule of law**.
   - Enables **effective enforcement of fundamental rights**.
   - Upholds the **welfare state** by protecting citizens from abuse of power.
   - Acts as a **deterrent** against arbitrary and illegal actions by public authorities.

## 1.2. FURLOUGHS AND PAROLE

**Context:**




- Recently, Dera Sacha Sauda chief Gurmeet Ram Rahim Singh, who is serving a 20-year prison sentence for raping two of his disciples and is lodged in Sunaria jail in Haryana's Rohtak, was again granted a 40-day parole.
- Prior to his latest parole, Singh has come out of prison 14 times since being convicted in 2017.

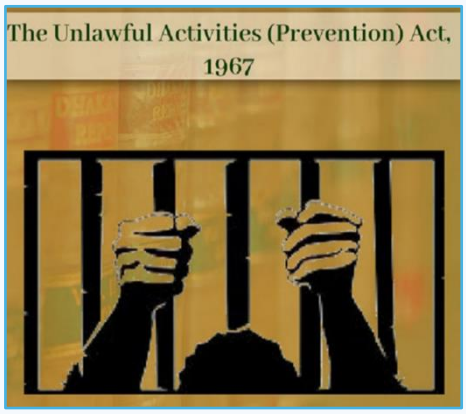
**Difference between parole and furlough**

| | **Furlough** | **Parole** |
|---|---|---|
| Granting Authority | Deputy Inspector General of Prisons | Divisional Commissioner |
| Sentence Status | Continues to run. For example, if a person has been sentenced to 10 years' imprisonment and is released on furlough for 30 days, in effect he will be in jail for 9 years 11 months and yet will be deemed to have completed the sentence. | When the convict is released on parole, the sentence is suspended and the quantum of sentence remains intact. The days of leave aren't included within the sentenced period. |
| Sentence type | Furlough is usually granted in case of long-term imprisonment | Paroles are granted in short-term imprisonment. |
| Reason | No reason is required. Furlough is meant for breaking the monotony of imprisonment. | For parole, a specific reason is required. |
| Grant Limitation | There is limitation in the case of furlough grant. | Parole can be granted a number of times. |
| Duration | Max 14 days | **30-40 Days.** |

**Similarities**

- **Parole and furlough** originate from **jail manuals and prison rules** and fall within the **executive domain**.
- Both are **conditional releases**, dependent on good conduct and compliance with prescribed conditions.
- **Under-trial prisoners** are **not eligible** for regular parole or furlough.

## 1.3. UNLAWFUL ACTIVITIES (PREVENTION) ACT (UAPA), 1967




**Context:**

- The **Supreme Court of India** recently refused bail to activists in the **2020 Delhi riots case**, citing prima facie evidence under the **UAPA**, **1967**
- The Court emphasized that constitutional guarantees of personal liberty (**Article 21**) are **not absolute** and are subject to **restrictions under special statutes** like UAPA.
- This highlights the **stringent bail provisions and special thresholds** under UAPA designed to maintain **national security, public order, and sovereignty**.

**Overview of UAPA**

- The **Unlawful Activities (Prevention) Act** is India's **primary anti-terror legislation** enacted in **1967** to address **anti-national and secessionist activities** threatening India's **sovereignty and integrity**.
- Initially focused on **unlawful associations**, the Act has been **amended multiple times** to address terrorism, financing of terror, and individual designations as terrorists.
- UAPA empowers the **Central Government and investigative agencies** to act decisively against **terrorist acts** while prescribing **special bail, procedural, and punitive provisions**.

**Historical Background of UAPA Act 1967**

- **1963:** Constitution (**Sixteenth Amendment**) allowed restrictions on **Article 19** (freedom of speech) for safeguarding national integrity.
- **2004 Amendment:** Added Chapter IV to include **terrorist acts** under the UAPA, replacing **TADA (1987) and POTA (2002)**.
- **2013 Amendment:** Strengthened provisions against **money laundering and terror financing**.
- **2019 Amendment:** Included **cyber-terrorism, property seizure, and individual designation as terrorists**.

**Key Provisions of the Unlawful Activities (Prevention) Act (UAPA), 1967**

1. **Declaration of an Unlawful Association:** The **Central Government** can declare an association "unlawful" if it engages in activities that:
    - Support the **cession or secession** of any part of India.
        - Challenge or deny India's **sovereignty or territorial integrity**.
    - Such a ban on an organization can be **extended for up to five years**.
2. **Designation of Terrorist Organisations:** The Central Government may designate an organisation as a **terrorist organisation** if it:

- Commits or participates in **terrorist acts**.
  - **Prepares for, promotes, or facilitates terrorism**.
  - Is otherwise involved in activities considered **terrorism-related**.

3. **Definition of Terrorist Acts:** Threaten India's unity, integrity, sovereignty, security, or economic security;
   - Instill fear or terror among the public in **India or abroad.**
   - It also covers offences under international conventions listed in the UAPA Schedule, such as:
   - Convention for the Suppression of Terrorist Bombings (1997)
   - Convention Against the Taking of Hostages (1979)
4. **Establishment of Tribunals:** The **Central Government** may set up an **Unlawful Activities Prevention Tribunal** comprising a **High Court judge**.
5. **Extended Investigation and Judicial Timelines:** Remand orders can extend to **30 days** instead of the **standard 15 days**. **Maximum judicial custody** before filing a charge sheet can be **180 days** (instead of 90).
6. **Bail Provisions:** Bail is **restricted** under UAPA. Courts may deny bail if the charges appear **prima facie valid**.The **burden of proof** lies with the accused to demonstrate innocence.
7. **Punishments for Terrorist Offences: Death penalty or life imprisonment** if the act results in death.
8. **Investigating Agency**
   - The **National Investigation Agency (NIA)** is the primary agency for investigating UAPA cases.

**UAPA Amendment Act 2019**

a. **Individual Designation:** Union Government empowered to designate individuals as terrorists; earlier, only organisations could be listed.

b. **Property Seizure:** NIA Director General's approval required for seizure of terror-linked property, in addition to State DGP approval.

c. **NIA Powers:** Inspectors and above authorised to investigate UAPA cases (earlier limited to DSP/ACP and above).

d. **Treaty Addition:** Included the International Convention for the Suppression of Acts of Nuclear Terrorism (2005) in the UAPA schedule.

## 1.4. PRO-ACTIVE GOVERNANCE AND TIMELY IMPLEMENTATION (PRAGATI) PLATFORM

**Context:**

- Recently, the **50th meeting of PRAGATI** was held, chaired by **Prime Minister Narendra Modi**, where Cabinet Secretary **T.V. Somanathan** highlighted that **land acquisition** remains a **major challenge** in **infrastructure development**.
- The PRAGATI platform reviewed **over 3,300 projects worth ₹85 lakh crore**, raised **7,735 issues**, and resolved **7,156 of them**, showcasing the system's role in **timely monitoring and problem resolution**.
- About **35% of resolved issues** were related to land acquisition, followed by 20% on **forest, wildlife, and environment**, and 18% on **right of use/way**, with remaining delays due to law and order, construction, power utility approvals, and financial constraints.

**Overview of PRAGATI Platform**

- **PRAGATI** is a **multi-purpose, multi-modal platform** designed to **address public grievances** and simultaneously **monitor and review key government programmes and projects** at the central and state levels.
- **Objectives:** It aims to enhance **e-transparency and e-accountability** by enabling real-time interaction among key stakeholders.
- **Launched On**: The platform was **launched on March 25, 2015** and was developed **in-house by the PMO team in collaboration with the National Informatics Centre (NIC)**.
- PRAGATI integrates **three advanced technologies**:
  - **Digital data management** for centralized project tracking.
  - **Video conferencing** for direct interaction with officials.
  - **Geospatial technology** for visual representation of ground-level project data.
- The platform strengthens **cooperative federalism** by bringing together **Union Government Secretaries** and **State Chief Secretaries** on a common interface,

**Key Features of PRAGATI**

- **Three-tier system:**
  - Prime Minister's Office (PMO)
  - Union Government Secretaries
  - State Chief Secretaries

**Projects Facilitated by PRAGATI**

- Chenab Bridge (Jammu & Kashmir)
- Bogibeel Bridge (Assam)
- Jal Jeevan Mission

## 1.5. UIDAI & AADHAAR: INSTITUTIONAL FRAMEWORK AND STRATEGIC PROFILE

**Context:**


The Unique Identification Authority of India (UIDAI) has announced a significant revamp in its operational framework, focusing on expanding accessibility for adult enrolment while simultaneously tightening verification protocols to ensure data integrity and national security.

**Institutional Status:**

- **Legal Nature:** A **Statutory Authority** established under the provisions of the **Aadhaar Act, 2016**.
- **Nodal Ministry:** Operates under the jurisdiction of the **Ministry of Electronics & Information Technology (MeitY)**.
- **Core Vision:** To empower residents with a unique identity and a digital platform for "anytime, anywhere" authentication.

**Administrative Composition:**

- **Leadership:** The Authority consists of a **Chairperson**.
- **Members:** Includes two **part-time Members**.
- **Executive Head:** A **Chief Executive Officer (CEO)**, who also serves as the Member-Secretary of the Authority.

**Functional Mandate:**

- **Issuance:** Responsible for issuing the **Unique Identification Number,** commonly known as the 'Aadhaar number', to all Indian residents.
- **Lifecycle Management:** Manages all stages of the Aadhaar lifecycle, from enrollment to authentication.
- **System Integrity:** Ensures the security and operation of the database and authentication systems.

**The Aadhaar Architecture:**

- **Format:** A **12-digit** individual identification number issued after a rigorous verification process.
- **Data Collection:**
  - **Demographic:** Name, Date of Birth/Age, Gender, Address, Mobile Number, and E-mail ID (optional).
  - **Biometric:** Fingerprints, Iris Scans, and Facial Photograph.
- **Validity:** The number is **unique** to every individual and remains valid for a **lifetime**.

**Strategic Utility:**

- **Verification:** Serves as a robust proof of **identity** and **address** for residents.
- **Service Delivery:** Facilitates seamless access to banking, mobile connections, and various Government (DBT) and Non-Government services.

***

## UPSC PRELIMS PRACTICE QUESTIONS

Q. Which of the following best describes the concept of Constitutional Tort?

(a) A civil wrong committed by a private individual against another private individual.
(b) A criminal offence punishable under the Indian Penal Code.
(c) A public law remedy where the State is held liable for violation of fundamental rights.
(d) A contractual dispute between the government and citizens.

**Ans. (c)**

**Explanation:**

The concept of constitutional tort refers to a public law remedy in which constitutional courts hold the State liable to compensate individuals for violation of their fundamental rights, especially under Articles 14 and 21. It is not a private civil dispute, not a criminal offence, and not related to contractual obligations.

Q. Which one of the following correctly describes the legal status of parole and furlough?

(a) Both parole and furlough are legal rights of prisoners.
(b) Parole is a legal right, whereas furlough is a privilege.
(c) Furlough is a legal right, whereas parole is a privilege.
(d) Neither parole nor furlough can be considered legal rights.

**Ans. (d)**

**Explanation:**

- Parole is a temporary, conditional release granted to a prisoner by the executive authority. It is not a legal right of the prisoner but a discretionary relief, granted on humanitarian or emergency grounds under the relevant State Prison Rules.
- Furlough is also a temporary release, but it is considered a reformative measure.
- Unlike parole, furlough is treated as a statutory right subject to eligibility conditions, provided under State Prison Rules, and is granted periodically unless specifically denied for valid reasons. However, both are considered privileges granted at the discretion of prison authorities, not absolute entitlements.

Q. Under the UAPA, 1967 which of the following powers are vested with the Central Government?

1. Designating individuals as terrorists
2. Declaring organisations as unlawful
3. Freezing assets linked to terrorist activities

Select the correct answer using the code below:

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1, 2 and 3
(d) 1 and 3 only

**Ans. (c)**

**Explanation:**

**Statement 1 is correct:** The UAPA Amendment Act, 2019 empowers the Central Government to designate individuals as terrorists, a power that earlier existed only for organisations. This enables preventive action against individuals involved in terrorist activities.

**Statement 2 is correct:** The Central Government may declare an organisation as "unlawful" if it engages in activities that support cession or secession, or challenge India's sovereignty and territorial integrity.

**Statement 3 is correct:** The Act authorises the Central Government to freeze, seize, or attach funds and financial assets linked to terrorism, particularly after the 2008 and subsequent amendments, to curb terror financing.

Q. With reference to the PRAGATI platform, consider the following statements:

1. PRAGATI is designed to ensure coordinated decision-making between the Centre, States, and local authorities.
2. Issues to be flagged for review during PRAGATI are uploaded seven days prior to the meeting.
3. The Prime Minister personally resolves all issues during the PRAGATI session without prior inputs from Union and State Secretaries.
4. PRAGATI integrates databases such as CPGRAMS, Project Monitoring Group (PMG), and Ministry of Statistics and Programme Implementation (MoSPI).

Which of the statements given above is/are correct?

(a) 1, 2, and 4 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) All of the above

**Ans. (a)**

**Explanation:**

**Statement 1: Correct** – PRAGATI facilitates coordinated action among the Centre, States, and local authorities for timely project implementation.

**Statement 2: Correct** – Issues are uploaded seven days before PRAGATI Day for review by Union and State Secretaries.

**Statement 3: Incorrect** – The PM reviews issues with the latest inputs and visuals, but initial updates and comments are provided by Union Secretaries and State Chief Secretaries.

**Statement 4: Correct** – PRAGATI leverages CPGRAMS, PMG, and MoSPI databases for issue tracking and project monitoring.

Q. With respect to the institutional framework of the Unique Identification Authority of India (UIDAI), consider the following statements:

1. It is a constitutional body established under Article 21 of the Constitution.
2. The Authority functions under the administrative jurisdiction of the Ministry of Home Affairs.
3. It is mandated to issue a 12-digit unique identification number to residents of India.

Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 3 only
(c) 2 and 3 only
(d) 1, 2 and 3

**Ans. (b)**

**Explanation:**

**Statement 1 is incorrect:** UIDAI is a statutory authority established under the Aadhaar Act, 2016, not a constitutional body.

**Statement 2 is incorrect:** It operates under the Ministry of Electronics & Information Technology (MeitY).

**Statement 3 is correct:** Its core mandate is issuing the 12-digit Aadhaar number to residents.

**Scan to attempt more questions**

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# INTERNATIONAL RELATIONS

## 2.1. UNESCO MEDIA AND INFORMATION LITERACY (MIL) ALLIANCE

**Context:**

The recent election of the first Global Board of the UNESCO Media and Information Literacy (MIL) Alliance marks a significant milestone in the governance and strategic development of the global network.


**What is the MIL Alliance?**

- **Definition:** A UNESCO-coordinated global network of experts and organizations dedicated to advancing media literacy.
- **Primary Mandate:** Equipping societies to identify and counter disinformation, misinformation, and hate speech.
- **Composition:** Over 300 organizations and 180 experts spanning 100+ countries.

**Evolutionary Timeline**

- **Inception (2013):** Established at the Global Forum for Partnerships on MIL in Abuja, Nigeria.
- **Revitalization:** In 2025, the Alliance was formally relaunched during Global MIL Week through the Cartagena Declaration and a renewed strategic action plan.
- **Institutional Milestone:** Transitioned to a structured governance model with the election of its first-ever **Global Board**.

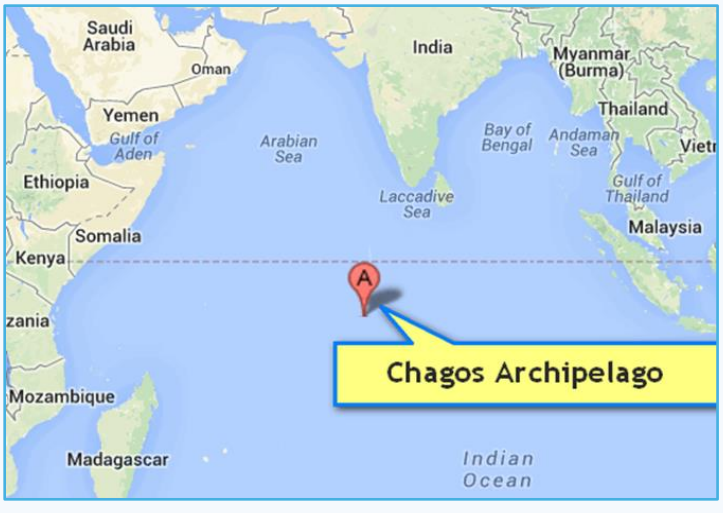
**Strategic Objectives**

- **Societal Resilience:** Building public capacity to navigate complex digital information ecosystems.
- **Policy Leadership:** Empowering the MIL community to influence global, regional, and national policy frameworks.
- **Standard Setting:** Shaping international norms and strategies regarding information integrity.

## 2.2. CHAGOS ARCHIPELAGO

**Context:**

- **Recently**, the United Kingdom reached a historic agreement to transfer the sovereignty of the **Chagos Archipelago** to **Mauritius**, effectively ending decades of diplomatic and legal disputes over the territory.
- This development is significant as it addresses the status of Britain's last African colony while ensuring the continued operation of the strategically vital UK-US military base on **Diego Garcia** through a 99-year lease agreement.



1. **Geographical Profile**
   - **Location:** The Chagos Islands are a group of seven atolls and more than 60 individual tropical islands located in the **central Indian Ocean**, approximately 500 km south of the Maldives and 1,600 km south of India's southern tip.
   - **Physical Features:** The islands are mostly flat, low-lying coral atolls with an average elevation of less than 2 meters; they do not possess any rivers or freshwater lakes.
   - **Key Islands:** The archipelago includes **Diego Garcia** (the largest and southernmost island), the **Salomon Islands**, **Peros Banhos**, **Danger Island**, and the **Egmont Islands**.
   - **Geological Context:** It sits on the **Chagos-Laccadive Ridge**, a submarine mountain range that also includes the Lakshadweep and Maldives chains.
2. **The Diego Garcia Base**
   - **Strategic Importance:** Often referred to as a "stationary aircraft carrier," Diego Garcia is one of the most important US overseas military bases, supporting long-range bombers and naval operations in the Middle East and Indo-Pacific.

## 2.3. YEMEN

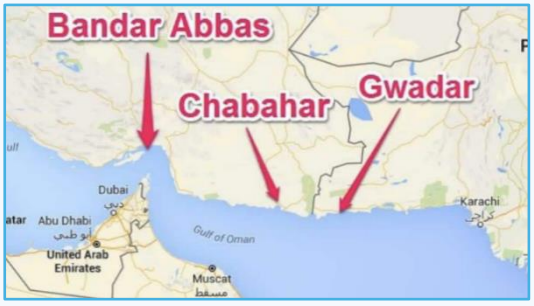
**Context:**

- Recently, Yemen experienced significant political and security realignments as the Saudi-backed **Presidential Leadership Council (PLC)** launched a counter-offensive to recapture the oil-rich provinces of **Hadramawt and Al-Mahra** from the UAE-backed **Southern Transitional Council (STC)** following a month-long conflict.


1. **Geographical Profile: Yemen**
   - **Location:** Situated at the southwestern tip of the **Arabian Peninsula** in West Asia.
   - **Land Borders: North:** Saudi Arabia; **East:** Oman
   - **Water Bodies: West:** Red Sea; **South:** Gulf of Aden; **Southeast:** Arabian Sea
   - **Strategic Chokepoints:**
     - **Bab-el-Mandeb Strait:** Connects the Red Sea to the Gulf of Aden. It is often referred to as "**Gate of Tears."**
   - **Strategic Islands:**
     - **Socotra Archipelago:** Located in the Indian Ocean, it is a **UNESCO World Heritage site** known for its unique flora like the **Dragon Blood Tree**.
     - **Perim Island (Mayun):** A volcanic island in the Bab-el-Mandeb strait that provides control over the shipping lane.
2. **India's Strategic Interests**
   - **Energy Security:** Yemen's proximity to the **Bab-el-Mandeb** makes it vital for India's oil imports coming from the Atlantic and Mediterranean regions.
   - **Operation Raahat:** India's landmark 2015 evacuation mission remains a case study for Indian diplomacy and military coordination.
   - **Maritime Security:** The Indian Navy maintains a persistent presence in the **Gulf of Aden** to provide "naval protection" to Indian-flagged merchant vessels against piracy and missile threats.

## 2.4. CHABAHAR PORT

**Context:**




- **Recently**, India has been in active diplomatic negotiations with the United States to secure a long-term extension of the **sanction's waiver** for the Chabahar Port, which is set to expire on **April 26, 2026**.
- This follows the landmark **10-year agreement** signed in May 2024 between **India Ports Global Limited (IPGL)** and Iran's Port and Maritime Organization (PMO) for the operation of the **Shahid Beheshti terminal**.

1. **Location & Geography**

- Located in **Sistan-Baluchistan province of Iran**.
- Lies on the **Gulf of Oman**, outside the **Strait of Hormuz**.
- Closest Iranian port to **India's western coast**.

2. **Strategic Importance for India**

- Provides **direct sea access to Afghanistan and Central Asia** bypassing Pakistan.
- Key pillar of **India's "Connect Central Asia" policy**.
- Enhances India's presence in the **Indian Ocean Region (IOR)**.

3. **Connectivity Projects Linked to Chabahar**

- **Chabahar–Zahedan railway line** connects port to Iran's rail network.
- Integrated with the **International North–South Transport Corridor (INSTC)**.
- Acts as a gateway to **Eurasian markets**.

4. **Chabahar vs Gwadar**

    - **Chabahar Port** → India–Iran cooperation
    - **Gwadar Port** → China–Pakistan Economic Corridor (CPEC)
    - Both ports lie on the **Makran Coast but** serve **competing strategic interests**.

## 2.5. OPERATION PAWAN

**Context:**


- Recently, Operation Pawan regained prominence in national discourse as the Chief of the Army Staff (COAS), General Upendra Dwivedi, paid homage to the martyrs of the mission at the National War Memorial, New Delhi.
- This marks a historic shift, as it is the **first time the Indian Army** has officially commemorated the soldiers of this 1987 mission at the national level, addressing a decades-long demand for formal recognition.

1. **About Operation Pawan**
    - Operation Pawan was the codename for the **Indian Peace Keeping Force (**IPKF's) combat role in Sri Lanka, conducted mainly against the LTTE after it refused to surrender arms, marking a shift from peacekeeping to active military engagement.
    - It followed the **Indo–Sri Lanka Accord, 1987**, signed between: India (PM Rajiv Gandhi) & Sri Lanka (President J. R. Jayewardene)
2. **Indo–Sri Lanka Accord (1987) – Key Provisions**

- Devolution of powers to **Sri Lankan provinces** (13th Constitutional Amendment).
- **Disarmament of Tamil militant groups**.
- Deployment of **Indian Peace Keeping Force (IPKF)** to maintain peace.
- Assurance that Sri Lanka would not allow foreign powers to use its territory against India.

3. **Objectives of Operation Pawan**
    - Enforce the **Indo–Sri Lanka Accord**.
    - **Disarm LTTE** and other militant groups.
    - Restore **normalcy and political process** in Sri Lanka.
    - Prevent external powers from influencing Sri Lanka.

## 2.6. PAX SILICA INITIATIVE: PURPOSE, PARTNERS & STRATEGIC IMPLICATIONS

**Context:**


- Recently, Pax Silica, a U.S.-led strategic initiative launched to secure the entire global silicon and AI supply chain-from critical mineral refining to advanced semiconductor fabrication and data infrastructure- aiming to reduce "coercive dependencies" on China.
- China currently dominates the critical minerals segment underpinning the silicon and AI ecosystem, refining over 60% of lithium, cobalt, and rare earths; consequently, global diversification efforts have intensified following China's restrictions on rare earth magnets, which disrupted supply chains

1. **Key Highlights of Pax-Silica Initiative**
    - **Origin & Meaning**:
        - **Pax (Latin)**: Peace, stability, or order (similar to Pax Romana).
        - **Silica**: Refers to silicon, the fundamental material for semiconductors and AI hardware.
    - **Led by**: The **United States** (specifically via the U.S. State Department).
    - **Founding Members (The "Initial 9")**: USA, Japan, South Korea, Singapore, Netherlands, The United Kingdom, Israel, United Arab Emirates (UAE), Australia.
    - **India's Status**: India was **not** a founding member (initially excluded due to a nascent manufacturing base). However, as of **January 2026**, the U.S. has formally indicated that India will be invited to join the initiative to deepen strategic ties.

2. **Core Objectives**

- **De-risking from China**: Reduce global dependence on a single country for critical minerals (lithium, cobalt) and rare earth processing.
- **Supply Chain Resilience**: Secure the entire **"Silicon Value Chain"-**from raw mineral extraction and refining to chip design, fabrication (fabs), and packaging.
- **Trusted Ecosystems**: Ensure that **AI infrastructure** (data centers, fiber-optic cables, and software) is built and managed by "trusted partners" to prevent espionage or sabotage.
- **Economic Security**: Aligns with the principle that control over high-end compute and semiconductors is essential for modern military and economic power.

3. **What are India's key initiatives in semiconductors and AI?**
    - **IndiaAI Mission:** Central government approved the comprehensive national-level IndiaAI mission with a budget outlay of Rs.10,371.92 crore.
    - **National Critical Mineral Mission (NCMM):** It seeks to ensure India's self-reliance in critical minerals essential for high-technology industries, clean energy transitions, and defence requirements.
    - **Minerals Security Partnership (MSP):** A U.S.-led initiative that seeks to strengthen critical mineral supply chains by promoting their responsible production, processing, and recycling to maximize economic development benefits.

## 2.7. SYRIA AND ITS IMPORTANT CITIES: GEOGRAPHY, HISTORY & STRATEGIC ROLE

**Context:**

- Syrian government forces and the **Kurdish-led Syrian Democratic Forces (SDF)** recently exchanged fire in **eastern Aleppo province**, a tense frontline separating government-controlled areas from SDF-held territories in northeastern Syria.


**About Syria**

- **Capital: Damascus**
- **Geographical Location:** Syria is located in **West Asia** (Middle East).
- **Borders: North:** Turkey; **East:** Iraq; **South:** Jordan; **West:** Israel and Lebanon
- **Coastline:** Lies along the **Mediterranean Sea** on the western side.
- **Physical Features:**
    - **Major Regions:** Syrian Desert, Euphrates River Valley, Anti-Lebanon Mountains (forms part of the border with Lebanon).
    - **Major Rivers:** Euphrates, Orontes, and Tigris.
    - **Highest Point:** Mount Hermon (on the border with Lebanon).
    - **Important Cities in Conflict Zones:** Aleppo, Homs, Idlib, Golan Heights (disputed with Israel).
- **Historical & Strategic Significance:**

- Aleppo has historically been a **major trade hub**, lying at the intersection of important commercial routes connecting Asia, Europe, and the Middle East.
- It hosts the **UNESCO World Heritage Site "Old City of Aleppo"**, which includes the iconic **Aleppo Citadel**, a notable example of medieval Islamic architecture.

- **Security Situation:** The city has been affected by conflict involving **terrorist organizations**, including **Hayat Tahrir al-Sham (HTS)**.

## 2.8. KURDISTAN CRISIS

**Context:**


- Kurdish armed groups associated with the **Syrian Democratic Forces (SDF)** recently refused to withdraw from **Kurdish-dominated neighbourhoods of Aleppo** despite a ceasefire announced by the Syrian government.
- The episode has brought renewed attention to the **Kurdish question**, particularly the **political status, security concerns, and autonomy demands of Kurdish-inhabited regions** in **West Asia**.

**Overview of Kurdistan**

Kurdistan is located in **West Asia**, at the intersection of three major geographical zones: **Anatolia**, **Mesopotamia**, and the **Iranian Plateau**, that is **traditionally inhabited by the Kurdish people**.


- It is **not an internationally recognised sovereign state**, but a **transnational ethnic homeland** divided among **several modern nation-states** following **post–World War I** boundary settlements.
- **Administrative Structure**: The **Kurdistan Region of Iraq** is administratively organised into **four governorates**, namely **Erbil, Sulaymaniyah, Dohuk, and Halabja**.

**Kurdistan Region – Concise Notes**

- **Capital: Erbil**
- **Topography:** Rugged mountainous terrain dominated by the Zagros and eastern Taurus ranges.
- **Hydrography:** Source/route of major rivers—Tigris, Euphrates, Greater Zab, Little Zab; known as the "water tower of the Middle East."

**Historical Milestones**

- **Treaty of Sèvres (1920):** Promised a Kurdish state (never ratified).
- **Treaty of Lausanne (1923):** Omitted Kurdistan; Kurds divided among states.
- **Anfal Campaign (1988):** Genocidal campaign against Kurds, including Halabja.

**Geographical Extent & Borders**

- **Cross-border mountainous belt:** SE Turkey, N Iraq, W Iran, N Syria, parts of Armenia.
- **Borders:** Caucasus/Armenia (N), Syria (W), Iran (E), Arab plains of Iraq (S).
- **In Iraq,** the Green Line marks autonomy; Kirkuk remains a disputed, oil-rich flashpoint.

**Climate, Vegetation & Resources**

- **Continental to semi-arid climate;** snowy winters in mountains, hot summers in lowlands**.**
- Oak forests, scrub, alpine grasslands; valley agriculture (wheat, barley, fruits, nuts).
- **Rich in oil and natural gas**

## 2.9. IRAN: STRATEGIC AND GEOGRAPHICAL PROFILE OF A WEST ASIAN POWER

**Context:**


- Iran has recently entered a state of high military readiness following threats of **preemptive strikes** issued by its **Army Chief**, Major General Amir Hatami.
- This stance is a **direct response** to escalating external rhetoric from the **United States**, specifically regarding potential American intervention in Iran's internal civil unrest.
- Domestically, Iran is grappling with **economic instability** and protests, while externally, it seeks to maintain its **regional dominance** against the perceived **dual threat** of the **U.S.-Israel alliance**.

**Political and Administrative Profile of Iran**

- Iran is a **strategically located West Asian country** situated at the junction of **Central Asia, South Asia, and the Middle East**.
- **Capital: Tehran**.
- **International Groupings:** Iran is a member of **OPEC**, **BRICS**, and the **Shanghai Cooperation Organisation (SCO)**, reflecting its growing engagement with non-Western multilateral platforms.

**International Boundaries and Neighbours of Iran**

- **Land Boundaries:** Iran shares land borders with **seven countries**, making it one of the most geopolitically connected states in West Asia.
  - **Northern borders** include **Armenia, Azerbaijan, and Turkmenistan**, linking Iran to the **Caucasus and Central Asia**.
  - **Eastern borders** with **Afghanistan and Pakistan** place Iran close to South Asian and security-sensitive regions.
  - **Western borders** with **Iraq** and **Turkey** connect Iran directly to **Arab West Asia and Europe-linked Anatolia**.
- **Maritime Boundaries:**

- **North**: The **Caspian Sea** lies to the north and represents an important zone for **energy resources and regional diplomacy**.
- **South:** The **Persian Gulf** and **Gulf of Oman** lie to the south, giving Iran access to the **Arabian Sea and the Indian Ocean**.

**Physical Geography of Iran**

- **Relief and Land Surface:** Iran's landscape is largely shaped by the **Iranian Plateau**, which includes expansive **arid zones and deserts**, notably the **Dasht-e Kavir** and the **Dasht-e Lut**.
- **Major Mountain Systems:** The country is bordered by prominent mountain ranges, with the **Zagros Mountains** (long folded range) stretching across **western Iran** and the **Alborz Mountains** extending along the **northern margins** near the Caspian Sea.
- **River Systems:** Rivers such as the **Karun**, **Dez**, **Karkheh**, and **Diyala** are vital for **agricultural irrigation and water supply**, especially in the western and south-western regions.
- **Lake Urmia**: **It is an endorheic salt lake** in **northwestern Iran** between the **Azerbaijan provinces,** historically the **largest lake in the Middle East** and among the largest saltwater lakes globally.
- **Mineral and Energy Wealth:** Iran possesses extensive **hydrocarbon reserves**, particularly **oil and natural gas**, along with notable deposits of **coal, chromium, copper, iron ore, lead, manganese, zinc, and sulphur**.

## 2.10. NATO CRISIS EXPLAINED: GREENLAND ISSUE & COLLECTIVE DEFENCE

**Context:**

- Recently, the stability of the **North Atlantic Treaty Organization (NATO)** has come under intense global scrutiny following remarks by **U.S. President Donald Trump** regarding a potential takeover of **Greenland**, an autonomous territory of **Denmark**.


