Today's Prelims Topics

Mission Sudarshan Chakra – India's Nationwide Air Defence Shield

Context

India has launched Mission Sudarshan Chakra to develop a nationwide, AI-driven air defence shield integrating radars, satellites, and laser weapons to counter emerging aerial threats.

About Mission Sudarshan Chakra

- **Mission Sudarshan Chakra** is a new national initiative aimed at building a **comprehensive, integrated air defence shield** across India.
- The system will integrate 6,000–7,000 radars, 52 surveillance satellites (by 2030), and Directed Energy Weapons (DEWs) into one real-time, networked defence ecosystem.
- **Objective:** To establish a **multilayered, AI-driven, space-linked air defence network** capable of:
    - **Monitoring**, **detecting**, and **tracking** enemy threats beyond visual range.
    - **Identifying** and **neutralising** hostile aircraft, drones, and missiles.
    - Providing **nationwide coverage** beyond military bases, extending to key population centres and strategic installations.

Key Components of the Mission

- **Multi-Layered Defence Architecture:** The shield will combine:
    - **Over-the-Horizon (OTH) Radars:** Capable of tracking targets far beyond the line of sight, deep into enemy territory.
    - **Short-, Medium-, and Long-Range Missile Systems:** For interception at multiple distances.
    - **Anti-Drone Systems and Air Defence Guns:** For close-range and swarm threats.
    - **Directed Energy Weapons (DEWs):** High-powered **laser-based systems** for neutralising aerial targets instantly.
- **Space-Based Surveillance Integration:** Under Phase 3 of the Space-Based Surveillance (SBS) Programme, 52 new surveillance satellites are to be deployed by 2030. These satellites will:
    - Continuously **scan and track** enemy movements from space.
    - Feed data into Sudarshan Chakra's **central AI-driven command network**.
    - **Cue missile or DEW systems** for interception.
- **Massive Radar Network:** Between **6,000 and 7,000 radars** will be deployed across the country. Includes multiple types:
    - **OTH radars** for long-range detection.
    - **Ground-based and mobile radars** for tactical tracking.
    - **Coastal and high-altitude radars** for strategic depth.
    - These will be interlinked through a **centralised command-and-control system** to share data in real time.
- **Integration with Advanced Computing and AI:** The mission will rely heavily on:
    - **Artificial Intelligence (AI)** for real-time threat assessment.
    - **Big Data and Advanced Analytics** for processing massive volumes of sensor data.

- **Quantum Computing and Large Language Models (LLMs)** for predictive threat modelling and automated response systems.

Recent DRDO Achievements

- **DRDO** has successfully tested the **Integrated Air Defence Weapon System (IADWS)** - a key component of Sudarshan Chakra.
  - Combines **QRSAM**, **VSHORADS**, and a **5-kilowatt laser-based DEW**.
  - Provides layered defence against multiple aerial threats.
- Demonstrates India's growing capability in indigenous air defence technologies.

Source: **Indian Express**

Coral Larvae Cryobank

Context

The Philippines has established Southeast Asia's first coral larvae cryobank to preserve and restore coral reefs. This initiative forms part of a regional network of cryobanks across the Coral Triangle.

The Coral Triangle: Global Marine Biodiversity Hotspot

- **Location:** Covers 5.7 million sq. km across Indonesia, Malaysia, Papua New Guinea, the Philippines, Solomon Islands, and Timor-Leste.
- **Biodiversity:**
  - Home to **>75% of the world's coral species**.
  - Contains **1/3 of all reef fish species**, extensive **mangrove forests**, and **6 of 7 marine turtle species**.
- **Socioeconomic importance:** Supports 120 million people, providing food security, livelihoods, and coastal protection.
- **Nickname:** Known as the **"Amazon of the Seas"** due to its immense biological richness.

Threats to Coral Ecosystems

- **Climate Change:** Rising sea surface temperatures cause coral bleaching.
- **Pollution:** From land-based sources, tourism, and waste discharge.
- **Destructive Fishing Practices:** Dynamite and cyanide fishing destroy reef structures.
- **Habitat Loss:** Due to coastal development and sedimentation.

Global coral loss:

- Between **2009 and 2018, 14%** of corals were lost (Status of Coral Reefs of the World, 2020).
- Without strong climate action, 70–90% of live coral cover may disappear by 2050.

Coral Cryobank

- A **Coral Cryobank** is a facility where **coral larvae, eggs, sperm, or fragments** are **preserved at extremely low temperatures** (around –196°C) using **liquid nitrogen**.
- It serves as a **"genetic bank"** that stores coral material for **future reef restoration**, especially after bleaching or other damage.
- **Advantages:**
  - Long-term **genetic preservation** of coral species.
  - Enables **repopulation of reefs** after bleaching events.
  - Acts as a **"genetic insurance policy"** for coral biodiversity.

India's Coral Conservation Efforts

- **Major Coral Regions:** Gulf of Mannar, Gulf of Kachchh, Lakshadweep, Andaman & Nicobar Islands.
- **Key Initiatives:**
  - National Coral Reef Monitoring Network (NCRMN)
  - Integrated Coastal Zone Management (ICZM)
  - Gulf of Mannar Biosphere Reserve Trust (GOMBRT) for coral transplantation
  - Marine Protected Areas (MPAs) – e.g., Gulf of Mannar Marine National Park
- **Global Engagements:** Member of International Coral Reef Initiative (ICRI) and UN Ocean Science Decade (2021–2030).