**Genesis and Evolution of NATO**

- **Founding and Purpose:** Established on **April 4, 1949**, via the **Washington Treaty** (**North Atlantic Treaty**), NATO was designed to act as a collective deterrent against **Soviet expansion** in **post-World War II Europe**.
- **Nature:** NATO is an **intergovernmental military alliance** of **32 countries** from Europe and North America.
- **Core Principle (Article 5):** The cornerstone of the alliance is **Collective Defense**. Article 5 stipulates that an **"armed attack"** against one member is considered an attack against all, requiring a unified response.
  - **Note:** Historically, **Article 5** has been invoked only once—following the **9/11 terrorist attacks** on the United States.
- **Headquarters:** Located in **Brussels, Belgium**

**Objectives of NATO**

- Provide **collective security** against external threats.
- Maintain **military readiness**, modernization, and strategic planning among member states.
- Enable **crisis management operations** using coordinated military and diplomatic strategies.
- Strengthen **partnerships with non-member countries** to promote global security and stability.
- Serve as a **transatlantic link** connecting Europe and North America for cooperative defense and security initiatives.

**Membership and Expansion of NATO**

As of **2026**, NATO has expanded to **32 member countries**, nearly triple its original 12 founding members.

- **Founding Members (12):** Belgium, Canada, Denmark, France, Iceland, Italy, Luxembourg, Netherlands, Norway, Portugal, United Kingdom, and the United States.
- **Recent Accessions:**
  - Finland (2023)
  - Sweden (2024)
- **Aspirant Partners: Ukraine**, **Georgia**, and **Bosnia and Herzegovina** have formally declared their aspirations to join the alliance.
  - **Ukraine** formally applied for **NATO membership in 2022** and received assurances of support at the **Vilnius Summit** in 2023.
- **Open Door Policy (Article 10):** NATO maintains an **"Open Door Policy,"** allowing any European state that can enhance the security of the North Atlantic area to apply for membership.
- **EU-NATO Overlap:** While many countries belong to both, EU members **Austria, Cyprus, Ireland, and Malta** are notably not part of NATO.
- **Bordering Russia:** Six NATO members share a direct land border with Russia: **Norway, Finland, Estonia, Latvia, Lithuania, and Poland**.

**NATO Partnerships**

NATO collaborates with **over 40 non-member countries** to enhance global security without giving them decision-making powers.

- **Key Partnership Programs:**
  - **Partnership for Peace (PfP):** Bilateral cooperation with **Euro-Atlantic countries** on military training, defense reforms, and crisis management.
  - **Mediterranean Dialogue (MD):** Engagement with **Mediterranean nations** to strengthen regional security and maritime cooperation.
  - **Istanbul Cooperation Initiative (ICI):** Cooperation with **Middle Eastern countries** on counter-terrorism and defense capacity-building.
- **International Cooperation:** Works with the **UN, EU, and OSCE** to support peacekeeping and crisis management.
- **NATO Plus Five:** A framework including the U.S., NATO members, and five global partners – **Australia, New Zealand, Japan, South Korea, and Israel** – aimed at enhancing global defense coordination against emerging threats, including China.

- **Major Non-NATO Ally (MNNA):** A U.S. legal status providing benefits in defense trade and security. Currently, 18 countries (including **Israel, Japan, and Qatar**) are designated as MNNAs. **India is not an MNNA** but maintains a cooperative relationship with NATO.

**India's Position with NATO**

India is **not a member** of NATO but maintains a **close partnership** with the alliance.

- **Contributions:** India has participated in **NATO-led operations**, including the **International Security Assistance Force (ISAF)** mission in Afghanistan.
- **Framework for Enhanced Cooperation (2021):** In 2021, India and NATO signed a **Framework for Enhanced Cooperation** to engage in dialogue on maritime security, counter-terrorism, and emerging technologies without committing to a military alliance.

## 2.11. SOMALILAND RECOGNITION

**Context:**

- Somaliland has recently gained global attention as **Israel**, the **first UN member country**, has formally recognised it as an **independent** and **sovereign state**.
- This recognition has highlighted Somaliland's **strategic location** in the Horn of Africa and its **role in maritime trade and security**.
- **Other countries, including Ethiopia**, are reportedly considering recognition or closer engagement with Somaliland to secure **port access and trade routes**.
- **Somalia has strongly opposed** these moves, claiming Somaliland as an integral part of its sovereign territory.


**Geographical Location and Borders of Somaliland**

Somaliland is situated in the **Horn of Africa**, occupying a pivotal position along the southern coast of the **Gulf of Aden**.

- **Northern Border:** It possesses an extensive coastline of approximately 850 km along the **Gulf of Aden**, which connects the Arabian Sea to the Red Sea via the **Bab-el-Mandeb Strait**.
- **Northwestern Border:** It shares a short land boundary with **Djibouti**.
- **Western and Southern Borders:** It is bordered by **Ethiopia**, which seeks access to the sea through Somaliland's ports.
- **Eastern Border:** It borders the **Puntland** region of Somalia, a territory with which it has long-standing jurisdictional disputes.

**Physical Geography and Landforms of Somaliland**

The topography of Somaliland is diverse, ranging from coastal lowlands to rugged mountain ranges.

- **The Guban Plain:** A narrow, sandy, and arid coastal strip along the Gulf of Aden. It is characterized by high temperatures and low rainfall, making it a "heat zone."
- **Ogo and Golis Mountains:** These are rugged mountain ranges that run parallel to the coast. The highest peak is **Mount Shimbiris** (approximately 2,460 meters), located in the **Cal Madow** range.
- **The Haud Plateau:** South of the mountains lies a vast, undulating plateau that extends into Ethiopia. This region is critical for **nomadic pastoralism** due to its seasonal grazing lands.
- **Valleys:** Notable landforms include the **Nugal Valley** and the **Ain Valley**, which consist of large seasonal drainage networks in the southeast.

**Hydrology and Rivers of Somaliland**

Somaliland lacks permanent, year-round rivers. Its hydrology is dominated by **seasonal watercourses** known locally as **Wadis** or **Toggas**.

- **Togga Maroodi Jeex:** A major **seasonal river** passing through the capital, **Hargeisa**, vital for local water supply during rainy seasons.
- **Drainage Patterns:** Most seasonal streams in the north flow toward the **Gulf of Aden**, while those in the south and east drain toward the **Indian Ocean** through the **larger Somali plateau systems.**

**Climate and Vegetation of Somaliland**

- **Climate:** The region experiences an **Arid to Semi-Arid climate**. It is characterized by four distinct seasons: Gu (main **rainy season**), Xagaa (**dry and windy**), Deyr (**short rains**), and Jiilaal (**long dry season**).
- **Vegetation:** Due to sparse rainfall, the vegetation is primarily **Xerophytic** (drought-resistant).
    - **Species:** Common flora includes **Acacia** trees, thorny shrubs, and various species of **Frankincense** and **Myrrh** trees, for which the region has been famous since antiquity.

**Mineral Wealth and Natural Resources of Somaliland**

Somaliland is considered highly prospective but remains largely underexplored.

- **Gemstones:** The region is a rich source of **Emeralds, Rubies, Sapphires**, and **Aquamarines**, found primarily in the crystalline basement rocks.
- **Metallic Minerals:** Significant deposits of **Gold, Iron Ore, Tin, Copper**, and **Zinc** have been identified.
- **Industrial Minerals:** It holds massive reserves of **Gypsum** (among the largest in the world), as well as **Marble, Mica,** and **Quartz**.
- **Hydrocarbons:** Seismic surveys indicate high potential for **Oil and Natural Gas** reserves both onshore and offshore in the Gulf of Aden.

**Strategic Importance of Somaliland**

- **Geopolitical Location**: Somaliland lies at the crossroads of the **Indian Ocean** and the **Red Sea**, making it a critical point for global maritime trade.
- **Berbera Port**: Provides access to some of the **world's busiest shipping lanes**, crucial for international commerce.
- **Maritime Security**: Shipping routes near Somaliland have been threatened by **Yemen's Houthi militia**, underlining its strategic security relevance.

## 2.12. GREENLAND STRATEGIC AND GEOGRAPHICAL SIGNIFICANCE

**Context:**

- Recently, **Greenland** surfaced as a flashpoint in international relations following remarks by the U.S. administration suggesting a potential **annexation** or takeover of the island for **national security** reasons.
- This follows a major U.S. military operation in **Venezuela** and has triggered a diplomatic standoff. **Danish Prime Minister** Mette Frederiksen warned that such a move would violate the sovereignty of a **NATO ally**, potentially leading to the collapse of the military alliance.


**Geographical Features & Landforms of Greenland**

Greenland is located in the **Northern Hemisphere**, with **most of its landmass lying within the Arctic Circle**.


- **The Ice Sheet:** Approximately **80%** of the landmass is covered by the **Greenland Ice Sheet**, the second-largest ice body in the world after Antarctica.
- **Topography:** The interior is a massive **ice-covered plateau**, while the edges are fringed by high **mountain ranges** and deep **fjords**.
- **Highest Point: Gunnbjørn Fjeld** (3,694m), situated in the **Watkins Range**; it is the highest peak in the entire Arctic circle.
- **Rivers & Lakes:** Greenland lacks long, perennial river systems. Most are short **meltwater streams** formed by seasonal glacial melting. **Notable examples** include the **Børglum Elv** (one of the largest) and the **Qinnguata Kuussua**.
- **Fjords:** It contains the world's largest fjord system, **Scoresby Sund**, on the eastern coast.

**Geographical Boundaries & Location of Greenland**

Greenland is strategically located between the **Arctic** and **Atlantic Oceans**. Its maritime and physical borders include:

- **North: Arctic Ocean**.
- **East: Greenland Sea** (separating it from **Svalbard)** and **Denmark Strait** (separating it from **Iceland**).
- **West: Baffin Bay** and **Davis Strait** (separating it from **Canada's Baffin Island**).
- **Southwest: Labrador Sea**.
- **Northernmost Point: Kaffeklubben Island** is often cited as the **northernmost point of land on Earth.**

**Climate and Vegetation of Greenland**

- **Climate Zone:** Entirely within the **Polar Zone**, featuring an **Arctic climate**.

- **High Arctic (North):** An **Arctic Desert** with minimal precipitation (e.g., **Peary Land**).
- **Low Arctic (South):** Maritime influence brings slightly higher humidity.

- **Vegetation:** Primarily **Tundra**. Due to the **permafrost** and extreme winds (**Piteraq**), tall trees cannot grow naturally.
  - **Flora:** Mosses, lichens, sedges, and dwarf shrubs like the **Arctic Willow**.
  - **Qinngua Valley:** The **only natural forest** in Greenland, home to **Downy Birch** and **Grey-leaf Willow** reaching **7-8 meters**.
- **Recent Shift ("Greening"):** Climate change is leading to **"Shrubification,"** where larger shrubs move northward, and retreating ice is forming new **wetlands**.

**Mineral Wealth: The "Arctic Treasure Chest"**

As the **Greenland Ice Sheet** melts, the island is emerging as a **"resource frontier"** critical for the global **green energy transition** and **defense technology**.

- **Rare Earth Elements (REEs):** Greenland hosts some of the world's most significant deposits of REEs (e.g., **Neodymium**, **Praseodymium**, **Dysprosium**).
- **Strategic Base Metals:** The island possesses world-class deposits of **Zinc and Lead** (e.g., **Citronen Fjord** in the North). It also holds significant **Iron Ore** (Isua Mine), **Copper**, and **Molybdenum**.
- **Precious Metals & Platinum Group:** Southern Greenland is a hotspot for **Gold** (Nalunaq mine), while the **Skaergaard intrusion** on the **East coast** contains substantial **Palladium and Platinum**, vital for high-end electronics.
- **Energy Reserves:** Offshore basins in **Baffin Bay** are estimated to hold **17–31 billion barrels of oil**. However, in 2021, Greenland joined the **Beyond Oil and Gas Alliance (BOGA)**, shifting focus to its massive **Hydropower** potential.
- **Gemstones & High-Value Minerals:** Greenland is globally renowned for high-quality **Rubies** and **Pink Sapphires** (Aappaluttoq mine). It also hosts significant reserves of **Graphite** (for EV batteries) and **Diamonds**.

**Strategic & Geopolitical Significance of Greenland**

- **Ballistic Missile Defense:** Greenland hosts the **Pituffik Space Base** (formerly **Thule Air Base**). It is the northernmost U.S. military installation and a critical node in the **Ballistic Missile Early Warning System (BMEWS)**.
- **The GIUK Gap:** Greenland forms the first part of the **Greenland-Iceland-UK (GIUK) Gap**, a strategic maritime chokepoint used to monitor and restrict Russian naval and submarine movements into the Atlantic.
- **Arctic Shipping Routes:** As Arctic ice retreats, the **Northwest Passage** and the **Transpolar Sea Route** become viable, potentially reducing shipping times between Europe and Asia by **40%**.
- **Arctic Council:** Greenland plays a key role in the **Arctic Council**, which governs Arctic environmental protection and maritime law.
- **Geopolitical Sovereignty:** While **Nuuk** (the capital) manages domestic affairs under the **Self-Government Act of 2009**, **Copenhagen** (Denmark) retains control over **Foreign Policy**, **Defense**, and **Currency**.

## 2.13. VENEZUELA: GEOGRAPHY, NATURAL RESOURCES & STRATEGIC SIGNIFICANCE

**Context:**

- Recently, **U.S. President Donald Trump** indicated that the **United States** had conducted a **targeted strike** on a **"major plant or facility"** in **Venezuela**, reportedly linked to maritime narcotics trafficking.
- This development marks a significant shift from maritime interceptions to **direct land-based operations** against Venezuelan infrastructure, escalating regional geopolitical tensions and raising concerns over sovereignty and international law.


**Overview: Geography of Venezuala**

Venezuela is located at the **northern extremity of South America**, holding a strategic position overlooking major sea lanes.

- **Land Borders:** Shared with three sovereign nations:
  - **Colombia (West & Southwest):** Shares the longest border (~2,219 km); the frontier is marked by the **Andes** and the **Orinoco** basin.
  - **Brazil (South):** The border runs through the remote and dense **Amazonian rainforests** and the **Guiana Highlands**.
  - **Guyana (East):** Shares a border currently subject to a severe territorial dispute over the **Essequibo** region, which Venezuela claims as Guayana Esequiba.
- **Maritime Boundaries:** It is bounded by the **Caribbean Sea** and the **Atlantic Ocean** to the north. It shares maritime boundaries with the U.S. (Puerto Rico/Virgin Islands), the Netherlands (Aruba/Bonaire/Curaçao), and Trinidad and Tobago.
- **Archipelagos:** Administers numerous islands, including **Margarita Island**, **Los Roques**, and the **Aves Island** (a strategic outpost in the Caribbean).

**Physical Landforms of Venezuala**

Venezuela is categorized into four primary physiographic regions:

- **The Maracaibo Lowlands:** A large, flat basin in the northwest surrounding **Lake Maracaibo**. It is the primary site for the country's **oil extraction**.
- **The Northern Mountains:** An extension of the **Andes** (the Cordillera de Mérida).
- **The Orinoco Plains (Llanos):** Vast, tropical **grassland plains** in the central region, used extensively for cattle ranching.
- **The Guiana Highlands:** A massive plateau in the southeast characterized by **Tepuis** (flat-topped, "table" mountains).

**Angel Falls:** Located here on the Auyán-tepui, it is the **world's highest uninterrupted waterfall**.

**Hydrography: Rivers and Lakes of Venezuala**

- **Orinoco River:** The 8th largest river in the world by discharge and the most important in Venezuela. It divides the country into two distinct halves.
- **Rio Negro:** A major tributary of the Amazon; it is the **world's largest black water river**.
- **Casiquiare Canal:** A unique natural wonder—a distributary of the Orinoco that flows into the Rio Negro, effectively **connecting the Orinoco and Amazon basins**.
- **Lake Maracaibo:** The largest lake in South America (though technically a brackish bay). It is famously known for the **Catatumbo Lightning**, a persistent atmospheric phenomenon.
- **Other Notable Water Bodies of Venezuala:**
  - **Caroní River:** A major tributary of the Orinoco, famous for its dark water and the **Guri Dam**, one of the world's largest hydroelectric power plants, providing the majority of Venezuela's electricity.
  - **Lake Valencia:** The country's **second-largest** lake. It is an **endorheic basin** (it has no outlet to the ocean), making it sensitive to pollution and environmental changes.

**Economic & Mineral Wealth of Venezuala**

- **Hydrocarbons:** Holds the **world's largest proven oil reserves** (estimated at ~300 billion barrels), primarily in the **Orinoco Belt**. It also has the 6th largest global natural gas deposits.
- **Strategic Minerals:** The **Orinoco Mining Arc** (South of the river) is rich in **Gold, Bauxite (Aluminum), Iron Ore, and Diamonds**.
- **Rare Earths:** Significant deposits of **Coltan** (essential for electronics) and **Thorium** have been identified in the Guiana Shield.

**Strategic Significance of Venezuala**

- **Energy Security:** Venezuela has the **largest proven crude oil reserves in the world** (~303 billion barrels), making it a critical player in **global energy markets**.
- **Maritime Control:** Its **coastline along the Caribbean Sea** provides access to **strategic shipping lanes** connecting South America with North America, Europe, and Africa.
- **Regional Geopolitics:** Located in **northern South America**, bordering **Colombia, Brazil, and Guyana**, Venezuela plays a central role in **regional security and geopolitical dynamics**.
- **Narcotics and Security:** Venezuela's territory is a key transit route for **drug trafficking from South America to North America and Europe**, making it significant for **counter-narcotics operations**.

**Natural Resources:** In addition to oil, Venezuela has **natural gas, bauxite, iron ore, gold, and diamonds**, enhancing its **economic and strategic importance**.

## 2.14. MUKALLA: STRATEGIC PORT CITY IN YEMEN

**Context:**

- Recently, **Mukalla** gained international attention due to **military and geopolitical developments** involving the **UAE-backed Southern Transitional Council (STC)** and **Saudi-led airstrikes** targeting **arms shipments**.
- The city's strategic location along the **Gulf of Aden** highlights its importance in **maritime security**, **offshore energy logistics**, and **humanitarian operations**.

**Geographical Overview of Mukalla**

- **Location:** Mukalla is situated on the **southern coast of Yemen**, along the **Arabian Sea** and the **Gulf of Aden**, forming a **strategic maritime corridor** connecting the **Red Sea to the Indian Ocean**.
- **Governorate:** It serves as the **capital of Hadhramaut Governorate**, the largest governorate in Yemen.


**Borders and Nearby Regions of Mukalla**

- **North:** Hadhramaut highlands and interior Yemen.
- **West:** Shabwah Governorate (Yemen).
- **East:** Omani frontier and Arabian Sea coast.
- **South:** Directly faces the Arabian Sea; linked to the **Gulf of Aden**, a key shipping lane connecting to the **Bab-el-Mandeb Strait**.

**Topography and Landforms of Mukalla**

- Located on a **narrow coastal plain** backed by the **Hadhramaut Mountains**.
- Terrain transitions from **low-lying plains to steep inland escarpments**.
- Contains **wadis (seasonal rivers)** that drain into the **Arabian Sea**, forming **small alluvial fans**.

**Oceans and Strategic Waterways of Mukalla**

- **Arabian Sea:** Forms Mukalla's coastal boundary, part of the **northwestern Indian Ocean**.
- **Gulf of Aden:** Lies south of Mukalla, forming a major **shipping corridor** linking the Red Sea (via **Suez Canal**) to the **Arabian Sea** and **Indian Ocean**.

## 2.15. ELECTIONS IN MYANMAR

**Context:**

- Myanmar has recently commenced **three-phase elections** orchestrated by the **military junta**, nearly five years after it overthrew the democratically elected government led by the **National League for Democracy (NLD)**.
- These elections are widely regarded as **"sham polls"**, aimed at **legitimising military rule** rather than reflecting the **popular will** of the people.

**Key Locations in Myanmar's Conflict Zones**

**Rakhine State**

- **Location:** Western Myanmar, along the **Bay of Bengal**, bordering **Bangladesh**.
- **Major Rivers:** Kaladan River, Mayu River, Lemro River.
- **Terrain:** Narrow coastal plain rising to **Arakan Mountains** along the east.

**Karenni State (Kayah State)**

- **Location:** Eastern Myanmar, bo rdering **Thailand**.
- **Major Rivers:** Salween (Thanlwin) River, Pai River.
- **Terrain:** Mountainous, part of the **Eastern Shan Hills**, with steep valleys.
- **Vegetation:** Dense tropical forests and upland bamboo forests.

**Karen State (Kayin State)**

- **Location:** Southeastern Myanmar, along the **Thailand-Myanmar border**.
- **Major Rivers:** Salween River, Moei River.
- **Terrain:** Hilly and mountainous, with lowlands along the Salween.
- **Vegetation:** Tropical and subtropical forests; fertile valleys in lowlands.

**Chin State**

- **Location:** Northwestern Myanmar, bordering **India's Mizoram and Manipur** and **Bangladesh**.
- **Major Rivers:** Chindwin River, Lemro River tributaries.
- **Terrain:** Extremely mountainous (**Arakan Range**), deep valleys, and rugged hills.
- **Vegetation:** Dense tropical and subtropical forests; temperate forests at higher elevations.
- **Location:** Northwestern central Myanmar, bordering **Nagaland and Arunachal Pradesh in India**.


- **Major Rivers:** Chindwin River (major tributary of Irrawaddy), Irrawaddy River (southern boundary).
- **Terrain:** Mix of **hilly terrain in the north** and **central plains along the Irrawaddy**.
- **Vegetation:** Tropical forests in hills, fertile plains along rivers suitable for agriculture.

## 2.16. CRUDE OIL DYNAMICS

**Context:**

- As of late 2025, Venezuela has returned to the center of global energy geopolitics following a **naval blockade** and a two-month **"quarantine"** imposed by the **U.S. administration**.
- This move aims to restrict the export of Venezuelan oil to international markets, intensifying economic pressure on the **Caracas government**.

- Despite possessing the **world's largest proven oil reserves**, Venezuela remains economically fragile, highlighting a classic case of the **"Resource Curse"** (or **Dutch Disease**), where an abundance of natural resources leads to economic stagnation and institutional decline.

**Types of Crude Oil**

Crude oil is classified based on **density and sulfur content**:

- **Light Crude Oil** – It has lower density, flows easily, and yields a higher proportion of valuable products such as gasoline and diesel.
- **Heavy Crude Oil** – It is denser, more viscous, and difficult to extract. Processing heavy crude requires **advanced refining techniques**.
- **Sweet Crude Oil** – Contains **low sulfur content** (less than 0.5%) and is easier and cheaper to refine.
- **Sour Crude Oil** – Contains **high sulfur content** (more than 1%), making refining more complex and expensive.
- **Extra-Heavy Crude Oil** – Very dense and viscous; Venezuela's crude is mostly extra-heavy, requiring specialized extraction and refining technologies.

**Crude Oil Benchmarks**

Crude oil prices in international markets are determined using standard **benchmark grades**, which act as reference points for global trade.

- **West Texas Intermediate (WTI)** is a light, sweet crude oil produced in the United States and is widely used as a global pricing benchmark.
- **Brent Crude**, extracted from the North Sea, is slightly heavier than WTI and serves as the benchmark for Europe, Africa, and much of Asia.
- **Dubai–Oman Crude** functions as a benchmark for Middle Eastern oil exports to Asian markets.

**Global Reserves**

- **Venezuela ranks first globally** with **303 billion barrels**, making it the country with the **largest proven crude oil reserves in the world**.
- Saudi Arabia ranks **second** with **267 billion barrels**.
- Iran ranks **third** with **209 billion barrels**.

**Global Crude Oil Production**

Crude oil production reflects actual extraction capacity and operational efficiency.

- The **United States** is the largest producer, with **13,208 thousand barrels per day**, ranking first globally.
- **Russia** ranks second with **9,193 thousand barrels per day**.
- **Saudi Arabia** ranks third with **8,955 thousand barrels per day**.
- **Venezuela ranks 16th globally**, producing only **921 thousand barrels per day**, despite holding the largest reserves.
- **Major Exporting Countries:** Saudi Arabia, Russia, Iraq, Canada, and the UAE are the largest crude oil exporters globally.
- **Major Importing Countries:** China, the United States, India, Japan, and South Korea are the largest crude oil importers.

## 2.17. H-1B VISA


**What is the H-1B Visa?**

- **Classification:** It is a **non-immigrant visa** issued by the United States.
- **Purpose:** Allows U.S. employers to temporarily employ foreign workers in **"specialty occupations"** that require theoretical or technical expertise.
- **Target Sectors:** Primarily utilized in Science, Technology, Engineering, and Mathematics (STEM), as well as finance, architecture, and medicine.

**Key Features & Eligibility:**

- **Educational Requirement:** The applicant must hold at least a **Bachelor's degree** or its equivalent in the specific field.
- **Sponsorship:** It requires a U.S. employer to act as a **sponsor**; individuals cannot apply for it themselves.
- **Duration:** Issued initially for **3 years**, extendable for another 3 years (Total **maximum of 6 years**).
- **Dual Intent:** Unlike many other visas, H-1B holders are allowed **"dual intent,"** meaning they can apply for a Green Card (Permanent Residency) while working.
- **Dependents:** Spouses and children (under 21) can accompany the holder on an **H-4 visa**.

**Recent Developments:**

- **Domestic Renewal Pilot:** In 2024, the U.S. launched a pilot program allowing eligible Indian H-1B holders to **renew their visas within the U.S.**, eliminating the need to travel back to India for stamping.
- **Modernization Rule:** The U.S. Citizenship and Immigration Services (USCIS) has introduced a **"Beneficiary Centric"** selection process to curb the practice of multiple employers filing for the same individual to game the lottery.

**Significance for India:**

- **Largest Beneficiary:** Indian nationals consistently receive over **70%** of all H-1B visas issued annually.

**IT Sector Backbone:** It is a critical enabler for the Indian IT services industry (e.g., TCS, Infosys) to deploy talent for on-site projects in the U.S.

## 2.18. KINGDOM OF THAILAND

**Geographic Positioning:**

- **Region:** Centrally located in mainland **Southeast Asia**.
- **Land Borders: Northwest:** Myanmar; **Northeast:** Laos; **East:** Cambodia; **South:** Malaysia
- **Maritime Boundaries:** Flanked by the **Andaman Sea** to the west and the **Gulf of Thailand** to the east.

**Physical Landscape:**

- **Topography:** The country features a diverse landscape ranging from mountainous highlands to river plains.
- **Highest Peak: Doi Inthanon** (located in the northern range).
- **Major River Systems:**
    - **Mekong River:** Forms a natural border with Laos.

  - **Chao Phraya:** The principal river system of the country, crucial for agriculture.
- **Climatic Zone:** Experiences a **Tropical Monsoon** climate.

**Economic Resource Profile:**

- **Natural Resources:** Rich in Tin, Rubber, Natural Gas, Tungsten, Tantalum, and Timber.

**Regional Spotlight: Sa kaeo Province**

- **Strategic Location:** Situated in **Eastern Thailand**, sharing a critical land border with **Cambodia**.
- **Trade Corridor:** Hosts the **Aranyaprathet-Poipet** border crossing, the primary land route connecting Bangkok to Siem Reap (Angkor Wat).
- **Cultural Heritage:** Famous for **Prasat Sdok Kok Thom**, an 11th-century Khmer temple that historically clarified the chronology of the Khmer Empire.


- **Connectivity:** A vital node in the **Greater Mekong Subregion (GMS)** economic corridors.

## 2.19. FEDERAL REPUBLIC OF NIGERIA

**Context:**

**Geographic & Demographic Significance:**

- **Region:** West Africa (Sahelian to Coastal zones)
- **Demography:** Africa's most populous country; often termed the "Giant of Africa."
- **Climatic Zones:** Exhibits a distinct **North-South dichotomy** –(Arid/Semi-arid Sahel in the North vs. Humid/Tropical Rainforest in the South.)

**Strategic Boundaries & Coastline: West:** Benin; **North:** Niger; **Northeast:** Chad; **East:** Cameroon; **Maritime Border: Gulf of Guinea** (Atlantic Ocean) in the South.


**Administrative & Key Facts: –**

- **Capital City:** Abuja (Centrally located, planned city).
- **Economic Hub:** Lagos (Former capital, largest metropolitan area).
- **Official Language:** English (Lingua franca due to colonial history).

**Hydrological Features:**

- **Major Rivers:**
  - **Niger River:** Third longest in Africa (after Nile and Congo); enters Nigeria from the Northwest.
  - **Benue River:** Major tributary; meets the Niger at Lokoja (The Confluence).
- **Key Lake: Lake Chad** (Endorheic basin in the Northeast; shrinking rapidly due to climate change.

**Economic Resource Profile:**

- **Energy:** Africa's largest **oil producer**; member of **OPEC**.
- **Mineral Wealth:** Rich in Natural Gas, Tin, Iron Ore, Coal, and **Limestone**.

International Relations

- **Memberships:** United Nations (UN), African Union (AU), ECOWAS (Headquarters in Abuja), OPEC, Commonwealth of Nations.

**Special Focus: Sokoto State in Nigeria**

**Geographic & Climatic Features:**

- **Location:** Extreme Northwest Nigeria; shares a long international border with the **Republic of Niger**.
- **Ecosystem:** Situated in the **Sudan Savannah** and **Sahel** zones.
- **Climate Phenomenon:** Heavily influenced by the **Harmattan**—a dry, dusty trade wind blowing from the Sahara Desert (Nov–March).
- **Drainage:** Drained by the **Sokoto River** and **Rima River** (seasonal tributaries of the Niger River).

***

## UPSC PRELIMS PRACTICE QUESTIONS

Q. With respect to the institutional history of the UNESCO Media and Information Literacy (MIL) Alliance, consider the following statements:

I. The Alliance was originally established during a Global Forum in Nigeria in 2013.
II. The MIL Alliance aims to promote global exchange of knowledge and enable the MIL community to influence policy development.

Which of the statements given above is/are correct?

(a) I only
(b) II only
(c) Both I and II
(d) Neither I nor II

**Ans. (c)**

**Explanation:**

**Statement I is correct:** The MIL Alliance was founded in 2013 at the Global Forum for Partnerships on Media and Information Literacy held in Abuja, Nigeria.

**Statement II is correct:** The MIL Alliance aims to promote global knowledge exchange, strengthen policy engagement, foster cooperation at all levels, and support MIL-related research.

Q. With reference to the Chagos Archipelago, consider the following statements:

I. It is located in the South Pacific Ocean, south of the Equator.
II. The archipelago is part of the Chagos-Laccadive Ridge.
III. Under the latest agreement, the UK has transferred sovereignty of the entire archipelago, including Diego Garcia, to Mauritius.
IV. The islands are characterized by high mountainous terrain and perennial rivers.

Which of the statements given above are correct?

(a) I and II only
(b) II and III only
(c) III and IV only
(d) I, II and III only

**Ans. (b)**

**Explanation:**

**Statement 1 Is Incorrect:** The Chagos Archipelago is located in the Central Indian Ocean, not the Pacific Ocean.

**Statement 2 Is Correct:** It is indeed a part of the Chagos-Laccadive Ridge, which extends from the Laccadives (Lakshadweep) down to the Chagos group.

**Statement 3 Is Correct:** The recent treaty recognizes Mauritian sovereignty over the entire archipelago, though the UK will lease back Diego Garcia for 99 years.

**Statement 4 Is Incorrect:** The islands are low-lying coral atolls with no rivers or lakes.

Q. Consider the following statements regarding the current situation and geography of Yemen:

1. Yemen is bordered by Saudi Arabia to the North, Oman to the East, and the United Arab Emirates to the Northeast.
2. The Bab-el-Mandeb Strait is a strategic chokepoint that connects the Red Sea to the Gulf of Aden.
3. The Southern Transitional Council (STC) is a Houthi-aligned group that recently dissolved itself in January 2026.
4. UN Security Council Resolution 2812, adopted in 2026, focuses on monitoring attacks on commercial vessels in the Red Sea.

Which of the statements given above are correct?

(a) 1, 2, and 4 only
(b) 2 and 4 only
(c) 1 and 3 only
(d) 2, 3, and 4 only

Ans. (b)

**Explanation:**

**Statement 1 incorrect:** Yemen shares land borders with Saudi Arabia and Oman. It does not share a land border with the United Arab Emirates.

**Statement 2 correct:** This is the primary geographical feature of the region; the Bab-el-Mandeb connects the Red Sea to the Gulf of Aden.

**Statement 3 incorrect:** The STC was a separatist group in the south, often allied with the government (PLC) against the Houthis. It was not Houthi aligned.

**Statement 4 correct:** Resolution 2812 (2026) was recently passed to extend the monitoring of Houthi maritime attacks

Q. With reference to Chabahar Port, consider the following statements:

1. Chabahar Port is located on the Persian Gulf coast of Iran.
2. The port provides India with an alternative route to access Afghanistan bypassing Pakistan.
3. Chabahar Port is operated by an Indian public sector company.

Which of the statements given above is/are correct?

(a) 2 and 3 only
(b) 1 and 2 only
(c) 2 only
(d) 1, 2 and 3

**Ans. (a)**

**Explanation:**

**Statement 1 Incorrect:** Chabahar Port is located on the Gulf of Oman, not on the Persian Gulf.

**Statement 2 Correct:** It enables direct access to Afghanistan and Central Asia, bypassing Pakistan.

**Statement 3 Correct:** The port is operated by India Ports Global Limited (IPGL).

Q. Consider the following statements regarding Operation Pawan:

1. Operation Pawan was conducted as part of India's commitment under the Indo–Sri Lanka Accord of 1987.
2. The Indian Peace Keeping Force was deployed exclusively for humanitarian assistance and never engaged in combat operations.
3. The LTTE initially agreed to disarm but later resisted the IPKF.
4. Operation Pawan marked India's first major overseas military intervention.

Which of the statements given above are correct?

(a) 1 and 3 only
(b) 1, 3 and 4 only
(c) 2 and 4 only
(d) 1, 2, 3 and 4

**Ans. (b)**

**Explanation:**

**Statement 1 – Correct**

Operation Pawan was launched to enforce provisions of the Indo–Sri Lanka Accord, 1987.

**Statement 2 – Incorrect**

IPKF was initially a peacekeeping force but later engaged in full-scale combat operations against LTTE.

**Statement 3 – Correct**

LTTE initially agreed to disarm but later refused and turned hostile.

**Statement 4 – Correct**

It was India's first large-scale military intervention outside its territory.

**Scan to attempt more questions**

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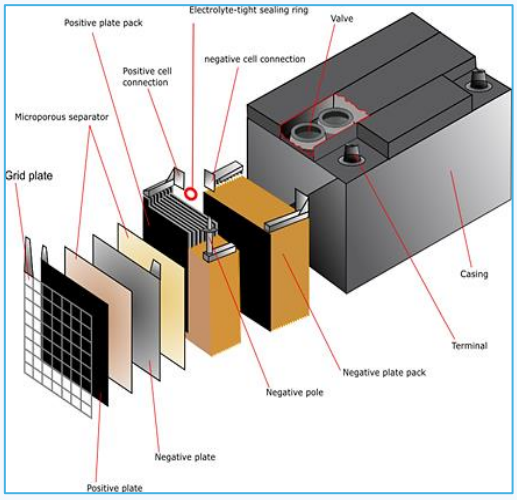
# ECONOMY

## 3.1. PRODUCTION LINKED INCENTIVE (PLI) SCHEME




**Context: Recently**, reports from organizations like the Institute for Energy Economics and Financial Analysis (IEEFA) have highlighted that only **2.8% (1.4 GWh)** of the targeted **50 GWh** manufacturing capacity for Advanced Chemistry Cells has been commissioned.

This underscores significant implementation challenges four years after the scheme's launch by the **Ministry of Heavy Industries**.

**Key Features of the Advanced Chemistry Cells PLI Scheme**

- **Objective:** To establish Giga-scale manufacturing facilities in India for Advanced Chemistry Cells to reduce import dependence (primarily from China) and support the electric vehicle (EV) transition.
- **Implementing Ministry:** The scheme is administered by the **Ministry of Heavy Industries (MHI)**.
- **Total Outlay:** A budgetary allocation of **₹18,100 crore**.
- **Capacity Target:** The program aims to achieve a total manufacturing capacity of **50 GWh** of ACC, along with an additional **5 GWh** for "Niche" ACC technologies.
- **Technology Agnostic:** The scheme does not favor any specific battery chemistry (e.g., Lithium-ion, Sodium-ion, or Solid-state). Instead, it provides higher incentives for technologies that offer better performance parameters like energy density and cycle life.
- **Domestic Value Addition (DVA):** Beneficiary firms must achieve a minimum DVA of **25% within two years** and escalate it to **60% within five years**.
- **Investment Commitment:** Bidders are required to invest a minimum of **₹225 crore per GWh** of committed capacity.

**Implementation Mechanism**

1. **Selection Process:** Beneficiaries are selected through a transparent **Quality and Cost Based Selection (QCBS)** mechanism via a global tender.
2. **Incentive Disbursement:** Incentives are not given upfront; they are disbursed over **five years** based on actual sales and the level of domestic value addition achieved.
3. **Gestation Period:** A two-year window is provided for setting up the manufacturing facility before the five-year performance period begins.

## 3.2. FISHERIES AND SEAFOOD EXPORT SECTOR IN INDIA

**Context:** Recently, in January 2026, the Union Ministry of Fisheries, Animal Husbandry, and Dairying advised State governments to "diversify their fish basket" to counter recent export challenges. This advisory follows the imposition of high retaliatory tariffs by the USA (up to 58.26% total duty on shrimp) and the growing threat of climate-led diseases.

The Ministry is pushing for a transition from traditional species like **Rohu** and **Catla** to export-oriented varieties such as **Tilapia**, **Pangasius**, and **Scampi**, while also exploring "waste-to-wealth" projects in saline-affected lands of Northern India.

**Fish Export and Production in India**

**I. Global Standing and Production Trends**

- **Rankings:** India is the **second-largest fish-producing nation** in the world, contributing nearly **8%** of global fish production. It also holds the rank of the **second-largest aquaculture producer** globally.
- **Decadal Growth:** Total fish production in India has doubled over the last decade, rising from 95.79 lakh tonnes in 2013–14 to nearly **198 lakh tonnes** in 2024–25.
- **Inland vs. Marine:** A significant shift has occurred where **Inland Fisheries and Aquaculture** now contribute more than **75%** of the total fish production, while Marine Fisheries account for the remaining 25%.

**II. Seafood Export Performance**

- **Export Value:** India's seafood exports reached a record high of **₹62,408 crore** in FY 2024–25.
- **Leading Commodity: Frozen Shrimp** remains the flagship export item, accounting for approximately **66%** of the total export earnings.
- **Major Markets:** The **USA** is the largest importer of Indian seafood, followed by **China**, the European Union, Southeast Asia, and Japan.

**2. Leading Fish Producing States**

- **Andhra Pradesh:** This state is the top producer in India, contributing over **25%** of the national output and dominating shrimp exports.
- **West Bengal:** It ranks second, driven primarily by freshwater aquaculture and a strong domestic cultural demand.
- **Gujarat:** It is the leading state in **Marine Fish production**, benefiting from the longest coastline in the country.

**3. Major Government Initiatives**

- **Pradhan Mantri Matsya Sampada Yojana (PMMSY):** Launched in 2020 with an outlay of **₹20,050 crore**, it aims to enhance production to 22 million tonnes and double export earnings by 2025.
- **PM Matsya Kisan Samridhi Sah-Yojana (PMMKSSY):** A sub-scheme under PMMSY focusing on formalizing the unorganized fisheries sector and providing digital identities to fishers.
- **Fisheries and Aquaculture Infrastructure Development Fund (FIDF):** Established to provide concessional finance for the creation of infrastructure like fishing harbors, cold storages, and ice plants.
- **Kisan Credit Card (KCC):** The government has extended KCC facilities to fishers, recently increasing the credit limit for the sector to **₹5 lakh**.

## 3.3. INDUSTRY 5.0: THE HUMAN-CENTRIC INDUSTRIAL REVOLUTION

**Context:**

- The Government of India announced the **National Manufacturing Mission (NMM)** in the Union Budget 2025–26, which specifically emphasizes transitioning Indian industries toward **Industry 5.0** paradigms.

- This shift aims to integrate human creativity with advanced automation to meet India's "Net-Zero 2070" commitments and bolster the "Make in India" initiative through sustainable and resilient manufacturing.

1. **Overview of Industry 5.0**


Industry 5.0, also known as the **Fifth Industrial Revolution**, is a conceptual framework that reintroduces the **"Human Touch"** into the highly automated world of Industry 4.0. While the previous revolution focused on interconnectivity and efficiency through Artificial Intelligence (AI) and the Internet of Things (IoT), Industry 5.0 focuses on the **symbiotic relationship** between man and machine.

2. **The Three Core Pillars**

Industry 5.0 stands on three foundational legs:

1. **Human-Centricity:** It shifts the focus from "technology-driven" to "human-driven." Machines are used to empower workers rather than replace them, focusing on worker well-being, safety, and privacy.
2. **Sustainability:** It moves beyond simple productivity to focus on the **Circular Economy**. This includes resource efficiency, waste reduction (Waste to Wealth), and reducing the carbon footprint of industrial processes.
3. **Resilience:** It emphasizes the ability of industrial production to withstand disruptions, such as pandemics (COVID-19) or geopolitical tensions, through agile and flexible supply chains.

3. **Comparison: Industry 4.0 vs. Industry 5.0**

| Feature | Industry 4.0 | Industry 5.0 |
|---|---|---|
| **Primary Focus** | Automation and Efficiency | Human-Machine Collaboration |
| **Goal** | Smart Factories & Connectivity | Sustainability & Worker Well-being |
| **Production** | Mass Production | Mass Customization |
| **Human Role** | Monitoring and Oversight | Creativity and Decision-making |
| **Technology** | IoT, Big Data, AI | Cobots (Collaborative Robots), 6G, Biotech |

4. **Key Technologies Driving Industry 5.0**

- **Collaborative Robots (Cobots):** Unlike traditional industrial robots that operate in cages, cobots are designed to work safely alongside humans in a shared workspace.
- **Digital Twins:** Virtual replicas of physical assets used for real-time monitoring and "what-if" scenario testing to improve resilience.
- **6G and Edge Computing:** Providing the ultra-low latency required for real-time human-machine interaction.
- **Bio-inspired Technologies:** Integration of smart materials and synthetic biology into manufacturing processes.

5. **Indian Initiatives & Policy Support**

- **National Manufacturing Mission (NMM) 2025-26:** Launched to synchronize policy across ministries with a focus on clean-tech and Industry 5.0.
- **SAMARTH Udyog Bharat 4.0:** An initiative by the Ministry of Heavy Industries to push for the adoption of Industry 4.0/5.0 solutions in MSMEs.

- **Production Linked Incentive (PLI) Schemes:** Incentivizing high-tech manufacturing in sectors like electronics and drones.
- **Special Campaign 5.0 (PIB):** Focused on institutionalizing "Swachhata" and "Waste to Wealth" models in industrial departments.

## 3.4. WORLD ECONOMIC OUTLOOK (WEO)

**Context:**


- Recently, the **International Monetary Fund (IMF)** released its **January 2026 update** of the World Economic Outlook, titled "Global Economy: Steady amid Divergent Forces," in which it upgraded the global growth forecast for 2026 to **3.3%**.
- This upward revision is primarily attributed to a massive surge in **Artificial Intelligence (AI) investments**, resilient supply chains, and a faster-than-expected easing of global inflation.
- **Key Facts About World Economic Outlook (WEO)**
  - **Released By:** The report is a flagship publication of the **International Monetary Fund (IMF)**.
  - **Frequency:** It is published **twice a year** (usually in April and October), with partial **updates** released in January and July.
  - **Purpose:** The WEO provides a comprehensive analysis of the global economy, covering near-term and medium-term growth projections, inflation trends, and financial stability.
  - **Data Source:** The projections are based on consultations between IMF staff and member countries (Article IV consultations).
- **Major Highlights (January 2026 Update)**
  - **Global Growth Projections:** The global economy is expected to grow by **3.3% in 2026** and **3.2% in 2027**, showing resilience despite geoeconomic fragmentation.
  - **Inflation Trends:** Global headline inflation is projected to decline from **4.1% in 2025** to **3.8% in 2026**, although the pace of disinflation varies across regions.
  - **AI as a Growth Catalyst:** The IMF identifies AI-related investments in data centers and semiconductors as a significant driver that could add up to **0.3 percentage points** to medium-term global productivity.
  - **Risk Factors:** Key downside risks identified include **geoeconomic confrontation**, trade protectionism (tariffs), potential asset bubbles in the tech sector, and geopolitical disruptions in energy-sensitive regions.
- **India-Specific Observations**
  - **Fastest Growing Economy:** India is projected to remain the **world's fastest-growing major economy**, with a growth forecast of **6.4%** for both 2026 and 2027.
  - **Drivers of Growth:** Strong domestic demand, robust private consumption, and significant government investment in infrastructure and digitalization are the primary pillars of India's economic performance.
  - **Consumer Market:** India is on track to become the world's **third-largest consumer market** by 2026, supported by a rapidly expanding middle class.

- **Other Key Flagship Reports of WEF**

**I. Global Risks Report**

- **Key Categories:** Economic, Environmental, Geopolitical, Societal, and Technological risks.
- **Current Trend:** The 2026 report warns of an "**age of competition**," where trade protectionism and AI-driven misinformation are top concerns.

**II. Global Gender Gap Report**

- **Dimension of Assessment:**
    - **Economic Participation and Opportunity** (India's weakest area).
    - **Educational Attainment** (India's strongest area).
    - **Health and Survival**.
    - **Political Empowerment**.
    - **India's Status (2025):** India is ranked **131st out of 148 countries**, showing a slight slip in rank despite a marginal improvement in its parity score.

**III. Energy Transition Index (ETI)**

- **Pillars:** System Performance (Equity, Security, Sustainability) and Transition Readiness (Regulation, Infrastructure, Innovation).
- **India's Status (2025):** India is ranked **71st**, falling from 63rd in 2024, though it received praise for improvements in energy efficiency and investment capacity.

**IV. Future of Jobs Report**

- **Focus:** It explores how technology, particularly **Generative AI**, is reshaping the labor market and identifies the skills most in demand (e.g., analytical thinking, creative thinking, and AI literacy).

**V. Other Notable Publications**

- **Global Competitiveness Report:**
- **Travel & Tourism Development Index**
- **Global Cybersecurity Outlook**

## 3.5. GLOBAL CAPABILITY CENTERS (GCCS)

**Context:**

- **Recently**, India has consolidated its position as the world's largest hub for Global Capability Centers, driven by multinational companies expanding high-end research, innovation, and digital operations in the country.

**Meaning of Global Capability Centers**

- A Global Capability Centre is a **captive offshore unit established by a multinational corporation** to deliver **strategic, knowledge-intensive, and core business services**.
- GCCs are **owned, controlled, and governed by the parent company**, unlike third-party outsourcing firms.
- They operate as **extensions of the global headquarters**, not as support vendor.

**Core Functions of GCCs**

- Global Capability Centers undertake **research and development, product engineering, and innovation management**.
- They provide advanced services in **artificial intelligence, machine learning, data analytics, cloud computing, and cybersecurity**.
- GCCs support **global finance, risk management, supply chain optimization, and strategic planning**.
- Many GCCs act as **centers of excellence** for specific technologies or domains.

**Economic Significance of GCCs for India**

- Global Capability Centers attract substantial **foreign direct investment in services**.
- They generate **high-quality, knowledge-intensive employment**, unlike low-skill outsourcing.
- GCCs help India move **up the global value chain**, from service delivery to innovation leadership.
- They strengthen India's role in the **global knowledge and digital economy**.

## 3.6. INFLATION TARGETING FRAMEWORK: CONCEPT, MECHANISM & INDIAN CONTEXT

**Context:**


- In December, India's retail inflation (CPI) hit a three-month high of 1.33%, while a "high" usually suggests rising prices, this figure presents a unique challenge for policymakers because it remains significantly below the Reserve Bank of India's (RBI) lower comfort level of 2%.
- Simultaneously, **core inflation (which excludes volatile food and fuel)** sits at a 28-month high of 4.8%, indicating a stark divergence between headline numbers and underlying economic pressures.

**What is Inflation Targeting?**

- A **monetary policy framework** in which the **central bank** aims to keep **inflation within a specified target range**.
- In India, ITF focuses on **Consumer Price Index (CPI) inflation**.

**Legal Basis in India**

- Introduced through the **Finance Act, 2016**.
- Amended the **Reserve Bank of India Act, 1934**.
- Inserted **Section 45ZA–45ZK** in the RBI Act.

**Inflation Target in India**

- **Target Inflation Rate: 4%**
- **Tolerance Band: ± 2%**
- **Effective Range: 2% – 6%**
- Target is **fixed for a 5-year period** by the **Government of India** in consultation with RBI.

**Price Index Used**

- **Consumer Price Index (CPI)**
- **Not WPI** (Wholesale Price Index).

**Monetary Policy Committee (MPC)**

- **Constituted under RBI Act, 1934**
- **Composition (6 Members):**
- **3 from RBI:** RBI Governor (Chairperson), Deputy Governor (Monetary Policy), One RBI nominee
- **3 external members**: Appointed by Central Government
- **Decision Making:**
  - Decisions by **majority vote**
  - In case of tie **Governor** has **casting vote**

**Role of MPC**

- Determine **policy repo rate**
- Aim to achieve the **inflation target**
- Meet **at least 4 times a year** (usually 6 meetings)

**Failure of Inflation Target**

- Inflation target is considered **failed if**: CPI inflation is **above 6%** or **below 2%** for **3 consecutive quarters**
- RBI must submit a report to Government stating: Reasons for failure, remedial actions, timeframe to achieve target.

**Objectives of Inflation Targeting**

- Maintain **price stability**
- Anchor **inflation expectations**
- Promote **macro-economic stability**
- Support **growth** in the long run

**Criticisms / Limitations**

- CPI heavily influenced by **food & fuel prices**
- Limited control over **supply-side shocks**
- May constrain RBI's ability to support growth during downturns

## 3.7. PENSION FUND REGULATORY AND DEVELOPMENT AUTHORITY (PFRDA)

**Context:**

- The **Pension Fund Regulatory and Development Authority (PFRDA)** has recently constituted a **high-level Expert Committee** (**15-member committee**) to develop a **framework for assured payouts under the National Pension System (NPS)**.
- The panel includes experts from **legal, actuarial, finance, insurance, capital markets, and academic disciplines**.
- The initiative aligns with the provisions of the **PFRDA Act, 2014** and aims to **enhance the security of retirement income for subscribers**.

**Overview of Pension Fund Regulatory and Development Authority (PFRDA)**

- **Statutory Status:** PFRDA is a **statutory regulatory body** established under the **PFRDA Act, 2014**.
- **Objective:** Its primary objectives are to **promote old-age income security**, **establish, develop, and regulate pension funds**, and **protect the interests of subscribers** to pension schemes.
- **Administrative Control:** PFRDA functions under the **Ministry of Finance**.
- **Headquarters:** New Delhi, with **regional offices across India**.

**Composition of PFRDA**

- As per Section 4 of the PFRDA Act**:** Chairperson**,** Three whole-time members**,** Three part-time members
- **Appointments:** Appointmentsare made by the **Central Government** from persons of **ability, integrity, and standing**, with expertise in **economics, finance, or law**.

**Functions of PFRDA**

- **Regulation of Pension Schemes**
- Approves pension schemes and sets **investment norms and guidelines**.
- Registers and regulates **NPS Trust, Points of Presence (PoPs), Central Record-Keeping Agency (CRA), Trustee Banks, Pension Funds, and Custodians**.
    - Ensures that **operational and intermediation costs are economical and reasonable**.
- Safeguards the **interests of subscribers** of NPS and other schemes approved by the Authority.

## 3.8. GOLD ETF INFLOWS SURGE AS INVESTORS SEEK SAFE-HAVEN RETURNS

**Context:**


- Net inflows into **Gold ETFs** in India recently surged to a record **₹1,16,467 crore**, tripling from the previous month, as investors preferred gold-backed instruments over equity-oriented schemes.

  The recent surge in **Gold ETF inflows** reflects **heightened safe-haven demand** amid macroeconomic uncertainty, strong gold price momentum, and relatively lower equity market returns. In 2025, **gold delivered a 70% annual return**,

**Understanding Gold Exchange-Traded Funds (ETFs)**

A **Gold ETF** is a **commodity-based exchange-traded fund** that primarily invests in **physical gold bullion** as its underlying asset. It allows investors to gain exposure to the price of gold without the necessity of **owning or storing the physical metal.**

- **Asset Linkage:** One unit of a Gold ETF is typically equivalent to **1 gram of gold** and is backed by physical gold of **99.5% purity**.
- **Trading Mechanism:** Units are listed and traded on major stock exchanges like the **National Stock Exchange (NSE)** and **Bombay Stock Exchange (BSE)**, just like individual company shares.
- **Transparency:** Due to direct gold pricing and mandatory regular audits of physical holdings by statutory auditors, the scheme offers high transparency.
- **Regulatory Oversight:**

- **Regulator:** Gold ETFs are strictly regulated by the **Securities and Exchange Board of India (SEBI)** under the **SEBI (Mutual Funds) Regulations, 1996**.
- **Custody:** The physical gold backing the ETF units is held in the custody of a **SEBI-registered custodian bank**, ensuring the security of the underlying asset.

- **Benefits of Gold ETFs:**
  - **Secure Alternative:** Offers a **safe, electronic alternative to physical gold**.
  - **Liquidity:** Can be traded easily on **stock exchanges**, providing quick access to funds.
  - **Cost-Effective:** Lower **management, storage, and transaction costs** compared to holding physical gold.
  - **Portfolio Diversification:** Adds a **commodity component**, reducing overall investment risk.
  - **Tax Efficiency:** More **favourable taxation** compared to physical gold.
  - **Market-Linked Returns:** Tracks the **price of gold**, which historically **hedges against inflation**.
  - **Transparency:** Fund value corresponds to **real-time gold prices**, ensuring clarity for investors.

**What is an Exchange-Traded Fund (ETF)?**

- An **ETF** is a **basket of investments**, including **equities, bonds, or commodities**, that **trades on an exchange** like a stock.
- **Key Characteristics:**
  - ETFs are **low-cost investment options**, with **lower fees than mutual funds or physical gold**.
  - They offer **liquidity and flexibility**, as they can be bought or sold anytime during market hours.
  - ETFs allow investors to gain exposure to a **diverse asset class** in a single product.

**Taxation and Funding Pattern (FY 2025-26) of Gold ETF**

- **Short-Term Capital Gains (STCG):** If units are held for **less than or equal to 12 months**, the gains are added to the investor's income and taxed at the applicable **income tax slab rate**.
- **Long-Term Capital Gains (LTCG):** If held for **more than 12 months**, gains are taxed at a flat rate of **12.5% without indexation** benefits.
- **Wealth Tax:** Gold ETFs are exempt from **Wealth Tax**, making them more **tax-efficient** than holding large amounts of physical gold.

## 3.9. TECHNICAL TEXTILES

**Context:**

- According to the Manmade and Technical Textiles Export Promotion Council, India's technical textile exports totaled $1.95 billion from April to October 2025, slightly down from $1.97 billion during the same period in 2024.

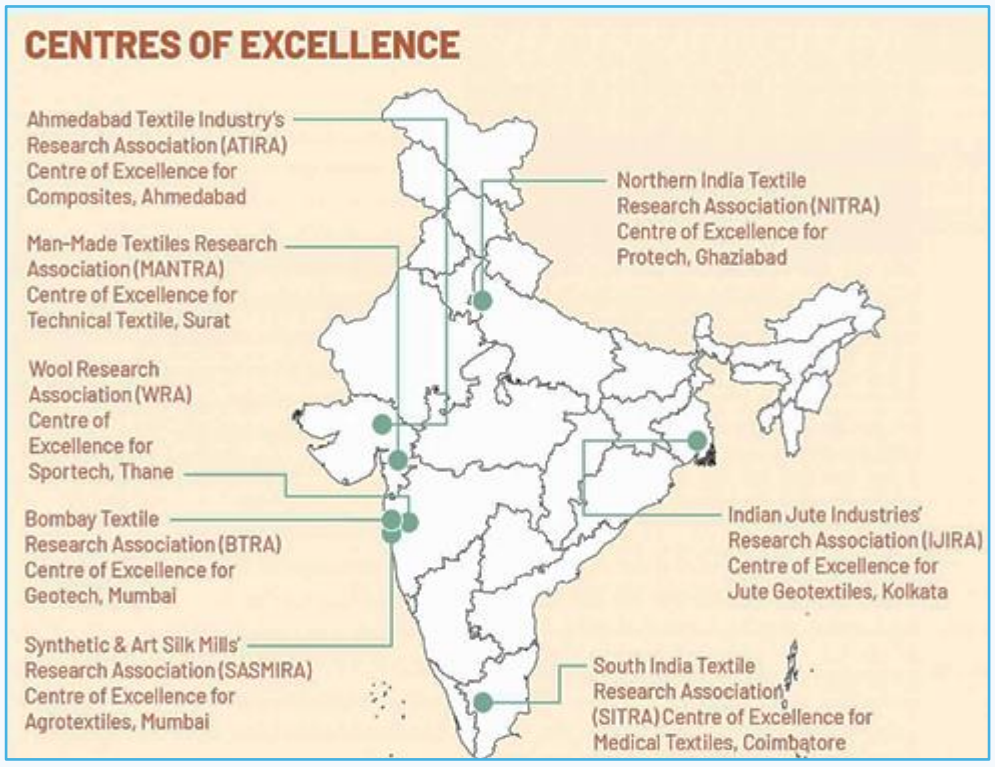
**What are Technical Textiles?**

- Technical textiles are textile products engineered for functionality rather than aesthetics. They are designed to perform specific technical functions (e.g., strength, durability, chemical/heat resistance) and are used in industries like automotive, medical, agriculture, construction, aerospace, and personal protection.

**Classification**

Technical textiles are broadly grouped into **12 segments** based on **application**:

- **Agrotech:** Textiles for agriculture, horticulture, forestry (shade nets, crop covers).
- **Buildtech**: Construction and building (architectural membranes, road geotextiles).
- **Clothtech:** Clothing components (interlinings, shoe parts, high-visibility vests).
- **Geotech:** Civil engineering geotextiles (erosion control, drainage, soil stabilization).
- **Hometech**: Household/furnishing textiles (carpets, upholstery, blackout curtains).
- **Indutech:** Industrial uses (filtration fabrics, conveyor belts, ropes).
- **Medtech:** Medical/hygiene textiles (surgical gowns, wound dressings, diapers).
- **Mobiltech:** Transport textiles (car seats, airbags, seatbelts, aircraft interiors).
- **Oekotech:** Environmental protection (waste disposal, water treatment, pollution control).
- **Packtech:** Packaging textiles (jute sacks, FIBCs, soft luggage).
- **Protech:** Protective textiles (bulletproof vests, fire/chemical-resistant clothing).
- **Sportech:** Sports/leisure (sportswear, tents, parachutes, artificial turf).




**Key Government Initiatives**

- **National Technical Textiles Mission (NTTM) 2020–24**: R&D: Support for specialty fibers, agro-textiles, geotech, protech.
- **Promotion & Marketing:** Fostering entrepreneurship through the Grant for Research and Entrepreneurship across Aspiring Innovators in Technical Textiles **(GREAT) scheme**, offering grants up to **₹50 lakh.**
- **Production Linked Incentive (PLI) Scheme (2021):** Boosts production of man-made fiber apparel, fabrics, and technical textiles; attracts investment.
- **Startup India Initiatives**: Fund of Funds (FFS), Seed Fund (SISFS), and Credit Guarantee (CGSS) support technical textile startups.
- **SAMARTH Scheme**: Capacity building for skilled manpower in textiles; aligns with Skill India.
- **PM MITRA Scheme**: Large-scale textile manufacturing hubs benefiting technical textiles indirectly.

- **Harmonized System of Nomenclature (HSN) Codes for Technical Textiles**: Dedicated HSN codes to help monitor production, trade & incentives for technical textile items.

## 3.10. TEX-RAMPS SCHEME: BOOSTING INDIA'S TEXTILE INNOVATION & MSMES

**Context:**

- Ministry of Textiles achieved a major milestone by signing **Memorandums of Understanding (MoUs)** recently with **15 States** during the **National Textile Ministers' Conference** in **Guwahati**.
- These MoUs operationalize the **Tex-RAMPS** (**Textiles focused Research, Assessment, Monitoring, Planning and Start-Up**) scheme at the state level.
- This initiative is designed to transition the Indian textile industry from ad-hoc planning to **evidence-based policymaking**, aiming to reach a **$350 billion** market valuation by **2030.**
- **Theme**: "India's Textiles: Weaving Growth, Heritage & Innovation."

**About Tex-RAMPS Scheme**

- **Full Name:** Textiles-focused Research, Assessment, Monitoring, Planning, and Start-up (Tex-RAMPS)
- **Implementation: Central Sector Scheme**, fully funded by the **Ministry of Textiles.**
- **Financial Outlay:** ₹305 crore for FY 2025-26 to FY 2030-31 (co-terminus with Finance Commission cycle).
- **Focus:** Clusters and districts across sectors like **handlooms, handicrafts, apparel, and technical textiles**.

**Objectives and Vision of Tex-RAMPS Scheme**

According to the **Ministry of Textiles**, the scheme seeks to synergize **research, data, and innovation** to establish India as a global leader in **sustainable practices, advanced technologies, and competitive manufacturing**.

**Key Components of Tex-RAMPS Scheme**

- **Research and Innovation:**
- **Data, Analytics, and Diagnostics:**
- **Integrated Textiles Statistical System (ITSS):**
- **Capacity Development and Knowledge Ecosystem:**
- **Start-up and Innovation Support:**

## 3.11. E-BUSINESS VISA (E-B-4 VISA) – INDIA

**Context:**

- **India has launched a new e-Production Investment Business Visa (e-B-4 Visa)** for **Chinese nationals**, effective **January 1, 2026**.
- The move is part of **people-centric confidence-building measures** aimed at **resetting India–China relations**, especially in the **economic and industrial domain**.

**What is the e-B-4 Visa?**

- The **e-B-4 Visa** is a **specialised electronic business visa** introduced by India to facilitate **production-linked and investment-related business activities**.
- It allows **Chinese business professionals** to travel to India for **specific, pre-defined commercial and industrial purposes**.
- The visa is **fully online**, eliminating the need for **embassy visits or intermediaries**.

**Objectives of the e-B-4 Visa**

- To **facilitate manufacturing, industrial production, and technology-related activities** in India.
- To **support foreign investment and supply chain integration**.
- To **ease short-term professional mobility** for essential business operations.
- To strengthen **economic engagement between India and China** while maintaining regulatory oversight.

**Permitted Activities under e-B-4 Visa**

The visa can be used for the following **specific business activities**:

- **Installation and commissioning of equipment**.
- **Quality checks and essential maintenance operations**.
- **Production-related activities**.
- **Information Technology (IT) and ERP ramp-up**.
- **Training of personnel**.
- **Supply chain development and vendor empanelment**.
- **Plant design, setup, and operationalisation**.
- **Senior management and executive-level engagements**.

**Institutional and Governance Linkages**

- **DPIIT (Department for Promotion of Industry and Internal Trade):** Facilitates company registration through NSWS.
- **National Single Window System (NSWS):** Integrates visa facilitation with broader **investment approval mechanisms**.
- **Bureau of Immigration:** Responsible for processing and issuing the e-Visa.

## 3.12. WORLD RISK INDEX (WRI)

**Context:** The **World Risk Index (WRI)** is a statistical model used to assess the disaster risk of countries through the multiplication of **exposure** to natural hazards and **societal vulnerability**. It is part of the annual **World Risk Report**.

**About World Risk Index**

- **Published by:** Released by the **United Nations University – Institute for Environment and Human Security (UNU-EHS)**
- **WRI measure**– World Risk = Exposure × Vulnerability

**Key Findings (World Risk Report 2025-26)**

- **Global Hotspots:** The **Philippines**, **Indonesia**, and **India** consistently rank as the top three countries with the highest disaster risk globally.
- **Continental Trend:** The Americas and Asia remain the most exposed continents.
- **Special Focus (2025):** The recent report highlighted **Flood Risk**, noting that climate change and land-use changes are making flooding the most frequent and costly disaster type.

**Conceptual Framework (WRI Model)**

The index calculates risk based on **four** core components:

1. **Exposure:** Frequency and severity of natural hazards like earthquakes, cyclones, floods, droughts, and sea-level rise.
2. **Susceptibility:** Dependent on public infrastructure, nutrition, and the general economic framework.
3. **Coping Capacities:** Ability to minimize negative impacts through governance, medical services, and economic security.
4. **Adaptive Capacities:** Long-term strategies to deal with future natural events and climate change.

**India's Ranking & Significance**

- **Rank:** India typically ranks in the **Top 3** (High Risk) in the World Risk Index.
- **India** loses 0.4% of its GDP every year to natural disasters.
- **Reason for High Rank:High Exposure:** Vulnerable to almost all major hazards (Himalayan earthquakes, 7,500km coastline for cyclones, and vast floodplains).
    - **Vulnerability Gap:** Despite improved "Coping Capacity" (NDRF, early warnings), India's "Susceptibility" remains high due to population density and uneven infrastructure.

**Comparison with Related Indices**

| Other Reports | Published by | About |
|---|---|---|
| **Global Climate Risk Index** | Germanwatch | **Historical impact** of extreme weather (Deaths & GDP loss). |
| **Global Risks Report** | World Economic Forum (WEF) | **Perception-based** survey of global experts on long-term threats. |

## 3.13. EXPORT PROMOTION MISSION (EPM)

**Context:**

- Recently, the Union Government operationalized two **critical credit-linked interventions** under the **Export Promotion Mission (EPM)**: The **Interest Subvention Scheme** and the **Collateral Support for Export Credit**.
- These measures are designed to lower the cost of capital and ease borrowing constraints for **MSME exporters**.
- With this rollout, **three out of the eleven planned components** under the EPM have now been activated to bolster India's export ecosystem.

**Export Promotion Mission (EPM): Overview**

- The **Export Promotion Mission (EPM)** is a flagship initiative of the Government of India designed to enhance the **global competitiveness of Indian exports**, with a special focus on **MSMEs, first-time exporters, and labour-intensive sectors**.
- Announced in the **Union Budget 2025–26**, the Mission brings together multiple export-support measures into a **single, digitally driven and outcome-oriented framework** to improve efficiency and impact.

**Institutional Framework and Governance of Export Promotion Scheme**

- The EPM follows a **whole-of-government approach**, involving coordinated participation from:
  - The **Department of Commerce**,
  - The **Ministry of MSME**,
  - The **Ministry of Finance**, and
  - Export Promotion Councils, Commodity Boards, financial institutions, industry bodies, and State Governments.
- The **Directorate General of Foreign Trade (DGFT)** acts as the **nodal implementing authority** for the Mission.
- The scheme is operationalised through **two complementary sub-schemes** that address both financial and capability-related constraints faced by exporters.

**Sub-Schemes under EPM**

1. **Niryat Protsahan (Financial Support):**

- Focuses on improving **access to affordable trade finance**, especially for **MSMEs**.
- Provides **interest subvention** on pre- and post-shipment export credit, **export factoring**, and **exporter credit facilities**.
- Offers **collateral support for export-linked loans**, with guarantees up to **85% for micro and small enterprises** and **65% for medium enterprises**, subject to a **₹10 crore cap per exporter**.
- Implemented through **scheduled banks** and the **Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE)** to enhance liquidity and competitiveness.

2. **Niryat Disha (Non-Financial Support):**

- Aims to strengthen **export readiness and market access**.
- Supports **quality certification, regulatory compliance**, and alignment with global standards.
- Provides assistance for **international branding, packaging, logistics, and export warehousing**.
- Promotes **district-level capacity building** to encourage exports from **non-traditional and underrepresented regions**.

**Key Features of the Export Promotion Mission**

- **Unified Export Framework:** The Mission replaces fragmented schemes with a **single, flexible, and adaptive mechanism** aligned with current global trade conditions.
- **Digital Delivery:** A **DGFT-managed digital platform** enables paperless processing, integrated approvals, and transparent monitoring.
- **Targeted Sectoral Support:** Priority is given to **tariff-impacted sectors** such as textiles, leather, gems and jewellery, engineering goods, and marine products.

- **Regional Inclusion:** Special emphasis is placed on **interior and low-export districts** to widen India's export base and promote balanced regional growth.
- **Scheme Convergence:** Existing initiatives such as the **Interest Equalisation Scheme (IES)** and the **Market Access Initiative (MAI)** are streamlined within the EPM structure.
- **Policy Alignment:** The Mission is supported by **RBI Trade Relief Measures (2025)**, which help ease liquidity constraints for export-oriented enterprises.


**India's Major Initiatives to Promote Exports**

- **PM Gati Shakti National Master Plan**: It aims to integrate infrastructure planning across sectors, improve multimodal logistics connectivity, and significantly reduce transportation time and costs for exporters.
- **National Logistics Policy (NLP)**: It seeks to lower overall logistics costs by promoting multimodal transport, digital logistics platforms, and seamless coordination among stakeholders.
- **Credit Guarantee Scheme for Exporters (CGSE)**: It provides up to **100% government-backed credit guarantees**, especially benefiting MSME exporters by improving liquidity and reducing risk for lending institutions.
- **Production Linked Incentive (PLI) Schemes**: These schemes encourage large-scale manufacturing and export growth in key sectors such as **electronics, pharmaceuticals, textiles, drones, and advanced manufacturing**.
- **Trade Infrastructure for Export Scheme (TIES)**: It supports the development of export-related infrastructure, including **testing laboratories, cold storage facilities, inland container depots (ICDs), and border haats**.
- **Free Trade Agreements (FTAs)**: FTAs with partners such as the **UAE, Australia, and EFTA countries** enhance market access for Indian goods through tariff reductions and improved trade facilitation.
- **Districts as Export Hubs (DEH)**: It promotes district-specific products by strengthening local capacity, branding, logistics support, and integration into global value chains.

## 3.14. PURCHASING MANAGERS' INDEX (PMI)

**Context:**

- **Recently**, India's **Manufacturing Purchasing Managers' Index (PMI)** fell to a **two-year low**, reflecting a **slowdown in the pace of expansion** in manufacturing activity.
- The decline was driven by **easing growth in new orders, production, employment, and export demand**, indicating moderation in manufacturing momentum despite remaining in the expansion zone.

**What is Manufacturing PMI?**

- The **Purchasing Managers' Index (PMI)** is a **survey-based indicator of business activity** in an economy.
- It captures changes in **business conditions** in both the **manufacturing** and **services** sectors by recording how purchasing managers perceive key variables compared to the **previous month**.
- Because it reflects real-time business sentiment, PMI is regarded as a **leading indicator of economic health of the country**.
- The index helps determine whether business activity is **expanding, contracting, or remaining stable**.

**Types of PMI**

- **PMI exists in two forms** — **Manufacturing PMI** and **Services PMI**, and a combined PMI (**composite**) index is also calculated using both to provide an overall view of economic activity.

**How is Manufacturing PMI Derived?**

- Manufacturing PMI is compiled through **monthly surveys** sent to a large sample of **manufacturing companies**.
- The questionnaire consists of **objective, fact-based questions**, not opinions or expectations.
- It evaluates five key variables, each assigned a specific weight:
  - **New Orders (30%)** – Indicates demand conditions.
  - **Output (25%)** – Reflects production levels.
  - **Employment (20%)** – Shows hiring or workforce trends.
  - **Suppliers' Delivery Times (15%)** – Signals supply-chain efficiency.
  - **Stock of Items Purchased (10%)** – Indicates inventory movements.

**PMI Scale and Interpretation**

- PMI is expressed on a **scale of 0 to 100**.
- A **PMI above 50** signifies **expansion** in manufacturing activity.
- A **PMI below 50** indicates **contraction**.
- A **reading of exactly 50** denotes **no change** from the previous month.

**Who Publishes PMI?**

- PMI is generally **released at the beginning of each month**, making it a **leading indicator of economic activity**, ahead of data such as GDP and industrial output.
- The PMI was first introduced in **1948 by the Institute for Supply Management (ISM)** in the United States.
- PMI for different countries is compiled by various institutions:
  - **IHS Markit (now part of S&P Global)** compiles PMI data for **over 40 economies**, including India.

**Significance of Manufacturing PMI**

- Manufacturing PMI is a **key barometer of economic health**, as the manufacturing sector plays a crucial role in employment, output, and exports.
- A **higher PMI reading** indicates strong industrial performance and positive growth prospects.

## 3.15. ELECTRONICS COMPONENT MANUFACTURING SCHEME (ECMS)

**Context:**


- Recently, the **Ministry of Electronics and Information Technology (MeitY)** approved the third tranche of projects under the **Electronics Component Manufacturing Scheme (ECMS)**.
- This phase involves **22 new projects** with a combined investment commitment of **₹41,863 crore**, aimed at creating over **33,000 direct jobs**.
- The approvals include major industry players like **Samsung Display**, **Tata Electronics**, **Foxconn**, and **Dixon Technologies**.
- This move is a strategic step toward reducing India's heavy reliance on imported components, particularly from **East Asian markets**, and moving the domestic industry from assembly-led growth to high-value-added manufacturing.

**Overview of the Electronics Component Manufacturing Scheme (ECMS)**

- **Nature of the Scheme**: The Electronics Component Manufacturing Scheme (ECMS) is the **first dedicated production-linked incentive (PLI) scheme** to promote the manufacturing of select **passive electronic components** in India.
- **Target Components**: The scheme targets components such as **resistors, capacitors, relays, switches, connectors, speakers, microphones, and special ceramics**.
- **Nodal Ministry:** Ministry of Electronics and Information Technology (**MeitY**).
- **Primary Objective:** To develop a robust component manufacturing ecosystem by attracting large-scale domestic and foreign investments and integrating Indian industries into **Global Value Chains (GVCs)**.
- **Implementation Agency:** MeitY through a **Project Management Agency (PMA)**.

**Target Segments and Incentive Structure**

| Category | Target Segments | Incentive Type |
|---|---|---|
| **Category A** | **Sub-assemblies** (e.g., Display modules, Camera modules, Optical transceivers). | **Turnover-linked** (Based on incremental sales). |
| **Category B** | **Bare Components** (e.g., Multilayer PCBs, Li-ion cells for digital use, Enclosures, Connectors). | **Turnover-linked** (Based on incremental sales). |
| **Category C** | **Selected Bare Components** (e.g., SMD passive components, Flexible PCBs). | **Hybrid Model** (Combination of Turnover and Capex-linked). |
| **Category D** | **Supply Chain & Capital Equipment** (Capital goods used in electronics manufacturing). | **Capex-linked** (Based on eligible capital investment). |

- **Note on Incentive Rates**: Incentives for **incremental investments** and **turnover range** from **1% to 10%** depending on the specific component and the year of production.

**Key Features and Eligibility**

- **Tenure:Turnover-linked incentives** are provided for **6 years**, following a **one-year gestation period**.

- **Capex-linked incentives** generally span **5 years**.

- **Nature of Investment:** The scheme is open to both **Greenfield** (new units) and **Brownfield** (**expansion of existing units**) investments.
- **Focus Areas:** It primarily focuses on **Passive Components** (resistors, capacitors, etc.), while **Active Components** (like semiconductors) are covered under the **India Semiconductor Mission (ISM)**.
- **Employment Requirement:** Generating employment is mandatory for all applicants, including component manufacturers and capital equipment producers, ensuring that the scheme promotes manufacturing while creating skilled jobs.

## 3.16. SILVER IN INDIA

**Context:**

- Recently, **silver** (**white metal**) prices surged by **6%** in futures trading on the **Multi Commodity Exchange (MCX)**, reaching a record high of **₹2,54,174 per kilogram** for March delivery, driven by strong investor demand and bullish global trends.
- Internationally, silver futures crossed the **$80 per ounce** mark for the first time on the **Comex**, climbing **7.09%** to **$82.67 per ounce** amid expectations of lower **U.S. Federal Reserve** interest rates and robust industrial demand from green energy sectors like solar photovoltaics and electric vehicles.
- **Gold**, another **precious metal**, also hovered near all-time highs in domestic markets, underlining the parallel trend in precious metal investment.
- **Chemical Name:** Argentinum (from Latin argentum, meaning silver;
- **Chemical Symbol:** Ag
- **Atomic Number:** 47
- **Properties:** Lustrous, highly conductive, malleable, ductile, resistant to corrosion
- **Uses:** Jewellery, silverware, electroplating, photography, electronics, chemical catalysts, and glass colouring
- **Occurrence:** Found mixed with **lead, zinc, copper, and gold** in polymetallic ores
- **Mode of Production in India:** Mostly produced as a **by-product of other base metals** such as lead, zinc, and copper, rather than from primary silver mines.

**Extraction Process of Silver**

Given its **byproduct nature**, silver extraction in India integrates with the refining of primary metals through efficient metallurgical techniques. The process typically involves:

- **Smelting of lead ores**: Silver, present as an **impurity in galena**, separates during high-temperature furnace operations, followed by cupellation to purify the metal.
- **Electrolytic refining**: Applied to isolates from zinc, copper, or gold ores, where electrolysis dissolves and deposits pure silver on cathodes.
- **Chemical leaching**: Utilizes **cyanide or other solvents** to extract **silver from low-grade ores,** with subsequent precipitation for recovery. These methods ensure high purity levels, with modern facilities emphasizing environmental controls to minimize emissions.

**Key Note for India**

India is rich in **galena (PbS)** and **sphalerite (ZnS)**. Most of India's silver is **extracted as a by-product** from these base metal ores during **smelting and refining operations**, rather than from primary silver mines.

**Silver Production in India**

India is a **moderate producer of silver**, with most production occurring as a **by-product** during the mining and refining of **lead, zinc, copper, and occasionally gold**. Silver is rarely mined as a primary metal in India, and production is concentrated in a few states rich in **polymetallic deposits**.

1. **Rajasthan – Leading Silver Producer**: Rajasthan accounts for **over 60% of India's total silver output** due to its rich **polymetallic deposits**, primarily **lead and zinc**.
    - Major Mines
    - Sindesar Khurd Mine (Rajsamand)
    - Rampura Agucha (Bhilwara)
    - Zawar Mines (Udaipur)
    - Rajpura Dariba
2. **Other Contributing Regions:**
    - **Jharkhand:** Silver is recovered at the **Tundoo Lead Smelter** near Dhanbad.
    - **Karnataka:** The **Hutti Gold Mines** and **Kolar Gold Fields** (historically) recover silver during the final stages of gold refining.
    - **Andhra Pradesh:** The **Vizag Zinc Smelter** processes lead concentrates to extract silver.

**Major Global Silver Producers (2023, approx.)**

- **Mexico:** ~6,300 tonnes
- **China:** ~3,600 tonnes
- **Peru:** ~3,400 tonnes
- **Russia:** ~1,400 tonnes
- **Australia:** ~1,200 tonnes
- **India:** ~700 tonnes

**Silver Production–Consumption Gap in India**

- **Import Value and Sources:** According to the **Ministry of Commerce and Industry (GoI)**, silver imports were valued at about **₹54,000 crore in FY23**; in **2023**, India imported **over 7,000 tonnes of silver**, mainly from **Hong Kong, the United Kingdom, and Switzerland**.

**Applications and Importance of Silver in India**

Silver has **significant economic, industrial, and strategic importance** in India due to its unique physical properties and expanding role in modern technologies:

- Jewellery and Silverware
- Coins and Investment Instruments
- Electronics and Electrical Industry
- Renewable Energy and Solar Sector
- Medical and Healthcare Applications
- Water Purification and Sanitation
- Chemical and Industrial Catalysts
- Photography and Imaging

- Automotive and Emerging Technologies

**Government Initiatives to Boost Silver Production in India**

To **reduce import dependence**, enhance **domestic mineral security**, and support **strategic industries**, the Government of India has introduced multiple policy and regulatory measures that indirectly and directly support silver production:

- **National Mineral Policy, 2019:** Encourages **private sector participation**, **ease of doing business**, and **scientific exploration** of mineral resources, including polymetallic deposits containing **silver as a by-product**.
- **Atmanirbhar Bharat Mission:** Emphasises **self-reliance in critical and strategic minerals**, aiming to lower India's dependence on imported silver used in **electronics, renewable energy, and defence-related applications**.
- **FDI Liberalisation in Mining:** Permits **100% Foreign Direct Investment (FDI)** under the **automatic route** for mineral exploration and mining
- **National Solar Mission (MNRE):** Rapid expansion of **solar photovoltaic capacity** increases demand for **silver paste**, indirectly incentivising **domestic exploration and recovery of silver** from base metal ores.
- **Auction-Based Mineral Allocation:** Introduction of **transparent auction mechanisms** for mineral blocks promotes **efficient resource utilisation** and encourages investment in **polymetallic mines rich in lead, zinc, and silver**.
- **Strengthening Exploration by GSI and MECL:** The **Geological Survey of India (GSI)** and **Mineral Exploration Corporation Limited (MECL)** are enhancing **regional and detailed exploration** of **silver-bearing polymetallic zones**.
- **National Mineral Exploration Trust (NMET):** Funds **early-stage exploration** to identify new **silver-bearing mineral reserves**, reducing geological risks for private players.

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## UPSC PRELIMS PRACTICE QUESTIONS

Q. With reference to the 'National Programme on Advanced Chemistry Cell (ACC) Battery Storage' PLI scheme, consider the following statements:

1. It is a Central Sector Scheme implemented by the Ministry of New and Renewable Energy.
2. The scheme is technology-agnostic, allowing manufacturers to choose any advanced battery chemistry.
3. To claim incentives, beneficiary firms must achieve at least 60% domestic value addition within the first year of production.

How many of the statements given above are correct?

(a) Only one
(b) Only two
(c) All three
(d) None

**Ans. (a)**

**Explanation:**

**Statement 1 incorrect:** While it relates to renewable energy storage, it is implemented by the Ministry of Heavy Industries, not MNRE.

**Statement 2 correct:** The scheme is indeed technology-agnostic to encourage the latest innovations in battery science.

**Statement 3 incorrect:** The target is to reach 25% DVA within two years and 60% DVA within five years, not within the first year.

Q. Consider the following statements regarding Thiruvalluvar and Tirukkural:

1. Tirukkural is written in Kural Venba metre and consists of 1,330 couplets.
2. Tirukkural is divided into four parts dealing with ethics, wealth, love, and liberation.
3. Thiruvalluvar's philosophy is secular in nature and avoids explicit religious references.
4. Tirukkural primarily focuses on devotional themes and religious rituals.

Which of the statements given above are correct?

(a) 1 and 3 only
(b) 1, 2 and 3 only
(c) 2 and 4 only
(d) 1, 3 and 4 only

**Ans. (a)**

**Explanation:**

**Statement 1 – Correct**

Tirukkural consists of 1,330 couplets written in the Kural Venba metre.

**Statement 2 – Incorrect**

Tirukkural has three parts (Aram, Porul, Inbam), not four; it does not explicitly deal with Moksha.

**Statement 3 – Correct**

Thiruvalluvar's work is secular and universal, avoiding explicit religious or sectarian references.

**Statement 4 – Incorrect**

Tirukkural focuses on ethics, governance, and love, not devotional rituals.

Q. With reference to 'Industry 5.0', consider the following statements:

1. It marks a shift from a focus on economic value to a broader concept of societal value and worker well-being.
2. Unlike Industry 4.0, Industry 5.0 aims to replace human workers with fully autonomous AI systems to eliminate human error.
3. One of its core principles is 'Resilience', which focuses on the ability of industries to adapt to sudden supply chain disruptions.

Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

**Ans. (c)**

**Explanation:**

**Statement 1 correct:** Industry 5.0 is fundamentally human-centric, prioritizing the well-being of the workforce and societal benefits alongside profit.

**Statement 2 incorrect:** This statement describes a misconception. Industry 5.0 specifically focuses on human-machine collaboration (using Cobots) rather than replacing humans. It is Industry 4.0 that leaned more toward full automation.

**Statement 3 correct:** Resilience is one of the three pillars of Industry 5.0, emphasizing agility in the face of global crises.

Q. Consider the following pairs of Reports and their Publishing Bodies:

1. Global Risks Report — World Economic Forum (WEF)
2. Energy Transition Index — International Energy Agency (IEA)
3. Future of Jobs Report — World Economic Forum (WEF)
4. Global Competitiveness Report — World Bank

Which of the pairs given above are correctly matched?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 4 only
(d) 1, 2 and 3 only

**Ans. (b)**

**Explanation:**

**Statement 1 correct:** The Global Risks Report is the flagship publication of the WEF, based on the Global Risks Perception Survey.

**Statement 2 incorrect:** The Energy Transition Index (ETI) is published by the World Economic Forum (WEF), not the IEA.

**Statement 3 correct:** The Future of Jobs Report is an annual/biennial publication by the WEF focusing on labor market transformations.

**Statement 4 incorrect:** The Global Competitiveness Report is a flagship publication of the World Economic Forum (WEF), while the World Bank publishes the (now discontinued) 'Doing Business' report and the 'World Development Report'

Q. Consider the following statements regarding Global Capability Centers:

1. Global Capability Centers are wholly owned units of multinational companies established to perform core business functions.
2. Global Capability Centers primarily focus on routine clerical and low-skill services.
3. India hosts the largest concentration of Global Capability Centers globally.
4. Global Capability Centers contribute to research, innovation, and intellectual property creation.

Which of the statements given above are correct?

(a) 1 and 3 only
(b) 1, 3 and 4 only
(c) 2 and 4 only
(d) 1, 2, 3 and 4

**Ans. (b)**

**Explanation:**

**Statement 1 correct** – GCCs are captive units owned and controlled by multinational corporations performing core functions.

**Statement 2 incorrect** – Modern GCCs focus on high-value, strategic, and innovation-driven activities.

**Statement 3 correct** – India is the world's largest hub for Global Capability Centers.

**Statement 4 correct** – GCCs actively contribute to R&D, innovation, and intellectual property development.

**Scan to attempt more questions**

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Subject – Geography
PANKAJ SINGH
Experience – 10+ Yrs
Subject – AMC
DR. P M TRIPATHI
Experience – 25+ Yrs
Subject – Essay
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Old Rajinder Nagar, New Delhi
At Adamas University
8100819447
9933118849
8100971442

## 4.1. DISCOVERY OF RARE ANT FLY SPECIES IN INDIA

**Context:** Researchers have recently discovered two new, extremely rare ant fly species from Delhi and the Western Ghats, highlighting the hidden biodiversity of urban forests and biodiversity hotspots.

**Understanding Ant Flies:**

- **Classification:** Members of the subfamily **Microdontinae** (Syrphidae family).
- **Ecological Niche:** Renowned for **myrmecophily**, where larvae reside within ant nests and feed exclusively on ant brood.
- **Behavioral Traits:** Adults are inconspicuous, rarely visit flowers, and remain in close proximity to host ant colonies, making them exceptionally difficult to detect.

**Profiles of the New Discoveries**

1. Metadon ghorpadei (Urban Specialist)
   - **Location:** Northern Ridge Forest, **Delhi Ridge**.
   - **Habitat:** An urban, fragmented, and disturbed forest patch.
   - **Significance:** Proves that even isolated urban green spaces harbor high-value biodiversity.
     - Warns that urban planning focusing solely on "green cover" may overlook niche-specific species.
2. Metadon reemeri (Highland Specialist)
   - **Location:** Siruvani Hills, **Western Ghats**, Tamil Nadu.
   - **Habitat:** A globally recognized biodiversity hotspot with high endemism.
   - **Significance:** Expands the known insect diversity of the Western Ghats.
     - Emphasizes the urgency for molecular phylogenetics and targeted surveys in protected but under-studied regions.

## 4.2. KAZIRANGA ELEVATED CORRIDOR PROJECT

**Context:**

- Recently, the Prime Minister of India performed the **Bhoomi Pujan** for the **₹6,950-crore Kaziranga Elevated Corridor Project**, which includes a 35-km-long wildlife-friendly elevated highway designed to ensure the safe and uninterrupted movement of animals between the floodplains of Kaziranga and the highlands of Karbi Anglong.
- This project aims to reduce human-wildlife conflict and improve road safety by allowing animals like rhinos and elephants free passage underneath the road.

**About the Elevated Corridor**

1. **The Problem: National Highway 715** (formerly NH-37) bisects the landscape. During monsoon floods, 70–80% of the park is submerged, forcing animals to cross the highway to reach the **Karbi Anglong (Mikir) Hills**. This leads to high roadkill mortality.
2. **The Solution:** The 34.5-km **elevated section will allow** vehicles to pass above while wildlife moves freely through **nine identified animal corridors** (Amguri, Deosur, Chirang, etc.) underneath.
3. **Agency:** Implemented by the **National Highways and Infrastructure Development Corporation Limited (NHIDCL)** under the Ministry of Road Transport and Highways.

**Kaziranga National Park – The Ecosystem**

1. **Location:** Situated in the districts of **Golaghat, Karbi Anglong, and Nagaon** in Assam, it lies along the floodplains of the **Brahmaputra River**.
2. **Legal & International Status:**
    - **UNESCO World Heritage Site:** Designated in 1985.
    - **Tiger Reserve:** Declared in 2006 (notified in 2007); it currently boasts one of the highest tiger densities in the world.
    - **Important Bird Area (IBA):** Recognized by BirdLife International for the conservation of avifaunal species.
3. **Rivers:** The **Brahmaputra** forms the northern and eastern boundaries, while the **Mora Diphlu** forms the southern boundary. The **Diphlu** and **Mora Dhansiri** rivers also flow through the park.
4. **Flora:** It is a mosaic of **Wet Alluvial Grasslands** (nearly 2/3rd of the area), tropical moist mixed deciduous forests, and tropical semi-evergreen forests. It is famous for its dense and tall **Elephant Grass**.
5. **Key Fauna**
    - **The Big Five:** Kaziranga is home to five iconic species:
        - **Greater One-Horned Rhinoceros:** Hosts 2/3rd of the world's population (Status: **Vulnerable** on IUCN Red List).
        - **Royal Bengal Tiger:** Known for high density.
        - **Asian Elephant:** Massive population that migrates seasonally.
        - **Asiatic Water Buffalo:** Home to a significant wild population.
        - **Eastern Swamp Deer:** Almost the entire world population is found here.
    - **Primates:** It is one of the few homes of the **Western Hoolock Gibbon**, the only ape species found in India.

## 4.3. WORLD'S FIRST SANCTUARY FOR MOUNTAIN ICE CORES IN ANTARCTICA

**Context:**

- Recently, the Ice Memory Foundation opened the **world's first sanctuary for mountain ice** cores in Antarctica, aiming to preserve vital records of Earth's climate for centuries.
- The sanctuary is designed to protect ice cores from glaciers that are rapidly disappearing due to global warming.

1. **What are Ice Cores?**
   - **Ice cores** are cylindrical samples drilled from glaciers.
   - They act as **time capsules**, preserving:
     - Atmospheric gases
     - Aerosols
     - Pollutants
     - Dust particles
   - Useful for reconstructing **past climate and atmospheric conditions**.
2. **Location of the Sanctuary**
   - The sanctuary is located at Concordia Station on the Antarctic Plateau, stored in a snow cave within an area protected under the 1959 **Antarctic Treaty and the Madrid Protocol**.
   - Maintained at a constant temperature of around **–52°C**.
   - Ensures long-term preservation without artificial cooling.
3. **First Stored Samples**
   - Extracted from:
   - **Mont Blanc** (France)
   - **Grand Combin** (Switzerland)
   - Total weight: **1.7 tonnes of ice**
   - Transported via icebreaker on a 50-day refrigerated journey from Trieste, Italy.
4. **Ice Memory Foundation**
   - Launched in **2015**.
   - A consortium of **European research institutes**, including:
     - The National Centre for Scientific Research (CNRS)
     - The French National Research Institute for Sustainable Development (IRD)
     - University of Grenoble Alpes
     - The National Council of Research (CNR) and the Ca' Foscari University in Venice from Italy.
     - Paul Scherrer Institute (Switzerland)
5. **Objectives**
   - Preserve ice cores for **centuries** for future scientific study.
   - Enable future researchers to analyze samples using **technologies not yet developed**.
   - Develop an **international convention** over the next decade for safeguarding ice core heritage.

## 4.4. UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP)

**Context:**

- **UNEP recently released an issue note** highlighting the **rising environmental footprint of Artificial Intelligence (AI)**.
- The report warns that by 2027, AI servers could consume between **4.2 billion and 6.6 billion cubic meters of water**, potentially **exacerbating global water scarcity**.

- Furthermore, UNEP research indicates that training a single **Large Language Model (LLM)** generates nearly **300,000 kilograms of carbon emissions**, with individual **ChatGPT** queries consuming ten times more energy than a standard Google search.
- This has prompted calls for **integrating AI impacts** into **Environmental Impact Assessments (EIA)** and global sustainability disclosures.

**Overview of UNEP**

- **About UNEP:** The **United Nations Environment Programme (UNEP)** is the **environmental authority of the United Nations system**. It provides **leadership** on **global environmental issues and assists countries** in achieving **environmental goals** under international frameworks such as the **2030 Agenda for Sustainable Development**, the **Paris Agreement**, and major **biodiversity conventions.**
- **Establishment**: Founded as a result of the **United Nations Conference on the Human Environment (Stockholm Conference)** in June **1972**.
- **Headquarters: Nairobi, Kenya** (first UN agency headquartered in a developing country).
- **Leadership:** Headed by an **Executive Director**, appointed by the **UN Secretary-General**.

**Mandate and Objectives of UNEP**

UNEP's mandate focuses on **advancing environmental sustainability worldwide**.

- **Core Objectives of UNEP:**
  - **Coordinate global responses** to key environmental challenges including climate change, pollution, biodiversity loss, and ecosystem degradation.
  - **Support countries** in environmental policy formulation, planning, and institutional capacity building.
  - **Integrate environmental considerations** into economic and social development planning to promote sustainable development.
  - **Facilitate international environmental negotiations**, treaties, and scientific assessments.
  - **Address resource depletion and climate-related risks** through evidence-based strategies.
  - **Collaborate with governments, scientific institutions, NGOs, civil society, and the private sector** to manage emerging and existing environmental challenges.

**Organisational Structure of UNEP**

UNEP operates through a **multi-tier institutional framework** ensuring inclusivity and effective governance.

- **United Nations Environment Assembly (UNEA):** UNEA is the **highest global decision-making body on environmental matters**.It consists of **all UN Member States** and meets **biennially**.UNEA sets **global environmental priorities**, adopts resolutions, and provides strategic guidance to UNEP.
- **Committee of Permanent Representatives (CPR):** The CPR functions as the **main advisory body** to UNEA.It comprises **diplomatic representatives based in Nairobi**.It ensures continuity in UNEP's work between UNEA sessions.
- **UNEP Secretariat:** The Secretariat is led by the **Executive Director**.It is responsible for **implementing UNEA decisions**, coordinating programmes, and managing daily operations.It works in partnership with governments, research bodies, and international organisations.

- **Regional and Thematic Offices:** UNEP operates through **regional offices** in **Asia-Pacific, Africa, Europe, Latin America, West Asia, and North America**. These offices tailor environmental initiatives to **region-specific ecological and developmental needs**.

**UNEP and India**

India maintains **strong collaboration with UNEP** on climate action, biodiversity conservation, waste management, and circular economy initiatives.

- India hosted **World Environment Day 2018**, themed **"Beat Plastic Pollution"**.
- UNEP supports India through **policy advice, technical assistance, and sustainable finance initiatives**.
- Collaboration also extends to **ecosystem restoration, resource efficiency, and green technology promotion**.

**Major UNEP Initiatives**

- **Clean Up the World (1993):** Mobilises volunteers globally to clean public spaces and water bodies.Promotes **community participation** and sustainable waste practices.
- **Billion Tree Campaign (2006):** Encourages **large-scale afforestation and reforestation** to combat climate change and land degradation.
- **Seal the Deal (2009):** Aimed at mobilising global public opinion for a **legally binding climate agreement** during the Copenhagen Summit.
- **APELL (Awareness and Preparedness for Emergencies at Local Level):** Strengthens **community preparedness** for industrial and chemical emergencies.
- **TUNZA Youth Programme:** Engages youth through **environmental education, leadership programmes, and global summits**.
- **Faith for Earth Initiative (2017):** Engages **religious institutions and faith leaders** to promote environmentally responsible behaviour.
- **UN-REDD Programme:** Joint initiative with **FAO and UNDP** to reduce emissions from **deforestation and forest degradation**.
- **Global Peatlands Initiative:** Protects **peatlands**, which are critical **natural carbon sinks**.
- **Greening the Blue:** Aims to make **UN operations environmentally sustainable** by reducing emissions, waste, and resource use.

**Key Reports Published by UNEP**

- **Global Environment Outlook (GEO):** Comprehensive assessment of the global environment, published every four years.
- **Emissions Gap Report:** Analyses the gap between current emissions and Paris Agreement targets.
- **Adaptation Gap Report:** Evaluates global progress in climate adaptation and identifies key gaps. **Global Biodiversity Outlook (GBO):** Assesses biodiversity trends under the CBD framework.
- **Global Air Quality Assessment:** Examines air pollution sources, impacts, and mitigation strategies.
- **Frontiers Report:** Highlights emerging environmental threats such as microplastics and zoonotic diseases.
- **Food Waste Index Report:** Provides data and solutions to reduce global food wastage.

**Environmental Conventions Associated with UNEP**

| Category | Convention | Purpose |
|---|---|---|
| **Conventions Hosted by UNEP** | **Convention on Biological Diversity (CBD)** | Ensures **conservation of biodiversity**, **sustainable use of biological resources**, and **fair and equitable sharing of benefits** from genetic resources. |
| | **CITES** (Convention on International Trade in Endangered Species of Wild Fauna and Flora) | Regulates **international trade in endangered species** to ensure it does not threaten their survival in the wild. |
| | **Minamata Convention on Mercury** | Protects **human health and the environment** by **phasing out mercury use**, controlling emissions, and reducing mercury pollution. |
| **Conventions Supported by UNEP** | **Vienna Convention & Montreal Protocol** | Protect the **ozone layer** by phasing out **ozone-depleting substances (ODS)**; regarded as the **most successful environmental treaty**. |
| | **Basel Convention** | Controls **transboundary movement and disposal of hazardous wastes** to prevent environmental and health damage. |
| | **Stockholm Convention** | Eliminates or restricts **persistent organic pollutants (POPs)** harmful to human health and ecosystems. |
| | **Rotterdam Convention** | Promotes **Prior Informed Consent (PIC)** in international trade of **hazardous chemicals and pesticides**. |
| | **UNFCCC** (United Nations Framework Convention on Climate Change) | Receives **scientific, technical, and capacity-building support** from UNEP for global climate action. |
| | **UNCCD** (United Nations Convention to Combat Desertification) | Supports efforts to **combat desertification**, **mitigate land degradation**, and promote **sustainable land management**. |

## 4.5. SOLAR ENERGY IN INDIA: PROGRESS, POTENTIAL AND POLICY

**Context:**

- Ahead of the **Union Budget**, India's **solar energy industry** has recently sought enhanced policy and financial support, including an expanded **Production Linked Incentive (PLI) scheme**, **PM-KUSUM 2.0**, accelerated implementation of **PM Surya Ghar Yojana**, and **viability gap funding (VGF) for energy storage**.
- Industry bodies have highlighted that **solar energy has emerged as a major pillar of India's power sector**, reflecting its growing role in the country's energy transition.

**Solar Energy: Concept and Working**

- **Solar energy** refers to energy obtained from the **Sun's electromagnetic radiation** and converted into usable electricity or heat. It is a **renewable, inexhaustible, and clean energy source**, playing a crucial role in sustainable development and climate mitigation.
- **Ways of Harnessing Solar Energy**:

- **Photovoltaic (PV) conversion**: Direct conversion of sunlight into electricity.
- **Solar thermal conversion**: Utilisation of solar heat to generate electricity or for heating applications.

- **Usage and Scalability:** Solar energy systems are **highly scalable and decentralised**. **Example**: Cochin International Airport operates entirely on solar power, demonstrating large-scale feasibility.
- **Applications range from**:
  - **Large solar parks** supplying power to the national grid,
  - **Decentralised off-grid systems** in remote and rural areas,
  - **Rooftop solar installations** for residential and commercial buildings.

**Major Types of Solar Energy Technologies**

Solar energy can be harnessed through three main technologies: **Photovoltaics (PV)**, **Concentrated Solar Power (CSP)**, and **Solar Heating and Cooling (SHC)** systems. These technologies convert sunlight into **electricity** or **useful thermal energy** for various applications.


**Solar Photovoltaic (PV) Technology**

- **Principle**: Converts sunlight **directly into electricity** using the **photovoltaic effect**, where photons in sunlight free electrons in semiconductor materials.
- **Components**: PV cells made of **silicon** or other semiconductors.
- **Applications**: Rooftop solar panels, **solar pumps**, off-grid lighting, and **utility-scale solar power plants**.
- **Advantages**: Cost-effective, scalable, low maintenance, durable, and feeds surplus electricity to the grid.
- **Limitations**: Power generation depends on **sunlight** and varies during the day.

**Concentrated Solar Power (CSP) Technology**

- **Principle**: Uses **mirrors or lenses** to concentrate sunlight to generate **high-temperature heat**, which drives turbines for electricity.
- **Features**: Allows **thermal energy storage**, enabling electricity generation even after sunset.
- **Technologies**: Parabolic troughs, linear Fresnel reflectors, power towers, and dish/engine systems.
- **Advantages**: Provides **dispatchable and reliable electricity**, higher operational flexibility than PV.
- **Limitations**: Requires **direct sunlight**, high initial cost, and is land-intensive.

**Solar Heating and Cooling (SHC) Technology**

- **Principle**: Converts sunlight into **thermal energy** for direct use instead of electricity.
- **Applications**: Domestic and industrial **water heating**, **space heating/cooling**, refrigeration, drying, and solar cooking.

- **Components**: **Solar collectors** mounted on rooftops, heat exchangers, and thermal storage systems.
- **Advantages**: Reduces reliance on electricity or fossil fuels, environmentally friendly, cost-effective.
- **Limitations**: Requires wider adoption and greater awareness to realise full potential.

**Government Initiatives**

| Schemes | Objective | Key Feature | Benefit | Example |
|---|---|---|---|---|
| **PM-KUSUM** | Promote solar irrigation & income | Solar pumps, grid-connected plants | Reduce diesel use, increase farmer income | Solar pumps in Rajasthan/UP |
| **PM Surya Ghar** | Provide rooftop solar to households | 300 units free electricity per month | Reduce electricity bills, promote solar | Rural & semi-urban households |

## 4.6. FOREST MANAGEMENT COMMITTEES UNDER THE FOREST RIGHTS ACT (FRA)

**Context:**

- **Recently**, the **Ministry of Tribal Affairs** (MoTA) has initiated discussions with the **Ministry of Environment, Forests and Climate Change** (MoEFCC) to secure funding for **Community Forest Resource Management (CFRM) Committees**, set up under **gram sabhas** of tribal communities and other forest dwellers.
- This step aims to **correct perceptions** that the forest bureaucracy and local communities are at odds, and to strengthen **community-led forest resource management**.

**Community Forest Resources (CFR) under FRA: Background**

- **Definition:** Community Forest Resources (CFR) under the **Forest Rights Act (FRA)** include **customary common forest lands** within traditional village boundaries or areas used seasonally by pastoral communities.
  - CFR covers **reserved forests, protected forests, sanctuaries, and national parks** where communities had **historical access**.
- **Community Rights under FRA:**
  - **Traditional Usage Rights:** Rights such as **nistar** or similar customary entitlements under historical regimes like **Princely States or Zamindari systems**.
  - **Minor Forest Produce:** Right to collect, use, and dispose of minor forest produce, both within and outside village limits.
  - **Habitation Rights:** Tenure and use of **habitat** for **primitive tribal groups** and **pre-agricultural communities.**
  - **Resource Access:** Rights over fishing, grazing (settled or nomadic), and seasonal resource use for pastoral communities.
  - **Conservation Rights:** Right to protect, regenerate, conserve, or manage forest produce traditionally safeguarded by the community.
  - **Biodiversity and Knowledge Rights:** Access to biodiversity, traditional knowledge, and community rights over intellectual property related to cultural and biological resources.

- **Settlement Rights:** Rights to settle and convert forest villages, old habitations, un-surveyed villages, and other forest villages into revenue villages.
- **Other Rights:** Any customary rights enjoyed by forest-dwelling STs or other traditional forest dwellers, **excluding hunting, trapping, or extracting parts of wild animals**.

- **Vesting of Rights:** The **Gram Sabha** is the competent authority to initiate and determine the **nature and extent of individual and community forest rights**.
- **Objective of CFR Management Guidelines:** To assist **Gram Sabhas** and **Forest-Dwelling Scheduled Tribes (FDST)/Other Traditional Forest Dwellers (OTFD)** in **managing community forest resources** sustainably under FRA.
- **Duties of Forest Rights Holders:Section 5 of FRA** empowers forest rights holders, Gram Sabhas, and Village Institutions to:
  - Protect **wildlife, forests, and biodiversity**.
  - Safeguard **catchment areas, water sources, and ecologically sensitive zones**.
  - Preserve **habitats** of forest-dwelling STs and traditional communities against destructive practices.
  - Ensure **Gram Sabha decisions** on regulating access to CFRs are implemented and any harmful activities affecting forests or wildlife are stopped.
- **Committees for Protection:** As per **FRA Rules (amended 2012)**, Gram Sabhas are mandated to constitute **committees for protection of wildlife, forests, and biodiversity** from among their members to carry out the above responsibilities.

**Community Forest Resource Management Committee (CFRMC)**

- **Constitution of CFRMC:** The **Gram Sabha** shall constitute a **Community Forest Resource Management Committee (CFRMC)** from among its members. The CFRMC shall consist of **5 to 11 members**, ensuring that:
  - At least **two-thirds** of members are **Forest Rights holders**.
  - At least **one-third** of members are **women**.
- **Composition**: The CFRMC members shall select a **Chairperson, Secretary, and Treasurer**, and inform the **Sub-Division Level Committee (SDLC), District Level Committee (DLC),** and **District Level Monitoring Committee (DLMC)** constituted by the State/UT government.
- **Tenure:** The **tenure** of the CFRMC will be decided by the Gram Sabha, ranging from **3 to 5 years**.
- **Honorarium or allowances** for CFRMC members will be decided by a Gram Sabha resolution and funded from **CFRMC resources**.
  - In cases where a **common forest area** is managed by **multiple Gram Sabhas**, a CFRMC shall be formed through a **joint meeting of the concerned Gram Sabhas** under SDLC guidance.
- **Monitoring and Oversight: State Level Monitoring Committee** forms **District Level CFR Monitoring Committees (DLMCs)**. DLMCs **facilitate integration** of CFRM Plans with forest working/management plans and provide oversight for **conservation and sustainable management**.

**Functions of CFRMC**

- **Meetings:** Gram Sabha meets at least **once every six months** to approve and review CFRMC plans; Secretary notifies members **7 days in advance**.
- **Executive Functions:** CFRMC carries out all tasks as approved by Gram Sabha, remaining **accountable** to it.

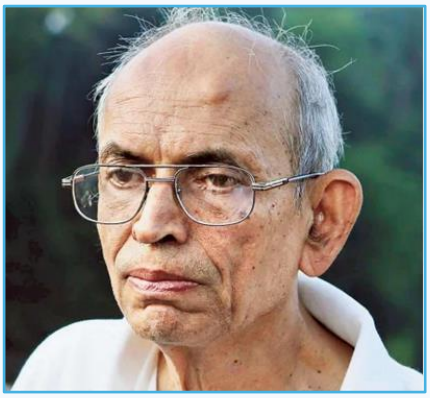
- **Planning:** Prepares **draft conservation and management plans (CFRM Plans)**.
- **Coordination:** Works with other departments for **protection of wildlife, forests, biodiversity, catchment areas, and water sources**.
- **Records:** Maintains **executive and financial records** related to CFR management.
- **Stakeholder Inclusion:** Ensures views of all **forest rights holders** are included in CFRM Plans.

Preparation and Execution of Community Forest Resources Management Plan (CFRM Plan).

- **Information Access:** Government agencies provide **authenticated data, maps, and records** on request from Gram Sabha.
- **Consensus Building:** Gram Sabhas concerned arrive at consensus; disputes are referred to **District Level CFR Monitoring Committee**.
- **Integration:** CFRMC coordinates with **Forest Department** to align CFRM Plan with forest working plans or micro plans.

## 4.7. MADHAV GADGIL AND PEOPLE-CENTRIC ENVIRONMENTAL CONSERVATION

**Context:**



- **Madhav Gadgil**, the legendary ecologist, scholar, and author, passed away in Pune on **January 7, 2026**, at the age of 83.
- His ideas and the **Western Ghats Ecology Expert Panel (WGEEP) Report, 2011** continue to resurface in public discourse, especially after recurring **landslides, floods, and ecological disasters** in the **Western Ghats region**.

**Profile of Madhav Gadgil (1942–2026)**

**Madhav Gadgil** was a pioneering scientist who bridged the gap between academic ecology and grassroots environmental activism.

- **Academic Legacy:** A **Harvard-educated scholar**, he founded the **Centre for Ecological Sciences** at the **Indian Institute of Science** (IISc), Bengaluru.
- **Evolution of Thought:** Initially a proponent of traditional **"fortress conservation"** (wildlife sanctuaries and national parks), he later metamorphosed into a critic of the **Wildlife (Protection) Act of 1972**, arguing it was often used to marginalize forest-dwelling communities.
- **Major Publications:** His autobiography, **A Walk Up the Hill: Living with People and Nature** (2023), and his co-authored works with **Ramachandra Guha**, such as **This Fissured Land**.
- **Notable Contributions of Madhav Gadgil:** He was a vocal supporter of the **"Save Silent Valley"** movement in Kerala and advocated for the rights of indigenous communities in the forests of **Bastar**.

**Western Ghats: Ecological Significance**

- **Geographical Extent:** The **Western Ghats** extend from **Gujarat to Tamil Nadu and Kerala**, covering about **1,600 km** along India's western coast.
- **Hydrological Importance:** They act as the **water tower of peninsular India**, giving rise to major rivers such as the **Godavari, Krishna, Cauvery, Periyar, and Netravathi**.

- **Biodiversity Hotspot:** The Western Ghats exhibit high endemism, with species such as the **Nilgiri tahr**, **lion-tailed macaque**, **Nilgiri langur**, **Malabar civet**, **purple frog**, and **Malabar grey hornbill** found nowhere else in the world.

**Western Ghats Ecology Expert Panel (WGEEP), 2010**

- **Constitution of the Panel:** The **WGEEP** was set up in **March 2010** by the **Ministry of Environment and Forests**, with **Madhav Gadgil as Chairman**, in response to growing concerns over **unregulated development and ecological degradation**.
- **Trigger for Formation:** The panel was influenced by deliberations of the **Save Western Ghats Movement** held in the **Nilgiris** and attended by then Environment Minister **Jairam Ramesh**.
- **Mandate of WGEEP:**
  - To **assess the ecological status** of the Western Ghats.
  - To **identify ecologically sensitive areas (ESAs)**.
  - To recommend **governance mechanisms** for conservation and sustainable development.

**Key Recommendations of the Gadgil Panel (WGEEP, 2011)**

- **Entire Western Ghats Declared Ecologically Sensitive:** The panel chaired by Madhav Gadgil identified the **entire Western Ghats region (1,29,037 sq km)** as an **Ecologically Sensitive Area (ESA)**, highlighting the inherent ecological fragility of the whole landscape rather than treating it in isolated pockets.
- **Three-Tier Ecological Sensitivity Classification:** The Western Ghats were categorised into **ESZ-1, ESZ-2, and ESZ-3**, based on the degree of ecological vulnerability, with **more stringent regulatory measures** prescribed for zones with higher sensitivity.
- **Restrictions on Developmental Activities:** The report recommended a **ban on genetically modified crops**, establishment of **new Special Economic Zones (SEZs)**, and creation of **new hill stations** across ecologically sensitive zones to prevent environmental degradation.
- **Mining and Quarrying Controls:** It proposed **no issuance of fresh mining licences**, a **phased closure of existing mines within five years in ESZ-1 and ESZ-2**, and a **total prohibition on new quarrying activities in ESZ-1**.
- **Limits on Infrastructure Expansion:** The panel advised that **new railway lines and major road projects** should generally be avoided in **ESZ-1 and ESZ-2**, except in cases of unavoidable necessity, in order to minimise ecological disturbance.
- **Establishment of a Statutory Regulatory Authority:** The report called for the creation of a **24-member Western Ghats Ecology Authority (WGEA)** under the **Environment (Protection) Act**, tasked with regulating, managing, and planning activities across all ecologically sensitive zones in the **six Western Ghats States**.
- **Composition of the Proposed Authority:** The suggested authority was to comprise **domain and resource experts**, along with representatives from **key nodal ministries**, to ensure **coordinated, multi-state environmental governance** across the Western Ghats.

**Opposition to Gadgil Panel Recommendations**

- **Submission Timeline:** The **Gadgil Panel** submitted its **draft report in March 2011** and the **final report in August 2011**.
- **Non-Disclosure:** The report was **not released publicly** and was instead **shared with State governments** for comments.

- **RTI Challenge: Environmental groups** questioned the secrecy by filing **RTI applications**.
- **Public Release:** After intervention by the **Chief Information Commissioner** and **court proceedings**, the report was **made public in May 2012**.
- **Gadgil's Stand: Madhav Gadgil** maintained that the report promoted **inclusive development** and advocated placing recommendations before **Gram Sabhas** to counter **exclusionary conservation and growth models**.
- **Resistance by State Governments:** The report encountered **strong opposition from Kerala and Maharashtra**, with **Maharashtra** opposing the proposed **Western Ghats Ecology Authority (WGEA)**, describing it as a **parallel institutional mechanism**.
- **Livelihood and Social Concerns: Kerala** contended that declaring extensive areas as **ecologically sensitive** would adversely affect **agriculture and local livelihoods**, especially in **Idukki and Wayanad**, while **political leaders and the Catholic Church** cautioned against **economic disruption and potential displacement** of communities.

**Kasturirangan Committee**

- In response to widespread opposition, the **Ministry of Environment** constituted a **High-Level Working Group in 2012** under **K. Kasturirangan** to reassess the Gadgil panel's recommendations.
- **Major Outcomes of the 2013 Kasturirangan Report:**
  - The **Kasturirangan Panel** recommended declaring about **56,825 sq km** of the **Western Ghats** as an **Ecologically Sensitive Area (ESA)**.
  - It endorsed restrictions on **mining**, **polluting industries**, **thermal power plants**, and **large townships**, but followed a **more limited approach** than the Gadgil report.
  - Unlike the earlier panel, it **identified specific villages** as ecologically sensitive and issued **state-wise lists**, making the approach **more targeted and administratively feasible**.

**Continuing Policy Stalemate**

- Based on these recommendations, the **Central Government** has issued **six draft ESA notifications**, with the **latest in August 2024**.
- However, **differences with States continue**, and a committee chaired by former **Director General of Forests Sanjay Kumar** is still working to **finalise ESA boundaries**.

## 4.8. UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

**Context:**

- Recently, **U.S. President Donald Trump** signed a presidential memorandum directing the **United States to withdraw** from the **United Nations Framework Convention on Climate Change (UNFCCC)** and the **Intergovernmental Panel on Climate Change (IPCC)**.
- This decision marks a significant escalation from previous withdrawals from the **Paris Agreement,** as the **UNFCCC is the foundational parent treaty** for all global climate cooperation.


- The memorandum identified these organizations as "contrary to the interests of the United States," leading to widespread international concern regarding the future of collective climate action.

**Overview of United Nations Framework Convention on Climate Change (UNFCCC)**

- The UNFCCC is the **global international treaty** for **addressing climate change**, adopted at the **Rio Earth Summit in 1992**.
- **Headquarters** (Secretariat): **Bonn, Germany**
- **Membership: 198 Parties**, comprising **197 countries and the European Union**, making it one of the **most widely ratified international treaties**.
- **Foundation:** It provides the **legal and institutional foundation** for subsequent agreements, including the **Kyoto Protocol (1997)** and the **Paris Agreement (2015)**
- **Meetings and Implementation**: Parties meet **annually at the Conference of the Parties (COPs)** and in technical meetings throughout the year to **advance the objectives of the Paris Agreement** and review progress.
  - **30th session of the COP (COP30)** was held in **Belém, Pará, Brazil,** November 2025.
- **Objective:** To **stabilize greenhouse gas concentrations** at a level that prevents dangerous anthropogenic interference with the climate system, while supporting **sustainable development** and **food security**.

**Historical Context of UNFCCC**

- UNFCCC is one of the **three Rio Conventions adopted at the 1992 Rio Earth Summit** to promote a **sustainable planet for future generations**.
- Its **sister conventions** are the **UN Convention on Biological Diversity (CBD)** and the **Convention to Combat Desertification (UNCCD)**.

**Institutional Framework of UNFCCC**

- **Conference of the Parties (COP):** The **highest decision-making body**, meeting annually to review progress and guide global climate action.
- **COP President and Bureau:** Rotates among **UN regional groups**; facilitates negotiations and promotes consensus among Parties.
- **Subsidiary Bodies:**
  - **SBSTA (Scientific and Technological Advice):** Provides scientific and technical guidance.
  - **SBI (Subsidiary Body for Implementation):** Reviews implementation and progress under the Convention.
- **Secretariat:** Supports the COP, subsidiary bodies, and other ad hoc committees.
- **Other Bodies:** Established for specific tasks such as dialogues, negotiations, and technical guidance, reporting back to the COP.

**Scientific Support: Intergovernmental Panel on Climate Change (IPCC)**

- UNFCCC decisions and negotiations are guided by the **Intergovernmental Panel on Climate Change (IPCC)**.
- The **IPCC** is the UN body responsible for **assessing climate science** and providing evidence-based recommendations.
- It was established in **1988** jointly by the **United Nations Environment Programme (UNEP)** and the **World Meteorological Organization (WMO)**.

**Key Climate Agreements under UNFCCC**

- **Kyoto Protocol (1997)**
  - Required **developed countries** to reduce emissions by **5% from 1990 levels (2008–2012)**.

- Introduced **market-based mechanisms** like the **Clean Development Mechanism (CDM)** to fund emission-reduction projects in developing countries.

- **Paris Agreement (2015)**
  - Aimed to limit **global temperature rise well below 2°C**, with efforts to cap it at **1.5°C**.
  - Encouraged **adaptation and resilience** against climate impacts.
  - Introduced **Nationally Determined Contributions (NDCs)**: Countries define and report their climate actions while respecting **sovereignty and national context**.
  - Strengthened **transparency, accountability, and international cooperation**.

**Significance for India**

- India is a **party to the UNFCCC** and actively participates in COPs and other climate negotiations.
- Supports India's efforts in **renewable energy expansion, climate adaptation, and technology transfer**.
- India's **NDCs under the Paris Agreement** align with UNFCCC principles of **sustainable development and emission reduction**.

**Achievements of UNFCCC**

- **Addressing Emission Responsibilities**: The **Kyoto Protocol** initially required only developed countries to reduce greenhouse gas emissions, which was contested, but the **Paris Agreement (2015)** included commitments from all nations, correcting this anomaly.
- **Raising Public Awareness**: UNFCCC has **significantly increased global awareness** about climate change and its impacts compared to the late 1990s.
- **Strengthening Climate Science**: The Convention has contributed to the **advancement of climate science**, improving the scientific understanding necessary for effective policy and negotiations.
- **Supporting Adaptation**: Enabled **planning and execution of adaptation initiatives**, including **National Adaptation Programmes of Action (NAPAs)** and the **Nairobi Work Programme**, helping countries cope with climate impacts.
- **Promoting Mitigation Mechanisms**: Introduced **innovative tools like the Clean Development Mechanism (CDM)**, allowing developing countries' emission-reduction projects to generate tradable credits for countries or companies with emission commitments.
- **Facilitating Technology Transfer**: Encouraged **development and transfer of climate technologies**, enabling nations to implement low-carbon and resilient solutions.
- **Supporting Developing Countries**: Provides a **platform for climate finance, technology transfer, international discussions, and partnerships**, assisting developing nations in mitigating and adapting to climate change.

## 4.9. BIOMATERIALS IN INDIA: SUSTAINABLE ALTERNATIVE TO PLASTICS

**Context:**

- India is actively exploring **biomaterials** as a strategic industrial and environmental opportunity.
- The country aims to reduce its **dependence on fossil-based imports** for plastics, chemicals, and advanced materials.

- Recent developments, including large-scale investments such as the planned **PLA plant by Balrampur Chini Mills** in Uttar Pradesh, highlight the growing importance of the **biomaterials sector** in India's industrial roadmap.

**Understanding Biomaterials**

- **Definition:** Biomaterials are substances that are **either entirely** or **partially sourced from biological materials**, or are developed using **biological processes**, with the purpose of **replacing or interacting with conventional materials**.
- **Purpose:** Designed to **reduce environmental impact** while supporting **sustainable production systems**.
- **Applications:** Packaging, textiles, construction, healthcare, and medical devices.

**Classification of Biomaterials**

Biomaterials can be classified into three main categories:

- **Drop-in biomaterials:** These are chemically identical to petroleum-based materials and can be incorporated into existing manufacturing processes without major modifications. An example is **bio-PET**.
- **Drop-out biomaterials:** These differ chemically from conventional materials and require new processing methods or specialized end-of-life management systems, such as **polylactic acid (PLA)**.
- **Novel biomaterials:** These offer unique properties not present in traditional materials, including **self-healing capabilities, bioactive implants, and advanced composite materials**.
- **Significance:** Biomaterials are considered the **next frontier in materials engineering**, helping industries reduce **carbon footprints** and comply with **environmental regulations**.

**Importance of Biomaterials for India**

- **Environmental Benefits:** Reduces **fossil fuel dependence** and **greenhouse gas emissions**.
- **Industrial and Economic Growth:** Supports domestic **capacity-building in advanced materials**, and decreases import reliance.
- **Agricultural Value Addition:** Utilizes feedstocks like **sugarcane, maize, and crop residues**, creating **new income streams for farmers** beyond food markets.
- **Policy Alignment:** Supports India's **single-use plastics ban, waste reduction policies**, and **climate action goals**.
- **Global Trade Advantage:** Positions Indian products competitively in **low-carbon, circular economy export markets**.

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## UPSC PRELIMS PRACTICE QUESTIONS

Q. With respect to the biological phenomenon of 'Myrmecophily' observed in certain insect subfamilies, consider the following statements:

1. It represents a specialized ecological niche where the larval development of the insect is entirely dependent on the ecosystem of ant nests.
2. The relationship is always mutualistic, where the insect larvae provide defense to the ant brood in exchange for nutrition.
3. High levels of habitat fragmentation in urban areas generally lead to the immediate extinction of myrmecophilous species due to their low mobility.

How many of the statements given above are correct?

(a) Only one
(b) Only two
(c) All three
(d) None

**Ans. (a)**

**Explanation:**

**Statement 1 is correct:** Myrmecophily (literally "ant-love") in the context of the Microdontinae subfamily is an obligate relationship. Their larvae are specialized to live within the complex environment of ant nests, making their developmental cycle entirely dependent on the host colony's ecosystem.

**Statement 2 is incorrect:** The term "Myrmecophily" describes a range of interactions, but it is not always mutualistic. In the case of these newly discovered ant flies, the relationship is predatory or parasitic, as the larvae actually feed on the ant brood (eggs and larvae) rather than providing a service like defense or honeydew.

**Statement 3 is incorrect:** While habitat fragmentation is a threat, it does not "generally lead to immediate extinction." The discovery of Metadon ghorpadei in the Northern Ridge of Delhi—a highly fragmented and disturbed urban forest—demonstrates that these species can persist in isolated "micro-habitats" as long as the specific host ant colonies remain viable.

Q. With reference to Kaziranga National Park and the recently launched infrastructure projects, consider the following statements:

1. The park is bounded by the Brahmaputra River to the North and the Karbi Anglong Hills to the South.
2. The One-Horned Rhinoceros, which is the flagship species of the park, is currently classified as 'Endangered' on the IUCN Red List.
3. The Kaziranga Elevated Corridor project is being implemented by the National Highways and Infrastructure Development Corporation Limited (NHIDCL) to provide safe passage through nine identified animal corridors.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

Ans. (c)

**Explanation:**

**Statement 1 correct:** The Brahmaputra forms the northern boundary, while the Karbi Anglong hills lie across the southern highway boundary, serving as a refuge.

**Statement 2 incorrect:** The Greater One-Horned Rhinoceros is currently classified as 'Vulnerable' (having been moved from 'Endangered' due to successful conservation).

**Statement 3 correct:** NHIDCL is the implementing agency for this ₹6,950-crore project designed to facilitate safe animal movement through the nine notified corridors

Q. Consider the following products of environmental particles:
1. Atmospheric gases
2. Aerosols
3. Pollutants
4. Dust particles

How many of the above are considered as time capsules?
(a) Only two
(b) Only three
(c) All four
(d) None
Ans. (c)

**Explanation:**

Certain environmental particles and materials are considered "time capsules" by scientists because they naturally trap and preserve samples of ancient air, dust, or pollutants from specific points in history or even from the early solar system. Analyzing these particles provides direct physical evidence of past environmental conditions.

Q. With reference to the United Nations Environment Programme (UNEP), consider the following statements:
1. UNEP provides scientific and technical support to global climate processes under the UNFCCC framework.
2. The Committee of Permanent Representatives (CPR) ensures continuity of UNEP's work between sessions of the United Nations Environment Assembly (UNEA).
3. The Adaptation Gap Report, published by UNEP, evaluates global progress in climate change mitigation.
4. UNEP collaborates with FAO and UNDP under the UN-REDD Programme to reduce emissions from deforestation and forest degradation.

Which of the statements given above are correct?
(a) 1, 2 and 4 only
(b) 1 and 3 only
(c) 2 and 4 only
(d) 1, 2, 3 and 4

**Ans. (a)**

**Explanation:**

**Statement 1 is correct:** UNEP supports UNFCCC processes through scientific, technical, and capacity-building assistance for global climate action.

**Statement 2 is correct:** The Committee of Permanent Representatives (CPR), based in Nairobi, functions as the main advisory body to UNEA and ensures institutional continuity between UNEA sessions.

**Statement 3 is incorrect:** The Adaptation Gap Report focuses on climate adaptation, assessing resilience, finance, and preparedness gaps—not mitigation targets alone (which are assessed in the Emissions Gap Report).

**Statement 4 is correct:** The UN-REDD Programme is a joint initiative of UNEP, FAO, and UNDP, aimed at reducing emissions from deforestation and forest degradation.

Q. Consider the following statements about solar energy in India:
1. Solar energy can be harnessed through Photovoltaics (PV).
2. Solar PV systems convert sunlight into electricity using the photovoltaic effect.
3. CSP plants can store thermal energy and generate electricity even after sunset.
4. Solar heating and cooling (SHC) systems generate electricity for the grid.

Which of the statements given above are correct?
(a) 1, 2, and 3 only
(b) 1 and 2 only
(c) 2, 3, and 4 only
(d) All of the above

**Ans. (a)**

**Explanation:**

**Statement 1 is correct:** India uses PV, CSP, and SHC technologies.

**Statement 2 is correct:** PV systems convert sunlight directly into electricity through the photovoltaic effect.

**Statement 3 is correct:** CSP plants can store thermal energy and generate electricity even after sunset.

**Statement 4 is incorrect:** SHC systems provide thermal energy for water heating, space heating/cooling, or cooking; they do not generate electricity for the grid.

**Scan to attempt more questions**

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# SCIENCE & TECHNOLOGY

## 5.1. NASA'S UPCOMING LUNAR MISSION: ARTEMIS II

**Context:** Recently, **the Artemis II mission** is poised for a historic liftoff, with NASA targeting a launch window opening on February 6, 2026. This mission signifies the first time in over 50 years—since the Apollo 17 mission in 1972-that humans will venture **beyond Low Earth Orbit (LEO)** toward the **lunar vicinity.**

**About the Mission:**

- **Operational Goal:** Artemis II is NASA's **first human spaceflight mission** under the Artemis program, featuring a lunar **flyby (without landing)** to evaluate deep-space systems with astronauts on board the **Orion spacecraft.**
- **Trajectory:** The mission will utilize a **Hybrid Free-Return Trajectory**. Orion will travel around the far side of the Moon, using lunar gravity to "slingshot" back to Earth without a major propulsion burn.
- **Launch vehicle:** Space Launch System (SLS) Block 1.
- **Duration:** A **10-day round trip** covering approximately 685,000 miles.
- **International Partners:** ESA (Europe), JAXA (Japan), and CSA (Canada).
- **Fuel Source:** The SLS core stage utilizes **Cryogenic Liquid Hydrogen (LH2)** and **Liquid Oxygen (LOX)**.
- **Final Phase:** High-speed atmospheric re-entry at **25,000 mph**, concluding with a precision splashdown in the Pacific Ocean.
- **Re-entry Dynamics:** Orion will enter Earth's atmosphere at **25,000 mph (Mach 32)**, testing the resilience of its advanced heat shield against temperatures reaching **2,800°C**.

**Technological Pillars:**

- **Space Launch System (SLS):** Specifically designed as the **only vehicle** capable of launching the Orion spacecraft, astronauts, and large cargo directly to the Moon in a **single launch**.
- **Orion Spacecraft:** A partially reusable crew module paired with the **European Service Module (ESM)**. The ESM is a critical international contribution (ESA) providing power, propulsion, and life-support consumables (air/water).
- **Optical Communications (O2O):** Artemis II will debut **Laser-based communication**, enabling high-definition data transmission from lunar distances- a jump from traditional radio frequency (RF) systems.

**Strategic Roadmap:**

- **Artemis III (Target 2027-28):** Scheduled to land the first woman and first person of colour at the **Lunar South Pole**—a region selected for its **water-ice** deposits in "Permanently Shadowed Regions" (PSRs).
- **Lunar Gateway:** A modular space station in **Near-Rectilinear Halo Orbit (NRHO)**. It will serve as a staging post for surface missions and a precursor for crewed Mars expeditions.
- **Artemis Accords:** A US-led international framework for peaceful space exploration. **India** became a signatory in 2023, facilitating **ISRO-NASA synergy** in lunar and planetary science.

**Artemis Phase I to IV**

The Artemis program follows a structured progression to establish a sustainable human presence on the Moon.

| Mission | Primary Objective | Status/Timeline |
|---|---|---|
| **Artemis I** | Uncrewed test of SLS and Orion around the Moon. | Completed (2022) |
| **Artemis II** | First crewed lunar flyby (no landing). | **Feb 2026 (Target)** |
| **Artemis III** | **Crewed landing** at the **Lunar South Pole**. | Planned (2027-28) |
| **Artemis IV** | Delivery of the **Lunar Gateway** habitat modules. | Future Mission |

## 5.2. ELEVATING DEFENSE INDIGENIZATION: THE C-295 TACTICAL REVOLUTION

**Context:** The India-Spain defence partnership is witnessing a landmark transition as the first 'Made in India' C-295 aircraft prepares for its rollout from the Vadodara Final Assembly Line (FAL) by September 2026. This project represents a shift from traditional public-sector dominance to a robust private-sector-led aerospace ecosystem.

**Strategic Background**

- **Purpose:** Modernisation of the **Indian Air Force (IAF) transport fleet**.
- **Replacement:** Aging **HS-748 Avro aircraft** (in service for ~60 years).
- **Operational Areas:**
  - High-altitude regions (e.g., **Ladakh**)
  - Island territories (e.g., **Andaman & Nicobar Islands**).

**About C-295 Aircraft**

- **Type:** Medium-range, twin-engine **turboprop tactical transport aircraft**
- **Manufacturer:** Airbus Defence and Space

**Key Capabilities**

- **Roles:**
  - Troop and cargo transport
  - Paratroop drops
  - Disaster relief
  - **MEDEVAC** (Medical Evacuation)
- **STOL Capability:** Can operate from **short, semi-prepared, or unpaved runways**
- **Design Feature:** Rear loading ramp
- **Mission Systems:**
  - **FITS (Fully Integrated Tactical System)**
  - Touchscreen-based navigation
- **Endurance:** Over **11 hours**

- **Special Feature:** "**Bubble windows**" for surveillance and observation

**Make in India & Defence Indigenization**

- **Deal Value:** ₹21,935 crore
- **Total Aircraft:** 56
  - **16** delivered in fly-away condition from **Seville, Spain**
  - **40** manufactured in India by **Tata Advanced Systems Ltd (TASL)**
- **Historic First:** First complete military aircraft manufactured in India by a **private consortium**
- **Indigenization:**
  - **~90% technology transfer**
  - Over **13,000 components** to be locally manufactured
- **Impact:** Creation of a **domestic aerospace supply chain ecosystem**

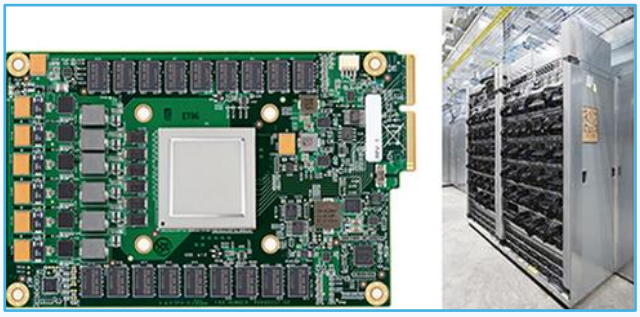
**Bilateral Significance: India–Spain**

- **Diplomatic Relations:**
  - **70 years** of ties in **2026**
  - Celebrated as **Dual Year of Culture, Tourism & Artificial Intelligence**
- **Economic Relations:**
  - Bilateral trade exceeds **$8 billion**
- **Strategic Outlook:**
  - Proposal to elevate ties to a **Strategic Partnership**
  - Cooperation for a **rules-based international order**, including the Indo-Pacific

## 5.3. TENSOR PROCESSING UNIT

**Context:**

The global AI landscape is transitioning toward domain-specific computing. Google's **Ironwood TPU** represents the pinnacle of this shift, offering a specialized alternative to traditional silicon to meet the massive computational demands of Generative AI.



**About Tensor Processing Units (Tpus):**

- **Specialization:** A TPU is a custom **Application-Specific Integrated Circuit (ASIC)** engineered exclusively for machine learning (ML) and deep learning.
- **Origin:** Developed by **Google (2016)** to optimize internal services like Search, Translate, and Photos.
- **Current Role:** Serves as a fundamental pillar in global AI infrastructure, particularly within data centers and cloud computing environments.

**Why "Tensors" Matter?**

- **Mathematical Core:** AI models utilize **Tensors**—multidimensional arrays of numbers—to process vast data and generate predictions.

- **Computational Optimization:** TPUs are architecturally tuned for high-speed tensor computations through:
  - **Massive Parallelism:** Executing thousands of simultaneous calculations per clock cycle.
  - **Energy Efficiency:** Delivering high performance with significantly lower power consumption compared to GPUs.
  - **Task-Specific Circuitry:** Dedicated hardware paths eliminate redundant operations found in general-purpose chips.

**Comparative Framework: CPU Vs. GPU Vs. TPU**

| Feature | CPU | GPU | TPU |
|---|---|---|---|
| **Primary Design** | General-purpose logic | Graphics & parallel tasks | **AI/ML specific (ASIC)** |
| **Execution** | Serial (one-by-one) | Parallel (many at once) | **Matrix-based parallelism** |
| **Best Use Case** | OS tasks, daily apps | Gaming, 3D, diverse ML | **LLMs, Deep Learning** |
| **Power Profile** | High flexibility | High consumption | **Optimized/Efficient** |

## 5.4. GUILLAIN-BARRE SYNDROME

**Context:**


- Recently, the health department in **Pune** reported a significant surge in cases of Guillain-Barré Syndrome, with over 70 cases identified, prompting the Union Health Ministry to dispatch a specialized multi-disciplinary team to assess the situation and investigate potential environmental or infectious triggers.

**What is Guillain-Barre Syndrome (GBS)?**

1. **Definition:** GBS is a rare **autoimmune neurological disorder** where the body's immune system mistakenly attacks its own **Peripheral Nervous System (PNS)**.
2. **Mechanism:** The immune system damages the **myelin sheath**, which is the protective insulation of the nerve fibers; this damage disrupts the transmission of signals between the brain and the rest of the body.
3. **Target:** Unlike some other neurological conditions, GBS primarily impacts the nerves outside the brain and spinal cord, affecting muscle movement, pain sensations, and touch.

**Causes and Triggers**

1. **Infections:** Most cases (around 70%) occur one to six weeks after a viral or bacterial infection, particularly **Campylobacter jejuni** (common cause of food poisoning/diarrhea).
2. **Viral Links:** It has been linked to the **Zika virus**, Influenza, Cytomegalovirus, Epstein-Barr virus, and even **COVID-19**.
3. **Other Triggers:** Rare instances include post-surgery complications or, very rarely, following certain vaccinations (though the risk from the actual disease, like the flu, is much higher than from the vaccine).

**Symptoms and Progression**

- **Initial Signs:** The symptoms usually begin as tingling sensations or muscle weakness in the **feet and legs** (Ascending Paralysis).
- **Progression:** The weakness can rapidly spread to the upper body, arms, and face, potentially leading to near-total paralysis.
- **Severe Complications:** In roughly 20-30% of cases, the chest muscles are affected, leading to **respiratory failure** which requires mechanical ventilator support.
- **Autonomic System:** It can cause fluctuations in blood pressure and heart rate (Dysautonomia), making it potentially life-threatening.

**Diagnosis and Treatment**

- **Diagnosis:** Doctors typically use a **Lumbar Puncture** (Spinal Tap) to check for elevated protein levels in the cerebrospinal fluid or **Electromyography (EMG)** to measure nerve activity.
- **Treatment:** While there is **no known cure**, two main treatments help speed up recovery:
  - **Plasma Exchange (Plasmapheresis):** Removing the liquid part of the blood (plasma) and replacing it to clear out harmful antibodies.
  - **Intravenous Immunoglobulin (IVIG) Therapy:** Injections of healthy antibodies from donors to block the immune system's attack on the nerves.

## 5.5. MAN PORTABLE ANTI-TANK GUIDED MISSILE (MPATGM)

**Context:**

- The **Defence Research and Development Organisation (DRDO)** has successfully **flight-tested the third-generation Man Portable Anti-Tank Guided Missile (MPATGM)** with **top-attack capability** against a **moving target** at the **KK Ranges, Ahilya Nagar (Maharashtra)**.
- The successful trial marks a key milestone towards its **induction into the Indian Army** and strengthens **Aatmanirbhar Bharat** in the defence sector.

**About Man Portable Anti-Tank Guided Missile (MPATGM)**

- **What is MPATGM?**
  - **MPATGM** is a **third-generation, Fire-and-Forget anti-tank guided missile system**.
  - It is a **shoulder-launched, portable weapon system** designed to destroy **modern main battle tanks (MBTs)**.
  - The missile has been **indigenously developed by DRDO** with significant participation from Indian industry.
- **Generation-wise Classification of ATGMs:**
  - **First Generation**: Manually guided (operator controls missile throughout flight).
  - **Second Generation**: Semi-automatic guidance (operator tracks target).
  - **Third Generation (MPATGM)**:
    - **Fire-and-Forget capability**

- **No operator guidance required after launch**, enhancing survivability.
- High survivability for the operator

**Key Technological Features of MPATGM**

- **Fire-and-Forget Technology**: Missile autonomously tracks and hits the target after launch.
- **Imaging Infrared (IIR) Homing Seeker**: Enables **high-precision target acquisition**. The missile allows **day and night combat operations** and can effectively defeat modern main battle tanks
- **Top-Attack Capability**: Missile strikes the **top portion of the tank**, which is the weakest armoured area. Effective against tanks with **frontal and side composite armour**.
- **Attack Mode and Warhead Configuration:** The missile features a **Top-Attack mode**, in which it strikes the **upper surface of the tank**, the least protected part of armoured vehicles. It is fitted with a **Tandem Warhead**, where:
  - The **precursor charge** neutralises **Explosive Reactive Armour (ERA)**.
  - The **main charge** penetrates the primary armour of the tank.
  - This configuration makes the MPATGM effective against **modern, well-protected main battle tanks**.
- **All-Electric Control Actuation System**: Improves reliability and reduces mechanical complexity.
- **Advanced Fire Control System (FCS)**: Enhances engagement accuracy and operational ease.
- **Indigenous Propulsion and Sighting Systems**: Contribute to reduced import dependence and improved logistical support.
- **Launching Platform**: The missile can be launched from: a **tripod-mounted ground launcher**,as well as a **vehicle-mounted launcher**, providing flexibility in combat deployment.

**Operational Capabilities of MPATGM**

- The MPATGM is capable of engaging **both stationary and moving armoured targets**.
- Its **Fire-and-Forget nature** allows the operator to relocate immediately after launch, thereby improving battlefield survivability.
- The system is designed to support **infantry units in close-combat and tactical battlefield scenarios**.

**Strategic and Defence Significance of MPATGM**

The induction of the MPATGM will:

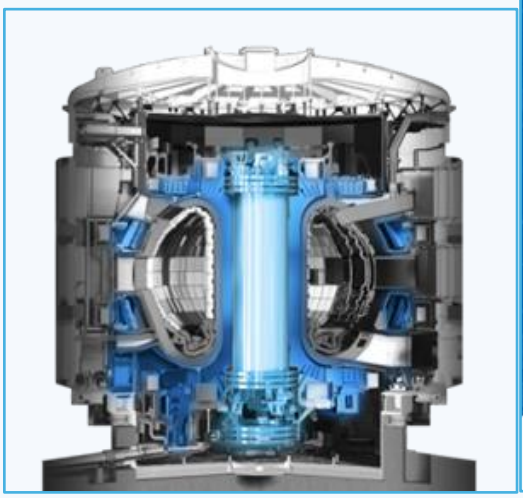
- Strengthen the **anti-armour capability of Indian infantry units**.
- Reduce India's **dependence on imported anti-tank missile systems**.
- Enhance **indigenous defence manufacturing and technological capability**.
- Support national initiatives such as **Make in India** and **Aatmanirbhar Bharat**.

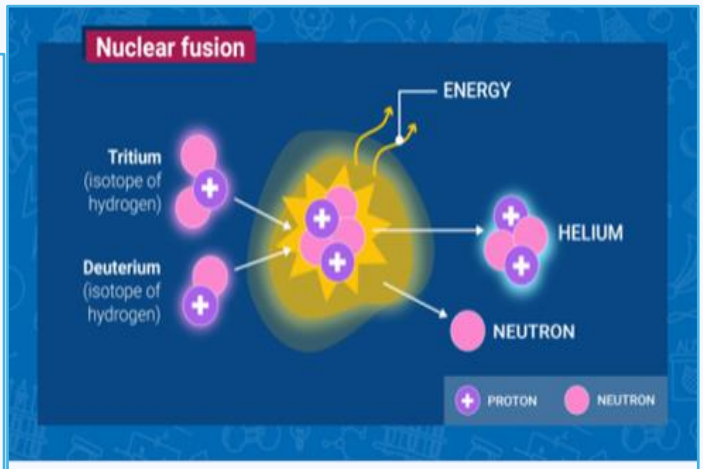
## 5.6. NUCLEAR FUSION & TOKAMAK TECHNOLOGY

**Context:**

- Scientists at China's **Experimental Advanced Superconducting Tokamak (EAST)**, colloquially known as the **"Artificial Sun,"** recently achieved a significant milestone by breaking the long-standing **Greenwald density limit**.

- The team successfully maintained **stable plasma** at densities **65% higher** than the **theoretical threshold** (**1.3 to 1.65 times the limit**).
- This breakthrough validates the **Plasma-Wall Self-Organisation (PWSO)** theory and offers a scalable pathway toward achieving **burning plasma**—the **stage where fusion reactions become self-sustaining.**



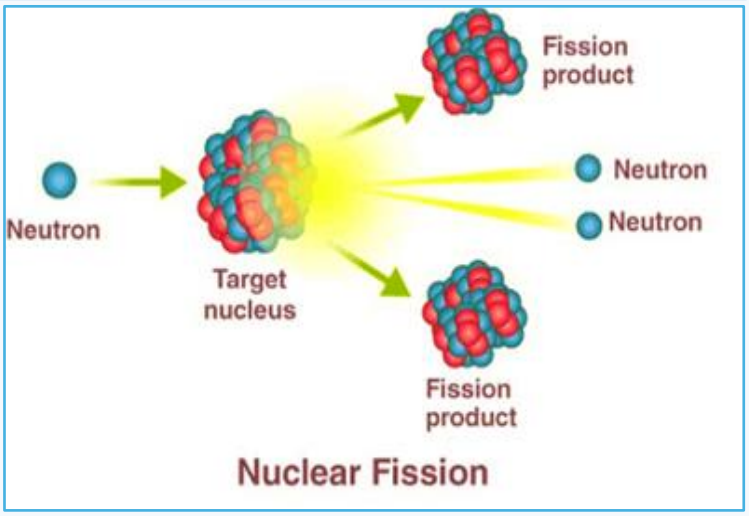



Fusion of Deuterium and Tritium

**Nuclear Fusion: Concept and Natural Occurrence**

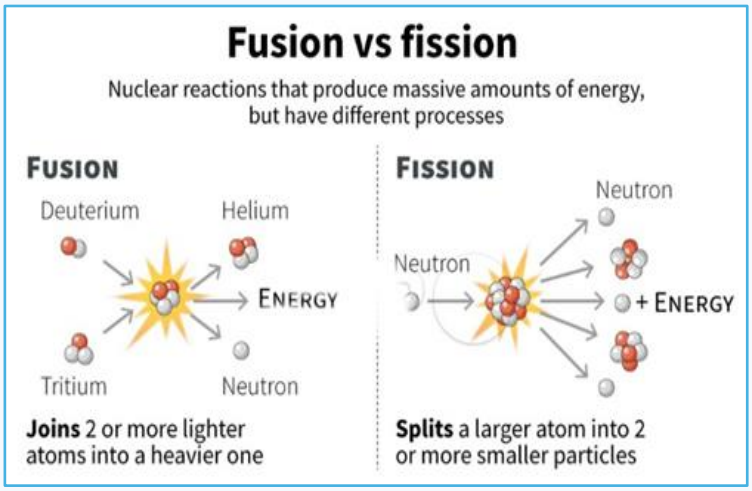
- **Definition:** Nuclear fusion is a nuclear reaction in which **light atomic nuclei combine to form a heavier nucleus**, releasing **a very large amount of energy**. The energy released through fusion is **significantly higher than that produced by nuclear fission**, as a greater portion of mass is converted into energy.
- **Occurrence:** Fusion can be **controlled**, as in stars and experimental reactors, or **uncontrolled**, as in thermonuclear (hydrogen) bombs.
- **Thermonuclear Nature:** Fusion requires **extremely high temperatures** to accelerate light nuclei to collide with enough energy. For example, **Deuterium** (from seawater) and **Tritium** (from lithium) are commonly used hydrogen isotopes.
- **Fusion in Stars:** In stars like the Sun, fusion occurs at around **10 million °C**, giving nuclei sufficient kinetic energy to **overcome the electrostatic repulsion** between positively charged protons.
- **Role of Temperature:** High temperatures enable nuclei to approach closely enough for fusion.
- **Confinement in Stars:** Stellar gravity creates enormous pressure, **confined nuclei collide more frequently**, supporting continuous fusion.
- **Nuclear Force Dominance:** At very short distances, the **strong nuclear force** overcomes repulsion, allowing nuclei to bind and **release energy**.
- **Plasma Formation:** At very high temperatures, matter exists as **plasma**, a **highly ionised state** consisting of **free electrons and positively charged ions**, which is difficult to manage and contain.
- **Challenges in Harnessing Nuclear Fusion Energy:** Controlled nuclear fusion requires **extremely high temperatures(~100 million °C**) and **plasma confinement** to prevent contact with **reactor walls**.
    - Maintaining such conditions demands **advanced heating, precise magnetic control (**as in **Tokamaks)**, and materials that can endure **extreme heat, radiation, and stress.**

- Currently, reactors consume more energy than they produce, but research continues due to fusion's potential as a **safe, clean and nearly limitless energy source.**




**Significance of Nuclear Fusion as a Future Energy Source**

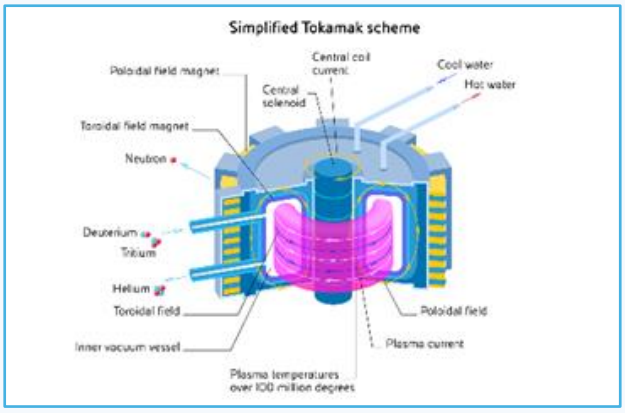
- **Abundant Fuel Supply:** Deuterium from seawater and tritium from lithium provide a virtually **unlimited fuel source**, ensuring long-term **energy security**.
- **Clean Energy:** Fusion produces **no greenhouse gases** or air pollutants. Its fuel is **non-radioactive**, and the main by-products are **helium and neutrons**, making it a **sustainable energy source**.
- **Low Radioactive Waste:** Reactor components become **mildly radioactive** due to **neutron exposure**, but this **fades within 50–100 years**, making **waste management safer** than in **fission reactors**. Fusion fuels are only active while in the reactor.




**Comparison Between Nuclear Fission and Nuclear Fusion**

| Feature | Nuclear Fission | Nuclear Fusion |
|---|---|---|
| **Process** | A neutron splits a **heavy atomic nucleus** into **two smaller nuclei**. | Two light atomic nuclei combine to form a heavier nucleus. |
| **Natural Occurrence** | Can occur naturally in uranium deposits. | Takes place naturally in stars, including the Sun. |
| **Conditions Required** | Requires a critical mass of fissile material and high-energy neutrons. | Needs plasma at extremely high temperatures to overcome electrostatic repulsion. |
| **Chain Reaction** | Involves a self-sustaining chain reaction. | Does not involve a chain reaction. |
| **By-products** | Produces radioactive isotopes such as cobalt-60, cesium-137, and iridium-192. | Produces minimal or no radioactive by-products. |
| **Nuclear Fuel** | Commonly uses **uranium.** | Uses light nuclei such as **deuterium, tritium, or lithium**. |
| **Energy Requirement** | Relatively lower energy required to split the nucleus. | Requires extremely high energy/temperature to fuse nuclei. |
| **Cost-effectiveness** | Relatively cheaper and operationally cost-effective. | More expensive due to high operational and infrastructural requirements. |

**Tokamak Device: Meaning and Working Principles**




- **Definition and Origin**: A **tokamak** is a **magnetic confinement fusion device** designed to produce nuclear fusion under controlled conditions. The term is derived from a **Russian acronym** referring to a **toroidal (doughnut-shaped) vacuum chamber** equipped with magnetic coils.
- **Working Principles of Tokamak Device:**
  - **Plasma Formation**: Fusion begins with a **neutral gas** that is **ionised into plasma**, consisting of **freely moving electrons and ions**, which is then guided into the **toroidal chamber.**
  - **Magnetic Field Structure**: Strong magnets generate two magnetic fields: a **toroidal field** that runs around the ring and a **poloidal field** that loops across it, together forming a **helical magnetic field** to confine the plasma.
  - **Plasma Confinement**: Charged plasma particles **spiral along magnetic field lines**, preventing contact with the reactor walls and maintaining the plasma in a **stable confined state**.
  - **Plasma Current Drive**: An **electric current flows through the plasma**, reinforcing magnetic confinement, while **external systems** help initiate and sustain this current.
  - **Plasma Heating Methods**: Advanced heating techniques, **including electromagnetic waves and particle beams,** raise plasma temperatures to **over 150 million degrees Celsius**, which is required for fusion.
  - **Fusion Reaction**: At these extreme temperatures, **hydrogen isotopes fuse**, releasing large amounts of energy.
  - **Magnetic 'Bottle' Concept**: Overall, the tokamak functions as a **magnetic bottle**, using carefully controlled magnetic fields to confine hot plasma long enough for fusion reactions to occur.

**Major Nuclear Fusion Projects Around the World**

- **Joint European Torus (JET), UK:** The **largest operational tokamak** in the world, focusing on plasma research and holding records for fusion power output.
- **ITER, France:** An **international megaproject** constructing the world's largest experimental tokamak to demonstrate the **feasibility of fusion energy**.
- **National Ignition Facility (NIF), USA:** An **inertial confinement fusion facility** using high-powered lasers to ignite fuel pellets and study fusion reactions.
- **Wendelstein 7-X (W7X), Germany:** An advanced **stellarator** testing magnetic confinement of plasma for **long-duration operations**.
- **Large Helical Device (LHD), Japan:** A **helical magnetic fusion device** for studying plasma confinement and stability in three-dimensional magnetic fields.
- **KSTAR, South Korea:** A **superconducting tokamak** conducting high-performance plasma experiments.
- **EAST, China:** An **experimental advanced superconducting tokamak** holding records for **long plasma pulse durations**.
- **HL-2M Tokamak, China:** The country's largest fusion reactor aimed at studying **plasma confinement and reactor engineering**.

**India's Efforts and Developments in Tokamak-Based Fusion Research**

India is actively engaged in **tokamak research**, both as a participant in the **ITER project** and through **indigenous fusion programs** led by the **Institute for Plasma Research (IPR), Gandhinagar**. Key projects include:

- **ADITYA-U:** An upgraded version of the ADITYA tokamak, **medium-sized**, with a **toroidal magnetic field of 1.5 T**, producing **circular plasmas** with currents of **150–250 kA** and plasma durations of **250–350 ms**.
- **Steady-State Tokamak (SST-1):** Medium-sized, with a **1.5 T magnetic field**, plasma currents of **~100 kA**, and confinement times around **450 ms**.
- **SST-2:** A **superconducting tokamak under construction** to handle **over 1000 plasma pulses** and currents exceeding **1 million amperes**, aimed at studying **high-current plasma stability**.
- **SST-3:** A next-generation **steady-state superconducting tokamak** integrating features from **SST-2 and ITER**, using **high-temperature superconductors**.
- **IN-SPARC:** A planned **demonstration reactor** targeting **net energy gain from fusion by 2030**, employing **advanced indigenous technologies**.

## 5.7. PSLV-C62 / EOS-N1 MISSION: KEY HIGHLIGHTS & STRATEGIC SIGNIFICANCE

**Context:**

- The **Indian Space Research Organisation (ISRO)** is scheduled to launch the **PSLV-C62/EOS-N1 mission** from the **first launch pad of the Satish Dhawan Space Centre (SDSC), Sriharikota**.
- This mission marks the **105th launch from Sriharikota**, the **64th PSLV flight**, and the **fifth mission of the PSLV-DL variant**.
- The launch will deploy **EOS-N1**, an **Earth observation satellite with strategic applications**, along with **15 co-passenger satellites** from India and international partners.

**PSLV-C62 Mission: Key Details**

- **Mission Overview:** The **PSLV-C62** is a **multi-payload mission** by the **Indian Space Research Organisation (ISRO)**, carrying **1 primary satellite and 18 secondary payloads**. It is ISRO's **first launch of 2026** and is scheduled to lift off from **Sriharikota**.
- **Primary Payload – EOS-N1 ('Anvesha'):**
  - **Type: Earth observation satellite** with **hyperspectral imaging** capability.
  - **Developer:** Primarily built by **Defence Research and Development Organisation (DRDO)** for **strategic purposes**.
  - **Capabilities:**
    - Captures data in **hundreds of wavelengths**, enabling precise identification of materials and objects.
    - Supports **national security, border surveillance, and strategic monitoring**.

    - Civilian applications include **agriculture planning, urban mapping, mineral exploration, and environmental monitoring**.
- **Secondary Payload – Kestrel Initial Demonstrator (KID):**
    - **Type:** Experimental **re-entry capsule** developed with a **Spanish startup**.
    - **Mission Objective:** Expected to **re-enter Earth's atmosphere** and **splash down in the South Pacific Ocean**.
- **Other Secondary Payloads:** Includes **17 commercial satellites** from **India, Mauritius, Luxembourg, UAE, Singapore, Europe, and the USA**.
    - **Indian startups and academic institutions** contributing satellites:
        - **OrbitAID Aerospace – AayulSAT** (India's first **on-orbit satellite refuelling payload**)
        - **CV Raman Global University – CGUSAT-1**
        - **Dhruva Space – DA-1**
        - **Space Kidz India – SR-2**
        - **Assam Don Bosco University – Lachit-1**
        - **Akshath Aerospace – Solaras-S4**
        - **Dayanand Sagar University – DSAT-1**
- **Technological Significance:**
    - **AayulSAT** aims to demonstrate **in-orbit servicing and satellite refuelling**, extending operational life of satellites.
    - These technologies are crucial for **reducing space debris** and promoting **sustainable use of increasingly crowded orbital space**.

**Polar Satellite Launch Vehicle (PSLV): Overview**

- **About:** The **PSLV** is India's **third-generation launch vehicle** and the first Indian launcher to incorporate **liquid stages**. It is an **indigenously built expendable launch system** developed by **ISRO**. Since its first successful launch in **October 1994**, PSLV has become a **reliable and versatile workhorse**, launching both Indian and foreign satellites.
- **Notable Achievements:**
    - Launched **Chandrayaan-1** (2008) and **Mars Orbiter Mission (Mangalyaan)** (2013).
    - Successfully deployed satellites for **LEO, GTO, communication, meteorology, navigation, scientific research, and space exploration**.
    - Launched **Astrosat**, India's first space observatory.
- **Key Features:**
    - **Expendable launch vehicle** capable of placing **remote sensing satellites into Sun-Synchronous Orbit (SSO)** and smaller satellites into **Geostationary Transfer Orbit (GTO)**.
    - Can carry **multiple payloads** using **multi-payload adaptors**.
    - Payload capacity:
    - **SSPO (600 km)** – 1,750 kg
    - **Sub-GTO** – 1,425 kg

**Key Comparison Between PSLV and GSLV**

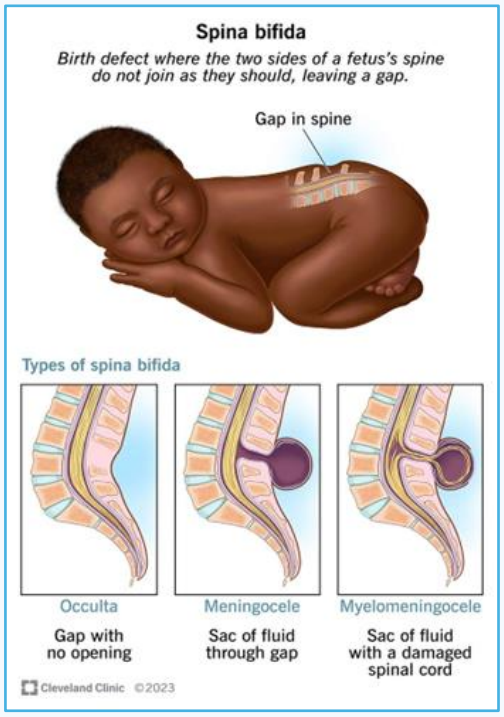
ISRO operates **two main satellite launch vehicles**: the **Polar Satellite Launch Vehicle (PSLV)** and the **Geosynchronous Satellite Launch Vehicle (GSLV)**. Both serve distinct purposes in India's space programme.

| Feature | PSLV (Polar Satellite Launch Vehicle) | GSLV (Geosynchronous Satellite Launch Vehicle) |
|---|---|---|
| **Number of Stages** | **4 stages**: PS1, PS2, PS3, PS4 | **3 stages**: GS1, GS2, CUS |
| **Lift-off Mass** | 320 tonnes (PSLV-XL variant) | 420 tonnes |
| **Fuel Type** | Combination of solid and liquid propellants | Liquid fuels (liquefied nitrogen and oxygen) |
| **Generation & First Flight** | Third-generation launcher; first flight in 1993 | Fourth-generation launcher; first flight in 2014 |
| **Orbit Capability** | Can launch satellites into LEO, SSO, GTO, and navigation orbits | Primarily designed for **Geostationary Transfer Orbit (GTO)** missions |
| **Primary Use** | Mainly for **earth observation** and remote-sensing satellites | Primarily for **communication satellites** such as INSAT-class in geostationary orbit |
| **Strap-on Boosters** | Available in four variants: 6, 4, or 2 solid rocket strap-ons | Equipped with four liquid strap-on boosters |
| **Payload Capacity** | Up to **1,750 kg** to Sun-Synchronous Polar Orbit (SSPO) | Up to **2,250 kg** to GTO |
| **Variants** | PSLV-CA, PSLV-G, PSLV-XL, PSLV-DL, PSLV-QL | GSLV Mk I, GSLV Mk II, GSLV Mk III |

## 5.8. SPINA BIFIDA: ETIOLOGY, PREVENTION, AND PUBLIC HEALTH CHALLENGES

**Context:**

- Healthcare experts and organizations like the **Center for Spina Bifida Prevention (CSBP)** highlighted a critical **"prevention gap"** in India.
- Despite the 1991 **Medical Research Council (MRC) Vitamin Study** proving that **pre-conceptional folic acid** can prevent over **70% of Neural Tube Defects (NTDs)**, India continues to report a high prevalence of **4 cases per 1,000 births**.
- Recent advocacy focuses on making **folic acid fortification** of staples (**like salt and tea**) a public health priority to reduce the massive socio-economic burden of this condition.




**What is Spina Bifida**

- **Spina Bifida** is a **congenital neural tube defect (NTD)** affecting the **spine and spinal cord**, caused

by **incomplete closure of the neural tube during early embryonic development**, typically within the **first 28 days of pregnancy**.

- The condition can range from **mild anatomical defects** to **severe neurological disability** and it is classified under **non-communicable congenital disorders**.

**Diagnosis and Treatment of Spina Bifida**

- **Prenatal Screening:** Detected via **maternal blood tests** (checking for high **Alpha-fetoprotein** levels), detailed **ultrasounds**, or **amniocentesis**.
- **Treatment:** Although **no definitive cure exists**, a range of **medical, surgical, and rehabilitative interventions** is available to effectively manage symptoms and improve quality of life.

## 5.9. INDIA'S FIRST INDIGENOUSLY DESIGNED POLLUTION CONTROL VESSEL

**Context:**


- Recently, the Raksha Mantri commissioned **Indian Coast Guard Ship Samudra Pratap**, India's first indigenously designed Pollution Control Vessel, built by **Goa Shipyard Limited (GSL).**
- This largest ship in ICG's fleet to enhance India's environmental response capabilities and bolster coastal patrol & maritime safety.

**About ICGS Samudra Pratap**

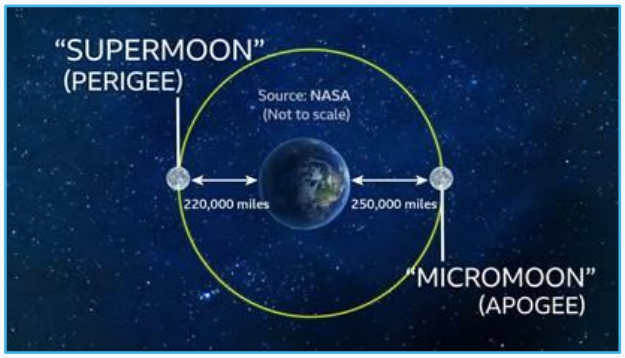
- **Name & Significance**: Samudra Pratap (Majesty of the Seas) reflects the ICG's commitment to safe, secure, and clean seas and protection of India's maritime interests.
- **Type:** India's first indigenously designed Pollution Control Vessel.
- **Dimensions & Performance:**
  - Displacement: 4,170 tonnes
  - Length: 114.5 metres
  - Speed: >22 knots
  - Endurance: 6,000 nautical miles
  - Propulsion: Two 7,500 kW diesel engines with indigenous controllable **pitch propellers**.
- **Pollution Control Capability:**
  - Side-sweeping arms, floating booms
  - High-capacity skimmers, portable barges
  - Onboard pollution control laboratory
- **Fire-Fighting & Advanced Systems:**
  - External Fire-Fighting System (Fi-Fi Class 1)
  - Dynamic Positioning System
  - Integrated Bridge System
  - Integrated Platform Management System
  - Automated Power Management System

- **Armament:**
  - 30 mm CRN-91 gun
  - Two 12.7 mm stabilised remote-controlled guns
  - Supported by modern fire-control systems

## 5.10. WOLF MOON & WOLF SUPERMOON

**Context:**

- On January 3, observers across the globe witnessed the full "Wolf Moon," a celestial phenomenon during which the Moon appeared significantly larger and brighter than usual.




**What is Full Moon?**

- A Full Moon occurs when the **Earth lies between the Sun and the Moon**, allowing the Moon's near side to be completely **illuminated.**
- It represents one of the primary phases of the lunar cycle, occurring roughly every 29.5 days (synodic month).
- During a Full Moon, the Moon **rises around sunset** and **sets around sunrise**, remaining visible throughout the night.
- Full Moons play an important role in tidal variations, contributing to spring tides due to the alignment of the Sun, Earth, and Moon.
- Many Full Moons have **traditional names** (e.g., Wolf Moon, Harvest Moon), reflecting seasonal and cultural associations.

**Why the 'Wolf Moon'?**

- The Wolf Moon is the traditional name for the **full Moon** occurring in January.
- The name originates from **Native American**, Anglo-Saxon, and European folklore, where winter months were associated with **howling wolves** roaming near human settlements due to **scarcity of food.**
- It is part of a system of seasonal full Moon names (e.g., Harvest Moon, Snow Moon) used to track time before modern calendars.

**Why is it called a 'Wolf Supermoon'?**

- A **Wolf Supermoon** occurs when the January full Moon **coincides** with a supermoon.
- The Moon revolves around the Earth in an **elliptical orbit**, rather than a perfectly circular one, resulting in variations in its distance from Earth.
- The point at which the Moon is **closest to Earth is termed perigee**, while its **farthest point is known as apogee.**
- When a full Moon coincides with perigee, the event is scientifically referred to as a **supermoon.**
- At perigee, the Moon is approximately 220,000 miles from Earth, compared to about 250,000 miles at apogee, making it appear **larger and brighter in the night sky.**

- On average, three to four supermoons occur each year, rendering them relatively common, though the occurrence of four consecutive supermoons is uncommon.

**Cultural Significance**

- Full moons have inspired art and folklore, with beliefs (though lacking scientific backing) about their influence on human behavior, sleep, and plant growth.

## 5.11. INDIA'S AIR DEFENCE SYSTEM

**Context:**

- Recently, the **Defence Research and Development Organisation (DRDO)** has been tasked with a pivotal role in the **Sudarshan Chakra initiative**, an ambitious air defence program aimed at providing comprehensive aerial protection to India's critical installations.
- The initiative will equip strategic locations across the country with **advanced air defence systems** over the next decade to counter evolving aerial threats, including aircraft, missiles, and drones.
- Defence experts have highlighted lessons from recent military operations like **Operation Sindoor**, emphasizing the need for robust and **reliable air defence capabilities** to ensure national security and operational readiness.

**What are Air Defence Systems?**

- **Air defence systems** are **multi-layered military frameworks** designed to **detect, track, and neutralize aerial threats** such as enemy aircraft, **unmanned aerial vehicles** (UAVs), ballistic missiles, and cruise missiles.
- Their primary objective is to **deny adversaries access to national airspace** while ensuring the safe operation of friendly forces.
- These systems integrate **radars, command centres, interceptor aircraft, surface-to-air missiles (SAMs), anti-aircraft artillery (AAA), and electronic warfare (EW) systems** using the **C3 model**:
  - **Command:** Decision-making and threat assessment.
  - **Control:** Operational management and resource allocation.
  - **Communication:** Coordination between subsystems for rapid response.

**Key Components of Air Defence Systems**

1. **Detection and Surveillance**

- **Radar Systems:** High-frequency radars emit electromagnetic waves to detect and locate incoming aerial threats by reflecting signals off objects.
- **Satellite and Infrared Sensors:** Monitor stealth aircraft, hypersonic missiles, and other high-speed threats.
- **Tracking Systems:** Analyze the speed, altitude, trajectory, and type of threat to support accurate classification and response planning.

**2. Engagement and Neutralization**

- **Surface-to-Air Missiles (SAMs):** Intercept hostile aircraft or missiles before they reach their intended targets.
- **Electronic Warfare (EW) Systems:** Employ jamming, deception, and cyber tools to disrupt enemy radar, communications, and missile guidance.
- **Anti-Aircraft Artillery (AAA):** High-caliber guns provide short-range protection against low-altitude targets or serve as last-resort defence.

**Operational Framework of Air Defence Systems**

- **Detection:**
  - Radars and satellite sensors identify aerial threats, including fighter jets, UAVs, and ballistic missiles.
  - Example: India's **Rohini** and **Arudhra** radar systems.
- **Tracking:**
  - Monitors multiple threats in real time and differentiates between hostile, friendly, and civilian aircraft.
  - Enables prioritization of targets and reduces risk of collateral damage in multi-threat scenarios.
- **Interception:**
  - Neutralizes threats using fighter jets, SAMs, AAA, or EW systems.
  - Engagement decisions depend on threat **range, altitude, speed, and trajectory**.
  - **Command, Control, and Communication (C3)** integration ensures rapid coordination between sensors and shooters for an effective response.

**India's Multi-Layered Air Defence Structure**

| Category | System/Weapon | Role / Key Feature |
|---|---|---|
| **Interceptor Aircraft** | Rafale, Su-30MKI, MiG-29, MiG-21 Bison, Tejas Mk-1 | Rapid-response jets for engaging high-speed aerial threats; equipped with air-to-air missiles and electronic warfare systems. |
| **Surface-to-Air Missiles (SAMs)** | **Long-range:** S-400 Triumf | Intercepts aircraft and missiles up to 400 km; protects strategic assets. |
| | **Medium-range:** Akash, Barak-8 | Mobile systems for tactical and field unit protection. |
| | **Short-range:** MANPADS | Hand-held, for drones, helicopters, and low-altitude threats. |
| **Anti-Aircraft Artillery (AAA)** | L-70, ZU-23-2 | Defends low-altitude targets; used as last-resort defense in close combat. |
| **Electronic Warfare (EW)** | Netra AEW&CS, Samyukta, Himshakti | Jam, deceive, and disrupt enemy radar, communications, and missile guidance. |
| **Command & Control** | Integrated Air Command and Control System (IACCS) | Fuses radar, sensors, and communication networks for coordinated decision-making. |

**Major India's Air Defence Systems**

- **Akash Missile System**: An **indigenously developed surface-to-air missile (SAM) system** capable of engaging multiple airborne threats simultaneously. It employs command guidance and phased array radar to enhance targeting precision.
- **S-400 Triumf Missile System**: Procured from **Russia,** this **long-range SAM system** significantly strengthens India's air defence capabilities. It can detect and intercept ballistic missiles, fighter jets, and

drones at ranges of up to 400 km. The system is also operational in countries like **China and Turkey** for **ballistic missile** and **aircraft defence**.

- **Integrated Counter-Unmanned Aerial System (UAS) Grid**: Deployed along sensitive borders, this network **combats hostile drones** and **unmanned aerial vehicles**. It integrates radar detection, electronic jamming, and kinetic interception to prevent aerial intrusions effectively.
- **Barak-8 Missile System**: A **joint Indo-Israeli medium-range SAM system** designed for rapid interception of aerial threats. It enhances both naval and land-based air defence capabilities through high-speed response and precision targeting.

**Notable Air Defence Systems Globally**

- **Patriot Missile System (United States)**: Widely used for **intercepting aircraft** and **missiles**, the Patriot system provides high-altitude defence and is deployed by the **United States, Germany, Japan,** and **Saudi Arabia.**
- **Iron Dome (Israel)**: A **short-range missile defence system** primarily designed to intercept and destroy incoming rockets. It is extensively used to protect urban areas and strategic military installations in Israel.
- **Terminal High Altitude Area Defense (THAAD – United States)**: A high-altitude missile defence system capable of intercepting ballistic missiles during their terminal phase. THAAD is deployed in countries including the **United States, South Korea,** and **Japan** to provide regional security against missile threats.

## 5.12. DHRUV NG: NEXT-GENERATION HELICOPTER OF INDIA

**Context:**

- **Recently, Hindustan Aeronautics Limited (HAL)** conducted the **maiden flight of the Dhruv NG (Next Generation) multi-role helicopter** at its helicopter division in **Bengaluru**, marking a major step in India's indigenous civil helicopter development.
- The event highlighted India's progress in **self-reliant aerospace manufacturing**, as the Dhruv NG is a **fully indigenously designed and manufactured platform**.
- On the same occasion**, the Directorate General of Civil Aviation (DGCA)** also granted **certification for indigenous manufacturing of the Shakti civil engine**, making it the **first aero engine in India to receive DGCA certification for indigenous production**.

**About ALH Dhruv (Advanced Light Helicopter)**

- **Indigenous Platform:** The Advanced Light Helicopter (ALH) Dhruv is a **twin-engine utility helicopter** designed and manufactured by **Hindustan Aeronautics Limited (HAL)**.
- **Operational Role:** It is a **multi-role, multi-mission rotary-wing platform** suitable for a wide range of **military and civil operations**.

- **Programme Initiation:** The ALH Dhruv programme was launched in **1984** to achieve **self-reliance in helicopter design and manufacturing**.
- **Design Assistance:** The initial design phase received technical support from **Germany's Messerschmitt-Bölkow-Blohm (MBB)**.
- **Induction Timeline:** The helicopter **first flew in 1992** and was **inducted into service in 2002** after completing airworthiness certification.

**Certification Status of ALH DRUV**

- **Military Certification:** The helicopter is **type-certified by the Centre for Military Airworthiness Certification (CEMILAC)**.
- **Civil Certification:** Certification for civil operations is granted by the **Directorate General of Civil Aviation (DGCA)**.
- **Operational Significance:** Dual certification enables deployment in **both defence and civilian roles**.

**Variants of ALH Dhruv**

- **Variant Structure:** The ALH Dhruv family comprises **four principal variants**, which **cater to the operational requirements of the Indian Army, Indian Navy, Indian Air Force, and Indian Coast Guard**.
- **Variant Names:** The four variants are **Dhruv Mk-I, Dhruv Mk-II, Dhruv Mk-III, and Dhruv Mk-IV**.

**Induction and Export Profile of ALH Dhruv**

- **Domestic Orders:** In **2017**, HAL received orders for **73 ALH helicopters** for the **Indian Army, Navy, and Coast Guard**, mainly for **Mk-III and Mk-IV variants**.
- **Export Destinations:** The helicopter has been exported to the **Nepal Army**, **Mauritius Police**, and **Maldives**.

**Key Features of ALH Dhruv**

- **Engine Configuration:** Twin-engine layout ensures **operational redundancy and enhanced safety**.
- **Cockpit Design:** A **glass cockpit** integrated with **advanced avionics** improves pilot situational awareness.
- **Structural Safety:** A **crashworthy airframe and landing gear** enhance survivability.
- **Rotor System: Composite, interchangeable main rotor blades** improve durability and performance.
- **Defensive Aids: Chaff and flare dispensers** provide protection against missile threats.
- **Pilot Interface:** A **Helmet-Mounted Sighting/Pointing System** improves targeting capability.
- **Protection Systems:** An **integrated self-protection suite** enhances combat survivability.
- **Fire Safety:** An **on-board inert gas generation system** reduces fire hazards.
- **Terrain Capability:** The helicopter can operate in **diverse terrains**, including **high-altitude and extreme climatic conditions**.

**Linkage with Government Schemes (UDAN & VGF)**

- **UDAN 5.1 Coverage:** Under **UDAN 5.1**, **Viability Gap Funding (VGF)** has been **extended to helicopter services**, including regional and remote area connectivity.
- **Affordability Impact:** VGF support has **significantly reduced helicopter travel costs**, improving **accessibility for civilians in remote and difficult terrains**.
- **Sectoral Expansion:** This policy intervention is expected to **accelerate growth of India's civil helicopter market** and strengthen **regional air connectivity**.

## 5.13. DEFENCE ACQUISITION COUNCIL (DAC)

**Context:**

- Recently, the **Defence Acquisition Council (DAC)**, chaired by Defence Minister Rajnath Singh, accorded **Acceptance of Necessity (AoN)** for capital acquisition proposals amounting to approximately **₹79,000 crore**.
- This major clearance aims to modernize the **Indian Army, Navy, and Air Force** through the procurement of advanced technologies, including **Loiter Munition Systems**, **Astra Mk-II missiles**, and **High Altitude Long Endurance (HALE) drones**.
- Significantly, these approvals prioritize **indigenous design and manufacturing**, aligning with the broader **"Atmanirbhar Bharat"** initiative to reduce dependency on foreign imports.

**Overview of Defence Acquisition Council**

The **Defence Acquisition Council (DAC)** is the highest decision-making body within the **Ministry of Defence (MoD)** tasked with deciding on new policies and capital acquisitions for the three services—**Army, Navy,** and **Air Force**—and the **Indian Coast Guard**.

- **Establishment:** The DAC was formed in **2001** based on the recommendations of the **Group of Ministers (GoM)** on **"Reforming the National Security System"** following the **Kargil War (1999)**.
- **Primary Objective:** To ensure the **expeditious procurement** of approved military requirements by optimizing the use of allocated budgetary resources within prescribed timeframes.
- **Significance:** It serves as a single-window clearance system to eliminate bureaucratic delays and ensure transparency in high-value defence deals.

**Composition of the DAC**

The council is a **multi-disciplinary body** representing the civilian leadership, military command, and administrative wings of the government.

- **Chairman:** The **Union Minister of Defence**.
- **Key Members:**
  - **Minister of State for Defence.**
  - **Chief of Defence Staff (CDS):** Acting as the principal military advisor.
  - **Service Chiefs:** Chiefs of the **Army (COAS)**, **Navy (CNS)**, and **Air Force (CAS)**.
  - **Administrative Secretaries:** Defence Secretary, Secretary (Defence Production), Secretary (DRDO), and Secretary (Defence Finance).
  - **Member Secretary:** Deputy Chief of Integrated Defence Staff (PP&FD).

**Major Functions and Responsibilities of DAC**

The DAC oversees the entire lifecycle of a procurement proposal before it reaches the final contract stage.

- **Acceptance of Necessity (AoN):** This is the **first formal step** in the procurement process. Granting an AoN signifies that the government has officially accepted the requirement for specific equipment.
- **Categorization:** The DAC decides the procurement route for proposals:
  - **'Buy':** Direct purchase from Indian or global vendors.

- **'Buy & Make':** Initial purchase followed by indigenous production or technology transfer.
- **'Make':** Fully indigenous research, development, and production.

- **Long-Term Planning:** It provides in-principle approval for the **15-year Long Term Integrated Perspective Plan (LTIPP)**, ensuring a roadmap for future military capabilities.
- **Offset Provisions:** For acquisition proposals exceeding **₹300 crore**, the DAC takes decisions regarding "offsets" (requiring foreign suppliers to invest a portion of the contract value back into the Indian defence industry).
- **Policy & Trials:** It looks into single-vendor clearance issues and oversees the evaluation of field trials for new equipment.

**Recent DAC Approvals**

- **Indian Army:**
  - **Loiter Munition Systems:** Enable precision strikes against tactical targets.
  - **Low Level Light Weight Radars:** Enhance detection of small, low-flying UAVs.
  - **Long Range Guided Rocket Ammunition (Pinaka MRLS):** Improve range and accuracy for high-value targets.
  - **Integrated Drone Detection and Interdiction System (IDD&IS Mk-II):** Strengthen protection of critical assets.
- **Indian Navy:**
  - **Bollard Pull (BP) Tugs:** Assist ships and submarines in berthing and maneuvering.
  - **High Frequency Software Defined Radio (HF SDR) Manpack:** Secure long-range communication for operations.
  - **High Altitude Long Endurance (HALE) RPAS (leased):** Provide persistent ISR for maritime domain awareness.
- **Indian Air Force:**
  - **Automatic Take-off and Landing Recording System:** Enhances aerospace safety.
  - **Astra Mk-II BVR Missiles:** Extend aerial strike capability.
  - **Full Mission Simulators (LCA Tejas):** Improve cost-effective and safe pilot training.
  - **SPICE-1000 Long-Range Guidance Kits:** Boost precision strike capability.

## 5.14. INSV KAUNDINYA: INDIA'S HERITAGE NAVAL VESSEL

**Context:**

- On **December 29, 2025**, the Indian Naval Sailing Vessel (**INSV**) **Kaundinya** embarked on its historic maiden overseas voyage from **Porbandar, Gujarat**, to **Muscat, Oman**.
- This expedition is a landmark effort to rediscover and celebrate India's ancient maritime heritage.

- The project is a unique collaboration under a **tripartite agreement** involving the **Ministry of Culture**, the **Indian Navy**, and **Hodi Innovations**, aimed at **reviving indigenous knowledge systems** and **traditional craftsmanship.**

**What is INSV Kaundinya?**

**INSV Kaundinya** is a pioneering **stitched sailing vessel** built entirely using traditional Indian shipbuilding techniques that date back over two millennia.

- **Historical Inspiration:** The vessel's design is modeled after a **5th-century CE merchant ship** depicted in the murals of the **Ajanta Caves** (specifically **Cave 17**). It also draws from ancient texts like the **Yuktikalpataru** (attributed to **King Bhoja, 11th century CE**).
- **Engineering Marvel:** Unlike modern ships, it is an **engineless vessel** that relies purely on wind and sails. It uses no metal nails or fasteners, representing a "**living experiment**" in ancient naval architecture.
- **Cultural Symbols:** The ship incorporates several motifs of civilisational significance:
  - **Gandabherunda:** A mythical two-headed eagle, the royal symbol of the **Kadamba dynasty** (and later the **Vijayanagara** and **Wodeyar dynasties**).
  - **Simha Yali:** A mythical lion-like creature sculpted on the bow.
  - **Harappan-style Stone Anchor:** A functional replica of anchors used during the **Indus Valley Civilization**.
  - **Sun Motifs:** Adorning the cotton sails, representing energy and cosmic order.

**The Tankai Method: Ancient Shipbuilding Technology**

The construction of INSV Kaundinya utilized the **Tankai Method**, a 2,000-year-old indigenous shipbuilding practice once prevalent across the Indian Ocean littoral.

- **Stitched Plank Technique:** Wooden planks (Teak and Sal) are painstakingly stitched together using **coconut coir rope** instead of metal nails.
- **Natural Sealants:** The seams are made watertight using a mixture of **natural resins, cotton fibre, and fish oil**.
- **Structural Flexibility:** In the Tankai method, the **hull is built first**, and the ribs are added later. This provides the ship with immense flexibility, allowing it to absorb wave energy and navigate shallow shoals without sustaining the rigid damage common in metal-fixed hulls.
- **Durability:** The absence of metal prevents corrosion in saline environments, traditionally making these ships easier to maintain for long-distance oceanic travel.

**Legendary Mariner: Who was Kaundinya?**

The vessel is named after **Kaundinya I**, a legendary Indian mariner and merchant believed to have sailed from India to the Mekong Delta around the **1st century CE**.

- **Historical Impact:** According to Southeast Asian and Chinese chronicles, Kaundinya married the local warrior **Queen Soma** and co-founded the **Kingdom of Funan** (in **modern-day Cambodia** and **Vietnam**).
- **Cultural Bridge:** This union marked the beginning of "Indianised" states in Southeast Asia. The **Khmer and Cham dynasties** trace their origins to this legendary figure.
- **Significance:** He represents the earliest documented Indian mariner to have established profound global, cultural, and political ties through maritime enterprise.

**Significance of the Voyage**

- **Maritime Diplomacy:** The voyage to **Oman (Muscat)** strengthens bilateral ties by celebrating shared maritime history between the western coast of India and the Arabian Peninsula.
- **Indigenous Knowledge Systems (IKS):** The project revives the fading skills of traditional shipwrights, particularly those from **Kerala** (led by master shipwright **Babu Sankaran**).
- **Naval Architecture Validation:** The Indian Navy oversaw the technical validation, using hydrodynamic testing (with support from **IIT Madras**) to ensure a 5th-century design could safely navigate modern open oceans.

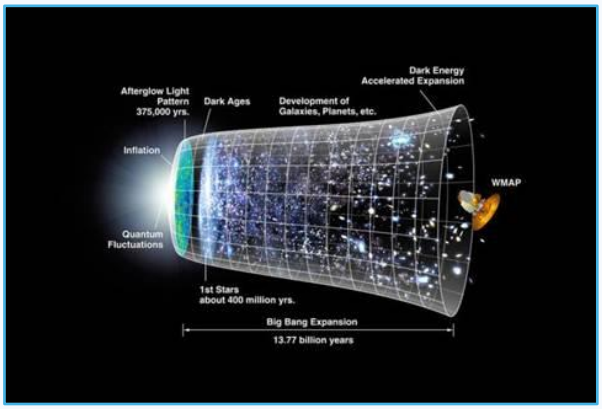
**Soft Power Projection:** It positions India as a historically rooted maritime power, showcasing civilizational continuity in the **Indian Ocean Region (IOR)**.

## 5.15. DARK ENERGY: THE COSMIC EXPANSION MYSTERY

**Context:**

- Recent findings from **Yonsei University** (South Korea) have challenged the long-standing **"Standard Model"** of cosmology **(Lambda-CDM).**
- While the **2011 Nobel Prize in Physics** was awarded for proving that the universe's expansion is accelerating, this new study suggests that **dark energy may be weakening**.
- According to the researchers, the **universe** might have already entered a **decelerated phase** of expansion.
- This discovery, supported by data from the **Dark Energy Spectroscopic Instrument (DESI)**, suggests that the **"Standard Candles" (Type Ia Supernovae)** used to measure **cosmic distances may be affected by the age of their parent stars**, potentially altering our understanding of the universe's ultimate fate—shifting from a **"Big Freeze"** (endless accelerated expansion) to a possible **"Big Crunch"** (collapse).

**Understanding Dark Energy: The Basics**




- **Dark energy** is a **hypothetical and poorly understood form of energy** that constitutes the **largest component of the universe**.
- It is believed to be **responsible for the accelerated expansion of the universe**, as inferred from astronomical observations of distant galaxies and supernovae.
- Observational cosmology indicates that:
  - **Dark energy forms approximately 68% of the universe**.
  - **Dark matter contributes about 27%**.
  - **Ordinary (baryonic) matter accounts for less than 5%**, including stars, planets, gas, dust, and all matter detectable by telescopes.

- These proportions are supported by data from the **Cosmic Microwave Background (CMB)**, **galaxy clustering**, and **Type Ia supernova studies**.

**Key Features of Dark Energy**

- **Driver of Cosmic Acceleration:** Dark energy acts like a **repulsive force** on cosmic scales, working against gravity. This causes galaxies to move away from each other faster over time, leading to the **accelerated expansion of the universe**.
- **Relationship with Space:** Dark energy shows that **space is not empty**, but a dynamic medium that can store energy. Unlike matter or radiation, its **energy density does not decrease** as the universe expands, making dark energy more dominant over time.
- **Influence of Different Energy Forms:** The universe's expansion history depends on which form of energy dominates at a given period:
    - **Radiation:** Dominated the early universe, driving rapid expansion.
    - **Matter:** Slowed expansion due to gravitational attraction.
    - **Dark Energy:** Currently drives accelerated expansion.

      Each form of energy affects the **geometry and evolution of spacetime** differently.
- **Dominance in the Cosmic Energy Budget:** Dark energy makes up about **68% of the universe's total energy**. Its interaction with **dark matter (27%)** and **ordinary matter (5%)** governs the **large-scale structure, stability, and evolution of the cosmos**.
- **Impact on the Universe's Fate:** The **strength and behavior** of dark energy are critical in determining the future of the universe:
    - Very strong dark energy could push galaxies beyond what we can observe.
    - Weakening or negative dark energy could slow expansion or even lead to **cosmic contraction**.
- **Extreme Diluteness:** Although it dominates the universe, dark energy is **incredibly sparse locally**, almost undetectable in small volumes. Yet, across vast cosmic distances, its cumulative effect is decisive in shaping the universe's expansion.

**Observational Evidence for Dark Energy**

- **Hubble's Discovery (1920s): Edwin Hubble** showed that galaxies are moving away from each other, proving that the universe is **expanding**.
- **Type Ia Supernova Observations (1998):** Astronomers observed **distant Type Ia supernovae** to be **dimmer than expected**, indicating that the universe's expansion has **accelerated over time**.
- **Nobel Prize in Physics (2011): Saul Perlmutter**, **Brian Schmidt,** and **Adam Riess** were awarded for using **Type Ia supernovae as standard candles** to establish the accelerated expansion of the universe.
- **Dark Energy in the ΛCDM Model:**
    - **$\lambda$ (Lambda):** Represents the **cosmological constant**, associated with dark energy.
    - **CDM (Cold Dark Matter):** Explains the formation of galaxies and **large-scale cosmic structures**.
    - The $\lambda$CDM model assumes that **dark energy density is constant** over time, driving the accelerated expansion.

## 5.16. INS VAGHSEER: SIXTH KALVARI-CLASS SUBMARINE OF THE INDIAN NAVY

**Context:**

- Recently, **President Droupadi Murmu** undertook a **dive sortie aboard the Indian Navy's indigenous Kalvari-class submarine INS Vagsheer** at the **Karwar Naval Harbour** in **Karnataka.**
- With this embarkation, she became the **second President of India after Dr. A.P.J. Abdul Kalam** to undertake a submarine sortie.

**Overview of INS Vagsheer**

- **Class & Project:** Sixth submarine of the **first batch of six Kalvari-class (Scorpene-class) submarines**, built under **Project-75**.
- **Naming:** Named after the **Vagsheer (sandfish)**, a lethal deep-sea predator of the **Indian Ocean**, continuing the tradition of naming submarines after sea creatures.
- **Commissioning Sequence:** Joins its sister vessels:
  - **INS Kalvari:** December 2017
  - **INS Khanderi:** September 2019
  - **INS Karanj:** March 2021
  - **INS Vela:** November 2021
  - **INS Vagir:** January 2023
  - **Builder:** Constructed by **Mazagon Dock Shipbuilders Limited (MDL)** through **French technology transfer**.

**About Project-75**

- Under **Project-75**, India is manufacturing **Scorpene-class submarines**, based on French design.
- These submarines are powered by **diesel-electric propulsion systems**.
- Additionally, they are designed to incorporate an **indigenously developed Air-Independent Propulsion (AIP) system**, which enables **non-nuclear submarines to stay submerged for extended durations**, enhancing stealth and operational endurance.

**Key Features and Capabilities of INS Vagsheer**

**Dimensions & Performance:**

- **Length**: 67.5 metres
  - **Submerged speed**: 20 knots
  - **Maximum diving depth**: 350+ metres
  - **Endurance:** up to 50 days at sea
- **Stealth & Design:**
  - Incorporates **advanced stealth technologies**, **reduced radiated noise**, and **sophisticated hydrodynamic design**.
  - Considered **one of the quietest submarines globally**, enhancing covert operations.
- **Armament:**

- Equipped with **torpedoes**, **anti-ship missiles**, and **mine-laying capabilities**.
- Excels in **anti-surface and anti-submarine warfare**, as well as **intelligence gathering and surveillance**.

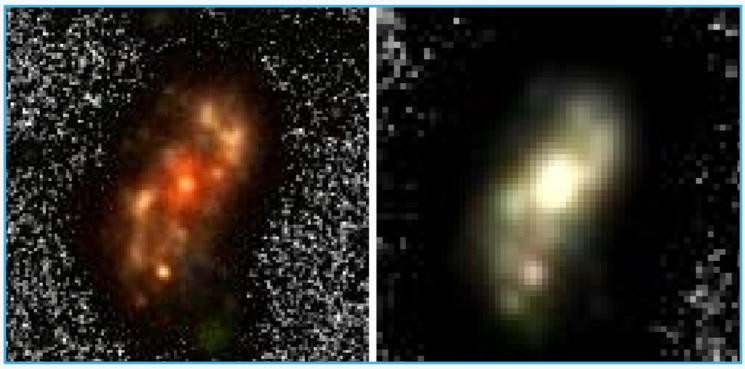
- **Indigenous Systems:**
  - Features domestically developed **air-conditioning plant**, **internal communication network**, and **Ku-Band SATCOM system**.
  - Fitted with an **anti-torpedo countermeasure system** for enhanced survivability.
- **Crew Capacity:**
  - **8 officers** and **35 sailors**, allowing efficient operation of complex onboard systems.

**Significance of INS Vaghshefor Indian Navy and Strategic Perspective**

- **Enhances Undersea Warfare Capability:** Strengthens the Indian Navy's ability to conduct **anti-submarine and anti-surface operations**, improving **maritime security** in the Indian Ocean Region (IOR).
- **Strategic Deterrence:** Adds to India's **submarine-based deterrence**, ensuring credible **underwater combat readiness** against regional threats.
- **Indigenous Defence Manufacturing:** Demonstrates **Make in India** success, as it is **built by Mazagon Dock Shipbuilders Limited (MDL)** using French technology transfer.
- **Intelligence, Surveillance, and Reconnaissance:** Equipped with advanced sensors and communication systems, enhancing **covert surveillance and intelligence gathering** capabilities.
- **Operational Readiness and Fleet Modernization:** Completes the **Kalvari-class submarine fleet**, providing a **state-of-the-art, stealthy platform** that improves the Navy's **long-term operational preparedness** and versatility.

## 5.17. ALAKNANDA: AN EARLY SPIRAL GALAXY IN THE YOUNG UNIVERSE

**Context:**



- **Recently**, Indian astronomers discovered an **implausibly old and distant spiral galaxy**, named **Alaknanda**, using observations from **NASA's James Webb Space Telescope (JWST)**.
- The discovery is notable because Alaknanda formed when the universe was only about **1.5 billion years old (around 10% of its current age)**, a period when existing **galaxy formation models do not predict the presence of fully developed spiral galaxies**.

**Discovery and Research Background of Alaknanda**

- **Discovered by**: A team of Indian astronomers at the **National Centre for Radio Astrophysics (NCRA), Pune**.
- **Global context**: Alaknanda is identified as the **second farthest known spiral galaxy**.

**Location, Distance, and Cosmic Age of Alaknanda**

- **Distance from Earth**: Approximately **12 billion light-years**.

- **Epoch of formation**: Around **1.5 billion years after the Big Bang**.
- **Redshift**: Approximately **z ≈ 4**, indicating that the galaxy is observed as it existed in the early universe due to the stretching of light to longer wavelengths.
- **Evolutionary context**: Alaknanda formed when the **Milky Way itself was only about 10% of its present age**.

**Naming and Cultural Context of Alaknanda**

- The galaxy is named **Alaknanda** after the **Alaknanda River**, a major **Himalayan river** and **tributary of the Ganga**.
- The naming also reflects its association with **Mandakini**, the Hindi name traditionally used for the **Milky Way**, which is itself a spiral galaxy.
- The name symbolically represents Alaknanda as a **distant counterpart of the Milky Way**.

**What is a Spiral Galaxy?**

- **Spiral galaxies** are flattened, rotating systems composed of **stars, gas, and dust**, arranged in distinct spiral arms extending outward from a central region.
- They are often rich in **hot, young, luminous stars**, particularly along their spiral arms, which makes them visually striking.

***

## UPSC PRELIMS PRACTICE QUESTIONS

Q. With respect to the orbital mechanics of the Artemis II mission, consider the following statements:

I. Artemis II is NASA's first crewed Artemis mission, performing a lunar flyby to test Orion's deep-space systems.
II. Space Launch System (SLS) the sole rocket designed to launch Orion, astronauts, and heavy cargo to the Moon in one mission.
III. The mission profile involves a high-speed atmospheric reentry at speeds exceeding Mach 50.

Which of the statements given above are correct?

(a) I and II only
(b) II and III only
(c) I and III only
(d) I, II, and III

**Ans. (a)**

**Explanation:**

**Statement I is correct:** Artemis II is NASA's first human spaceflight mission under the Artemis program, featuring a lunar flyby (without landing) to evaluate deep-space systems with astronauts on board the Orion spacecraft.

**Statement II is correct:** The SLS is the only rocket that can launch Orion, four astronauts, and heavy cargo to the Moon in one go.

**Statement III is incorrect:** Orion will enter Earth's atmosphere at 25,000 mph (Mach 32), testing the resilience of its advanced heat shield against temperatures reaching 2,800°C.

Q. With respect to the technical architecture of the C-295, consider the following statements:

I. The aircraft is equipped with the Fully Integrated Tactical System (FITS) for enhanced mission control.
II. The project establishes the first private-sector-led final assembly line for military aircraft in India.

Which of the statements given above is/are correct?

(a) I only
(b) II only
(c) Both I and II
(d) Neither I nor II

**Ans. (c)**

**Explanation:**

**Statement 1 is correct:** The C-295 is equipped with the Fully Integrated Tactical System (FITS). This is a modular, high-tech mission system that integrates data from various sensors (such as radars and electro-optical sensors) onto a common interface. It allows the crew to monitor and control complex missions like maritime surveillance, search and rescue, and environmental monitoring in real-time.

**Statement 2 is correct:** The C-295 program is a landmark in Indian defense manufacturing. It marks the first time a private-sector company (Tata Advanced Systems Limited) has established a Final Assembly Line (FAL) for military aircraft in India. Under the deal, while the first 16 aircraft are delivered from Spain, the remaining 40 will be manufactured and assembled at the Vadodara facility.

Q. With respect to Tensor Processing Units (TPUs), consider the following statements:

1. They are classified as Application-Specific Integrated Circuits (ASICs) designed to optimize deep learning workloads.
2. TPUs are less energy-efficient than Graphics Processing Units (GPUs) when processing massive datasets.
3. The architecture of a TPU is specifically optimized for tensor computations and matrix-heavy operations.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2, and 3

**Ans. (c)**

**Explanation:**

**Statement 1 is correct:** A TPU is a custom Application-Specific Integrated Circuit (ASIC). Unlike general-purpose chips, ASICs are hardwired for a specific task—in this case,

accelerating the stages of machine learning (training and inference).

**Statement 2 is incorrect:** TPUs are generally more energy-efficient than GPUs for massive AI datasets. Because they are stripped of the hardware required for non-AI tasks (like graphics rendering or general logic), they achieve a significantly higher performance-per-watt ratio.

**Statement 3 is correct:** The TPU architecture features specialized Matrix Multiplication Units (MXUs). It uses a "systolic array" design that allows it to process tensors (multidimensional arrays) with high throughput and minimal memory access.

Q. Consider the following statements regarding Guillain-Barré Syndrome:

1. Guillain-Barré Syndrome is an autoimmune disorder that affects the peripheral nervous system.
2. Guillain-Barré Syndrome is caused by direct viral invasion of the brain.
3. Ascending muscle weakness is a typical feature of Guillain-Barré Syndrome.
4. Plasmapheresis is used in the treatment of Guillain-Barré Syndrome.

Which of the statements given above are correct?

(a) 1 and 3 only
(b) 1, 3 and 4 only
(c) 2 and 4 only
(d) 1, 2, 3 and 4

**Ans. (b)**

**Explanation:**

**Statement 1: Correct –** Guillain-Barré Syndrome is an autoimmune disorder of the peripheral nervous system.

**Statement 2: Incorrect –** The disease is immune-mediated and not caused by direct viral invasion of the brain.

**Statement 3: Correct –** Ascending muscle weakness is a hallmark feature of the disease.

**Statement 4: Correct –** Plasmapheresis is an established treatment option.

Q. With reference to the Man Portable Anti-Tank Guided Missile (MPATGM), consider the following statements:

1. MPATGM is a third-generation anti-tank guided missile system developed indigenously by DRDO.
2. It uses Fire-and-Forget technology and does not require operator guidance after launch.
3. The missile is guided by a laser beam riding guidance system.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

**Ans. (a)**

**Explanation:**

**Statement 1 is correct:** The Man Portable Anti-Tank Guided Missile (MPATGM) is a third-generation anti-tank guided missile that has been indigenously developed by the Defence Research and Development Organisation (DRDO).

**Statement 2 is correct**: MPATGM employs Fire-and-Forget technology, which allows the missile to autonomously guide itself to the target after launch, thereby eliminating the need for operator guidance and enhancing battlefield survivability.

**Statement 3 is incorrect:** The MPATGM is not guided by a laser beam riding system. Instead, it uses an Imaging Infrared (IIR) homing seeker for target acquisition and guidance.

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# CULTURE

## 6.1. THIRUVALLUVAR

**Context:**

- Recently, the Prime Minister of India paid homage to saint-poet Thiruvalluvar on Thiruvalluvar Day, which is celebrated annually in Tamil Nadu as part of the Pongal festivities to honour his contributions.
- **Statue of Wisdom:** In early 2025, the Tamil Nadu government marked the 25th anniversary of the 133-foot Thiruvalluvar Statue in Kanyakumari by officially naming it the **"Statue of Wisdom."**
- **Global Recognition:** Recent initiatives include the establishment of a **Thiruvalluvar Chair** at the University of Houston (USA) and the release of the **Tok Pisin translation** of the Thirukkural in Papua New Guinea by the Prime Minister.

**Who is Thiruvalluvar?**

- Thiruvalluvar was an **ancient Tamil poet-philosopher**.
- Traditionally dated between **3rd century BCE and 1st century CE** (exact period debated).
- Considered a **moral philosopher rather than a religious preacher**.
- Revered across **religions and regions** in India.

**Major Work- Tirukkural**

- Tirukkural is a **classical Tamil text** authored by Thiruvalluvar.
- Consists of **1,330 couplets (kurals)**.
- Written in **Kural Venba metre**.
- Each couplet contains **two lines**.

**Structure of Tirukkural**

Tirukkural is divided into **three parts**:

a. **Aram (Virtue / Ethics)**
   1. Deals with moral values, righteousness, and duties.
   2. Contains **38 chapters**.

b. **Porul (Wealth / Polity)**
   1. Focuses on governance, statecraft, economy, and social life.
   2. Contains **70 chapters**.

c. **Inbam (Love / Desire)**
   1. Discusses love, family life, and emotions.
   2. Contains **25 chapters**.

**Philosophical Significance**

- Emphasizes **universal ethics** rather than sectarian beliefs.
- Avoids references to any **specific religion or deity**.

- Applicable to **individual conduct, governance, and society**.
- Often compared with:
  - **Arthashastra** (statecraft)
  - **Manusmriti** (ethics)
  - **Bhagavad Gita** (moral philosophy)

**Language and Style**

- Written in **pure classical Tamil**.
- Known for **brevity, clarity, and universality**.
- Translated into **many Indian and foreign languages**.
- One of the most translated non-religious texts in the world.

**Cultural Importance**

- Thiruvalluvar is regarded as a **cultural icon of Tamil civilization**.
- Statues and institutions named after him across India.
- Tirukkural is considered part of **Tamil Sangam literature (post-Sangam period)**.
- Frequently quoted in **administration, ethics, and public life**.

## 6.2. SAVITRIBAI PHULE

**Context:**

- Recently, the Prime Minister paid tribute to Savitribai Phule on her birth anniversary, remembering her as a pioneering reformer dedicated to social transformation through education and service.

**About Savitribai Phule**

**Early Life**

- Born on January 3, 1831, in Naigaon, Maharashtra, into the Mali caste, considered a lower social class.
- Married at age 9 to social reformer Jyotirao Phule, who supported her education in reading, writing, and arithmetic.

**Pioneering Role in Education**

- **First female teacher in India** and co-founder of the first girls' school in **Pune** (1848), promoting education for girls.
- Focused on educating **marginalized communities** with practical learning, moral education, and fostering confidence and critical thinking.

**Social Reform Work**

- **Challenged caste discrimination** and advocated for social equality and upliftment of the oppressed.
- **Supported widows** and abandoned women through shelters, education, and vocational training.
- **Opposed child marriage** and promoted women's empowerment through social and educational participation.

- Savitribai Phule started **Mahila Seva Mandal** in 1852, which worked for raising women's consciousness about their human rights, dignity of life and other social issues.
- She is also considered a pioneer of **India's feminist movement.**

**Literary Contributions**

- Savitribai Phule used poetry and writings to raise social consciousness, inspire education, and fight oppression.
- Her writings often highlighted injustice, caste discrimination, and gender inequality.
- Savitribai's literary contributions include **Kavya Phule (1854) and Bavan Kashi Subhodh Ratnakar (1892).**

## 6.3. SOMNATH TEMPLE: HISTORY, DESTRUCTION AND REVIVAL

**Context:**

- The Prime Minister of India highlighted the millennium-long continuity and resilience of the Somnath Temple, marking **one thousand years** since its destruction during Mahmud of Ghazni's invasion in 1026 CE.
- He also highlighted, **Ahilyabai Holkar's** role in restoring temples like Somnath and Kashi Vishwanath, and recalled **Swami Vivekananda's** view that such temples embody India's history and spirit more deeply than written texts.

**Somnath Temple: Key Facts & Historical Significance**

1. **Location & Identity**
   - Located at **Prabhas Patan**, near Veraval, in Gir Somnath district, Gujarat
   - Dedicated to Lord Shiva.
   - Revered as the first of the 12 Jyotirlingas of Shiva
   - Situated at the confluence of **sacred Triveni Sangam**, the confluence of **the Kapila, Hiran, and the mythical Saraswati rivers (Arabian coast)**
2. **Religious & Cultural Importance**
   - One of Hinduism's most sacred pilgrimage sites
   - Mentioned in several ancient texts, including:
     - Skanda Purana
     - Shiva Purana
     - Bhagavata Purana
   - Symbolises Shaivite tradition and India's civilizational continuity.
3. **Etymology & Symbolism**
   - "Somnath" means "**Lord of the Moon**"
   - Legend: Moon God (Soma) worshipped Shiva here to regain his lost radiance.
4. **Ancient History**
   - Believed to have existed since **ancient times**, possibly pre-Mauryan era

- The shore temple of Somnath is believed to have been built in **4 phases**-in gold by Lord Soma, in silver by Ravi, in wood by lord Krishna and in stone by King Bhimadeva.
- The first temple at the site, dedicated to Soma (the Moon God), is believed to have been built by the **Chaulukya (Solanki)** king Mularaja sometime before 997 CE.

5. **Attacks & Destruction**
   - **1026 CE**: The site was invaded and plundered by **Mahmud of Ghazni during the reign of Bhima I.**
   - The raid of 1026 by Mahmud is confirmed by the 11th-century Persian historian **Al-Biruni.**
   - The temple was repeatedly destroyed and rebuilt over centuries.
   - Subsequent destructions occurred during:
   - Delhi Sultanate period: Khalji's Invasion
   - Mughal era (notably under Aurangzeb)
6. **Reconstruction & Resilience**
   - Rebuilt multiple times by Hindu rulers and devotees
   - Major restorations associated with:
   - **Chalukyas: Kumarpala**
   - **Chudasama dynasty: Mahipala I**
   - **Marathas: Ahilyabai Holkar**
7. **Modern Reconstruction (Present Structure)**
   - Present temple reconstructed in **Chaulukya (Solanki) style**
   - Reconstruction initiated after independence:
   - **Sardar Vallabhbhai Patel** played a key role.
   - Inaugurated by **Dr. Rajendra Prasad**, India's first President.
8. **Temple Architecture**
   - The present temple is a **Māru-Gurjara architecture** (also called Chaulukya or Solanki style) temple.
   - The new Somnath temple is intricately carved, two level temple with pillared mandapa and 212 relief panels.
   - **A notable inscription** (The **Baan Stambh )** states that from the temple's southern arrow, there is **no landmass** till the South Pole, symbolizing cosmic alignment.
9. **National & Intellectual Significance**
   - **Swami Vivekananda** visited Somnath in the 1890s.
   - In his **1897 Chennai lecture**, he stated:
   - "Temples like Somnath reveal India's history and spirit more than books"

## 6.4. SANGITA KALANIDHI AWARD

**Context:**

- Recently, **violinist R.K. Shriramkumar** was conferred the prestigious **Sangita Kalanidhi Award** by the **Madras Music Academy** during the annual Sadas.

- The award ceremony highlighted the continued emphasis on excellence and dedication in **Carnatic music**, with veteran Hindustani violinist **N. Rajam** encouraging students to pursue continuous practice and **rigorous sadhana** to achieve mastery.
- The event also recognized other eminent musicians with awards such as **Sangita Kala Acharya**, **TTK Award**, and musicologist honors, emphasizing the Academy's role in promoting classical music.

**About the Sangita Kalanidhi Award**

- The **Sangita Kalanidhi Award** is regarded as the **highest honour in Carnatic music**.
- It is conferred annually by the **Madras Music Academy**, one of India's premier institutions for the promotion and preservation of classical music.
- The award includes a **gold medal** and a **birudu patra (citation)** recognizing outstanding contributions to Carnatic music.
- The Academy itself has a historical legacy, originating from the **All India Congress Session held in Madras in 1927**, and has since been a landmark institution in the fine arts.

**Significance of the Sangita Kalanidhi Award**

- Recognizes musicians who have made **exceptional contributions to Carnatic music**, both as performers and teachers.
- Encourages **rigorous practice, mastery of technique, and innovation** in the field of classical music.
- Strengthens the **cultural and artistic heritage** of southern India.

**About Carnatic Music**

- **Carnatic music** is the classical music tradition of southern India, primarily practiced in **Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, Telangana**, and also in **Sri Lanka**.
- It is one of the two main streams of Indian classical music, the other being **Hindustani music**, which evolved in northern India under Persian and Islamic influences.
- Carnatic music emphasizes **composition-based performance**, intricate **rhythmic patterns**, and **raga-based improvisation**.
- Its repertoire includes **keertanas, varnams, and kritis**, with contributions from composers like **Muthuswami Dikshitar, Tyagaraja, and Syama Sastri**.

**About Hindustani Music**

- **Hindustani music** is the classical music tradition of northern India, prevalent in regions where **Indo-Aryan languages** are spoken.
- It evolved over centuries, influenced by **Persian, Islamic, and Mughal cultural traditions**.
- Hindustani music emphasizes **improvisation**, with performances organized around **ragas** and **talas**, and includes genres like **khayal, dhrupad, thumri**, and instrumental music.

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## UPSC PRELIMS PRACTICE QUESTIONS

Q. Consider the following statements regarding Thiruvalluvar and Tirukkural:

1. Tirukkural is written in Kural Venba metre and consists of 1,330 couplets.
2. Tirukkural is divided into four parts dealing with ethics, wealth, love, and liberation.
3. Thiruvalluvar's philosophy is secular in nature and avoids explicit religious references.
4. Tirukkural primarily focuses on devotional themes and religious rituals.

Which of the statements given above are correct?

(a) 1 and 3 only
(b) 1, 2 and 3 only
(c) 2 and 4 only
(d) 1, 3 and 4 only

Ans. (a)

**Explanation:**

**Statement 1 – Correct**

Tirukkural consists of 1,330 couplets written in the Kural Venba metre.

**Statement 2 – Incorrect**

Tirukkural has three parts (Aram, Porul, Inbam), not four; it does not explicitly deal with Moksha.

**Statement 3 – Correct**

Thiruvalluvar's work is secular and universal, avoiding explicit religious or sectarian references.

**Statement 4 – Incorrect**

Tirukkural focuses on ethics, governance, and love, not devotional rituals.

Q. Who among the following social reformers revered Shivaji in one of her poems, referring to Shivaji- "Aao suraj ki pehli kiran mein yaad karein Shudron-Asprishyon ke masiha, Chhatrapati Shivaji ko. Wah masiha hain – unhein vinamra shraddhanjali."

(a) Savitribai phule
(b) Annie Besant
(c) Rani Rashmoni
(d) Mahalakshmi Sarada Devi

**Ans. (a)**

**Explanation:**

Although the links between Shivaji and the Phule couple remain underexplored, some scholars briefly introduced Savitribai Phule's literary contributions, highlighting her reverence for Shivaji. In one of her poems, she refers to him: "Aao suraj ki pehli kiran mein yaad karein Shudron-Asprishyon ke masiha, Chhatrapati Shivaji ko. Wah masiha hain – unhein vinamra shraddhanjali."

Q. Consider the following statements about the Somnath Temple:

1. The present temple is built in the Chaulukya (Solanki) style of architecture.
2. The Baan Stambh inscription reflects ancient Indian geographical knowledge, noting no landmass between Somnath and the South Pole.
3. Literary references to Somnath are entirely absent in early classical Sanskrit sources.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

**Ans. (a)**

**Explanation:**

**Statement 1 is correct:** The Somnath Temple in Gujarat, India, whose current structure, rebuilt after numerous destructions, follows the Māru-Gurjara or Chaulukya (Solanki) style of Hindu temple architecture, noted for its intricate carvings, grand shikhara (spire), and elements like Surya-kunds (sun tanks).

**Statement 2 is correct:** A notable inscription (The Baan Stambh) states that from the temple's southern arrow, there is no landmass till the South Pole, symbolizing cosmic alignment.

**Statement 3 is incorrect:** The Somnath Temple is indeed mentioned in ancient Hindu texts like the Skanda Purana, Shiva Purana, and Bhagavata Purana (also called Srimad Bhagvat), highlighting its immense spiritual significance as the first of the 12 Jyotirlingas, dedicated to Lord Shiva as "Lord of the Moon,"

Q. Consider the following statements with reference to the Sangita Kalanidhi Award:

1. The Sangita Kalanidhi Award is the highest honour in Carnatic music.
2. It is conferred annually by the Madras Music Academy.
3. The award is given for excellence in Hindustani music.
4. The award includes a gold medal and a birudu patra (citation).

Which of the statements given above is/are correct?

(a) 1, 2, and 4 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) All of the above

**Ans. (a)**

**Explanation:**

**Statement 1: Correct –** The Sangita Kalanidhi Award is regarded as the highest honour in Carnatic music, the classical music tradition of southern India.

**Statement 2: Correct –** The award is conferred annually by the Madras Music Academy, one of India's premier institutions promoting classical music.

**Statement 3: Incorrect –** The award is not for Hindustani music, which is the classical tradition of northern India.

**Statement 4: Correct –** Recipients of the award receive a gold medal and a birudu patra (citation) recognizing their contributions to Carnatic music.

**Scan to attempt more questions**

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# MISCELLANEOUS

## 7.1. SAMAGRA SHIKSHA 3.0: REFORMING SCHOOL EDUCATION FOR VIKSIT BHARAT 2047

**Context:**


- The Union Education Minister recently chaired a consultative meeting with State representatives and education experts to discuss the next phase of the **Samagra Shiksha programme (Samagra Shiksha 3.0)**.
- Key discussions included **curriculum equivalence across State boards, integration of Artificial Intelligence (AI) in classrooms**, and enhancing **school governance, teacher capacity, and student learning outcomes**.
- The initiative aligns with the long-term vision of **Viksit Bharat by 2047** and aims to achieve **100% school enrolment, holistic student development, and improved learning outcomes**.
- **Launched:** 2018, by **integrating Sarva Shiksha Abhiyan (SSA), Rashtriya Madhyamik Shiksha Abhiyan (RMSA), and Teacher Education (TE) schemes**.
- **Objective:** To provide a **holistic, unified framework for school education** from **pre-primary to Class 12**.
- **Administered by: Ministry of Education** (earlier the **Ministry of Human Resource Development**, through the **Department of School Education and Literacy**.
- **Focus: Inclusive access, equity, quality education, and improved learning outcomes**.
- **Special Programmes:** This includes the **NIPUN Bharat Programme**, which focuses on strengthening **foundational literacy and numeracy** for children **aged 3–9 years**, and the **Kasturba Gandhi Balika Vidyalayas (KGBVs)**, which provide education for girls from **Classes 6 to 12**, along with **stipends and self-defence training**.
    - In June 2021, the **Ministry of Education** introduced the **NIPUN Bharat Programme** as part of the Samagra Shiksha scheme.

**Funding Pattern of Samagra Shiksha Scheme**

- **Centrally Sponsored Scheme:** Shared responsibility between Centre and States.
    - **States/UTs with Legislature:** 60:40 (Centre 60%, State 40%).
    - **North-Eastern & Himalayan States:** 90:10 (Centre 90%, State 10%).
    - **UTs without Legislature:** 100% funded by Centre.

**Samagra Shiksha 2.0: Key Features**

- **Comprehensive Coverage:** The scheme integrates **school education from pre-primary to senior secondary levels** under a single framework, ensuring a holistic approach to education.
- **Unified Implementation:** It replaces earlier fragmented schemes like SSA, RMSA, and Teacher Education programs, promoting **better coordination, planning, and execution** across all levels of school education.
- **Infrastructure Development:** Focuses on improving physical and digital infrastructure, including **classrooms, laboratories, ICT labs, smart classrooms, libraries, sanitation facilities, and transportation** for students.

- **Teacher Training and Capacity Building:** Emphasises **continuous professional development** for teachers through SCERTs and DIETs, incorporates **pedagogical reforms**, and provides **leadership training** for school heads.
- **Digital Education:** Promotes **technology integration in classrooms**, including platforms like **DIKSHA**, ICT tools, and **Artificial Intelligence (AI)** to enhance learning outcomes and make education more interactive.
- **Equity and Inclusion:** Prioritises support for **girls, children with disabilities (CwSN), SC/ST students**, and learners in **Educationally Backward Blocks (EBBs), Left Wing Extremism (LWE) affected areas** as well as **border and aspirational districts**, in line with the national development principle of **"Sabka Saath, Sabka Vikas."**
- **Vocational Training:** Introduced from **Class 6 onwards**, providing students early exposure to **practical skills** and career-oriented learning.
- **Physical Education and Sports:** Encourages **sports and physical education** by providing financial support for equipment and aligning activities with **Khelo India initiatives** to foster overall development.

## 7.2. ANTI-TERROR CONFRENCE

**Context:**


Union Home Minister Amit Shah inaugurated the **Annual Anti-Terror Conference** organized by the **National Investigation Agency (NIA)** in New Delhi. The two-day conclave brings together operational forces, technical experts, and central agencies to formulate a cohesive defense against national security threats.

**What is the Event?**

- **Organizer:** National Investigation Agency (NIA), under the Ministry of Home Affairs.
- **Chairperson:** Union Home Minister.
- **Participants:** Senior police officers from States, Central agencies (IB, RAW), and experts in law, forensics, and technology.
- **Objective:** To serve as a unified platform for operational forces and technical experts to deliberate on national security and emerging terror threats.

**Key Focus Areas:**

1. **Terror Financing:** Disrupting financial networks by analysing new tools and case learnings (aligning with global standards like FATF).
2. **Hybrid Threats:** Addressing non-traditional security challenges, including espionage and cyber-warfare.
3. **Digital Forensics:** Enhancing capabilities in data analysis and collecting evidence from foreign jurisdictions.
4. **Radicalization:** Strategies to counter online propaganda and recruitment.

**About National Investigation Agency (NIA):**

- **Genesis:** Established under the **NIA Act, 2008**, enacted in the wake of the 26/11 Mumbai terror attacks.
- **Core Mandate:** To investigate and prosecute offences affecting India's **sovereignty, security, integrity**, friendly relations with foreign states, and international treaties.
- **Leadership:** Headed by a **Director-General (DG)**, an officer of the Indian Police Service (IPS).
- **Structure:** Headquartered in **New Delhi**. The agency has expanded to include **18 Branch Offices** across the country (originally included zonal offices in Guwahati & Jammu).

**How extensive is the Jurisdiction & Power?**

- **Territorial Reach:** Extends to the whole of India.
- **Extra-Territorial Jurisdiction:** Applies to:
  - Citizens of India outside the country.
  - Persons in government service globally.
  - Persons on ships and aircraft registered in India.
  - Individuals committing scheduled offences beyond India that affect Indian interests.
- **Investigative Authority:** The Central Government can suo motu direct the NIA to investigate if a Scheduled Offence is committed.
- **Prosecution:** Cases are tried in specially designated **NIA Special Courts**.

**NIA (Amendment) Act, 2019:**

- **Expanded Schedule of Offences:** The amendment added the following to the NIA's investigative scope:
  - Human Trafficking.
  - Counterfeit currency or bank notes.
  - Manufacture or sale of prohibited arms.
  - Cyber-terrorism.
  - Offences under the Explosive Substances Act, 1908.
- **Global Investigation:** Empowered the NIA to investigate scheduled offences committed **outside India**, subject to international treaties and domestic laws of the foreign nation.
- **Special Courts:** Allowed the Central and State Governments to designate **Sessions Courts** as Special Courts for the trial of scheduled offences.

**Recent Capacity Building measures:**

- **Specialized Divisions:** Establishment of two new divisions at HQ:
  - **Human Trafficking.**
  - **Cyber Terrorism, Explosives, and Prohibited Arms.**
- **UAPA Amendment (2019):** Empowered the DG, NIA to **seize/attach properties** representing proceeds of terrorism.
- **Financial Autonomy:** Financial powers delegated to the DG for engaging consultants and experts; consistent increase in fund allocation since 2019-20.

## 7.3. FOOD SAFETY AND STANDARDS AUTHORITY OF INDIA (FSSAI)

**Context:**


- **Recently**, the **Food Safety and Standards Authority of India (FSSAI)** directed food business operators (FBOs) to **stop using the term "tea"** for **herbal infusions and plant-based blends** not derived from Camellia sinensis.
- The regulator clarified that using labels such as **"herbal tea", "rooibos tea", or "flower tea"** amounts to **misbranding and misleading advertising** under the **Food Safety and Standards Act, 2006**.
- The directive applies to **manufacturers, importers, sellers, and e-commerce platforms**, with States asked to ensure strict compliance.

**What is FSSAI?**

- The **Food Safety and Standards Authority of India (FSSAI)** is an **autonomous statutory body** established under the **Food Safety and Standards Act, 2006 (FSS Act)**.
- It functions under the **administrative control of the Ministry of Health and Family Welfare**, Government of India.
- **Headquarters:** New Delhi.
- FSSAI acts as the **apex regulator for food safety**, ensuring the **availability of safe, wholesome, and nutritious food** for human consumption across India.

**Genesis and Evolution of FSSAI**

- The **Food Safety and Standards Act, 2006** was enacted to **consolidate multiple pre-existing food laws**, which were administered across different ministries and departments. These included:
  - **Prevention of Food Adulteration Act, 1954**
  - **Fruit Products Order, 1955**
  - **Meat Food Products Order, 1973**
  - **Vegetable Oil Products (Control) Order, 1947**
  - **Edible Oils Packaging (Regulation) Order, 1988**
  - **Milk and Milk Products Order, 1992**
- All these laws were **repealed** with the enactment of the FSS Act, 2006.
- **FSSAI was formally established in 2008**, but its operations became **fully functional in 2011** after the notification of its **Rules and Regulations**.
- This marked a **shift from multi-level, multi-departmental governance to a single-line regulatory framework**, emphasizing **self-compliance and risk-based regulation**.

**Objectives and Core Mandate of FSSAI**

The primary objectives of FSSAI are:

- To **set science-based food standards** for all food products.
- To **regulate the manufacture, storage, distribution, sale, and import of food items**.

- To **protect public health** by preventing food adulteration and contamination.
- To **promote awareness about safe, healthy, and nutritious food** among citizens.

**Organisational Structure of FSSAI**

- FSSAI is composed of a **Chairperson and 22 members**, with **one-third representation for women**.
- The **Chairperson is appointed by the Central Government**.
- It is supported by **Scientific Committees and Panels** for standard-setting and by a **Central Advisory Committee** for coordination with enforcement agencies.
- **State Food Safety Commissioners** are primarily responsible for enforcement at the state level.

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## UPSC PRELIMS PRACTICE QUESTIONS

Q. With reference to the Samagra Shiksha scheme, consider the following statements:

1. Samagra Shiksha was launched by integrating Sarva Shiksha Abhiyan (SSA), Rashtriya Madhyamik Shiksha Abhiyan (RMSA), and Teacher Education (TE) schemes.
2. It covers school education from pre-primary to senior secondary level (Class XII) under a single unified framework.
3. The scheme is implemented exclusively by the State Governments, without any funding contribution from the Centre.
4. The NIPUN Bharat Programme under Samagra Shiksha focuses on strengthening foundational literacy and numeracy for children aged 3–9 years.

Select the correct answer:

(a) 1 and 2 only
(b) 1, 2, and 4 only
(c) 2, 3, and 4 only
(d) All of the above

**Ans. (b)**

**Explanation:**

**Statement 1: Correct –** Samagra Shiksha was launched in 2018 by integrating SSA, RMSA, and Teacher Education schemes.

**Statement 2: Correct –** It covers the full spectrum of school education from pre-primary to Class XII.

**Statement 3: Incorrect –** The scheme is a Centrally Sponsored Scheme, with cost shared between Centre and States (60:40; 90:10 for NE/Himalayan States; 100% for UTs without legislature).

**Statement 4: Correct –** The NIPUN Bharat Programme is part of Samagra Shiksha, targeting foundational literacy and numeracy for children aged 3–9 years.

Q. With respect to the National Investigation Agency (NIA), consider the following statements:

1. The NIA was constituted under the NIA Act, 2008, in the aftermath of the Mumbai terror attacks.
2. The agency has the authority to investigate scheduled offenses committed outside India affecting the interests of India.
3. State Police forces are barred from investigating scheduled offenses once the NIA takes cognisance of a case.

Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 2 only
(c) 1 and 3 only
(d) 1, 2, and 3

**Ans. (a)**

**Explanation:**

Statement 1 is correct: The NIA was established following the 2008 Mumbai attacks under the NIA Act, 2008.

**Statement 2 is correct:** The NIA (Amendment) Act, 2019 empowers the agency to investigate offenses committed outside India.

**Statement 3 is incorrect:** While the NIA takes over specific cases, State Police forces are not "barred" from investigating scheduled offenses in general; they share concurrent jurisdiction until a specific case is transferred to the NIA.

Q. With reference to the Food Safety and Standards Authority of India (FSSAI), consider the following statements:

1. FSSAI was established under the Food Safety and Standards Act, 2006 and became fully operational in 2011.
2. All food sellers and importers in India are exempt from obtaining an FSSAI license if they operate in the unorganised sector.

3. The FSSAI is responsible for setting food standards, licensing food businesses, and accrediting food testing laboratories in India.
4. FSSAI's regulations cover packaging, labeling, organic food, and advertising, but do not include imported foods.

Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 4 only
(d) 1, 3, and 4

**Ans. (b)**

**Explanation:**

**Statement 1 is correct:** FSSAI was established under the Food Safety and Standards Act, 2006, and it became fully functional in 2011 after notification of Rules and Regulations.

**Statement 2 is incorrect:** While small-scale manufacturers and street vendors in the unorganised sector are partly exempted from licensing, not all food sellers and importers are exempt. Imports, in particular, are strictly regulated.

**Statement 3 is correct:** FSSAI is responsible for setting food standards, licensing and registering food businesses, and accrediting laboratories across India.

Statement 4 is incorrect: FSSAI's regulations also apply to imported foods, and it monitors compliance of food imports in addition to domestic food businesses.

**Scan to attempt more questions**

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