Source: The Hindu

Dark Stars

Context

Astronomers have recently identified four potential "dark stars" using data from the James Webb Space Telescope (JWST).

About Dark Stars

- Dark stars are theoretical celestial objects that might have formed in the early universe (around 200–400 million years after the Big Bang).
- Unlike ordinary stars powered by **nuclear fusion**, dark stars are thought to be powered by **dark matter annihilation** - a process where dark matter particles collide and release energy.
- **Composition and Structure:**
    - Made mostly of **hydrogen and helium** (like normal stars), but contain a **small amount of dark matter** at their core.
    - Dark matter acts as a **fuel source**, releasing enough heat to prevent the collapse of gas and allowing the star to **grow extremely large**.
    - These stars could reach sizes up to **10 billion times the Sun's luminosity** and **millions of times its mass**, yet remain relatively **cool** (surface temperatures around 10,000 K).

Dark Matter

- **Dark matter** is a mysterious form of matter that doesn't emit light but exerts gravitational effects.
- If composed of WIMPs (Weakly Interacting Massive Particles), they can annihilate each other when they collide, producing high-energy particles and heat.
- This energy supports the star against gravitational collapse, much like fusion does in ordinary stars.

Source: The Hindu

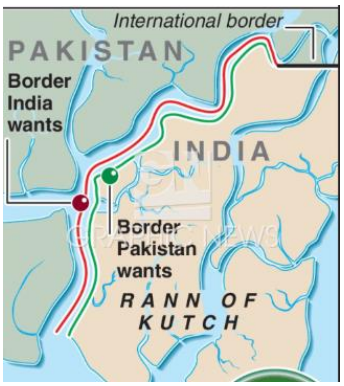
Sir Creek Dispute

Context

Defence Minister Rajnath Singh recently warned Pakistan against any "misadventure" in the Sir Creek sector, highlighting its strategic sensitivity.

About Sir Creek Dispute

Location & Geography



- **Sir Creek i**s a 96-km tidal estuary between Kutch (Gujarat, India) and Sindh (Pakistan), flowing into the Arabian Sea.
- **Terrain:** Marshy, muddy, roadless, sparsely populated, with frequent **monsoon flooding** and venomous wildlife.
- Formerly known as **Ban Ganga**, renamed **Sir Creek** during British colonial rule.
- **Strategic proximity:** Gulf of Kutch ports (Mundra & Kandla) and Pakistan's Karachi.

Historical Background

- Dispute originates from **British India**, when the region was part of the **Bombay Presidency**.
- **Partition 1947:** Sindh went to Pakistan; Kutch remained in India.
- **Early claims:**
    - **India asserts that Sir Creek is navigable** at high tide, making the **Thalweg Principle** applicable.
    - **Pakistan:** Claims entire creek based on **1914 Bombay Government resolution** (eastern bank, Green Line).
    - **1965 India-Pakistan War:** Pakistan claimed over half the **Rann of Kutch**; **1968 tribunal** awarded **90% to India** but left **Sir Creek unresolved**.

Economic Importance

- **Hydrocarbon Potential:** Believed to hold **untapped oil and gas reserves**, vital for India's energy diversification and Pakistan's energy needs.
- **Fishing Grounds:** The region supports **rich marine biodiversity** - livelihoods of thousands of fishermen in **Gujarat and Sindh** depend on it.
- **EEZ (Exclusive Economic Zone) Impact:**
    - The **maritime boundary** at Sir Creek determines the **starting point of EEZ delimitation**.
    - Affects each nation's jurisdiction over **marine and seabed resources** extending up to **200 nautical miles** into the Arabian Sea.

Strategic & Security Importance

- Lies close to **Karachi**, Pakistan's largest city and **naval base**,
- Potential **launchpad for terrorism**: Sir Creek used historically for infiltration (e.g., **2008 Mumbai attacks**).
- Pakistan has developed **military infrastructure** (bunkers, radars, forward bases) in adjacent areas, while India maintains strong military surveillance to deter incursions.
- Its control impacts the **security of India's western coastline and maritime border monitoring.**

Source: Indian Express, The Hindu

National Camel Sustainability Initiative

Context

The Central Government is preparing to launch the National Camel Sustainability Initiative aimed at reversing the steep decline in India's camel population and restoring its ecological and cultural role.

About the National Camel Sustainability Initiative (NCSI):

- It is a **multi-ministerial mission,** involving:
  - Department of Animal Husbandry and Dairying,
  - Ministries of Environment, Rural Development, and Tourism, and
  - **State governments** (especially Rajasthan & Gujarat).
- Developed in consultation with the **Food and Agriculture Organization (FAO)**.
- **Objectives:**
  - Reverse the decline of camels and **restore their ecological, economic, and cultural significance**.
  - Support **pastoral communities** dependent on camels for livelihoods.
  - Promote **conservation alongside regulated trade** and socio-economic development.

Background:

- India's camel population has declined by nearly **75% since 1977.**
- According to the **20th Livestock Census (2019)**, only **2.52 lakh camels** remain, down from **11 lakh in 1977** and **4 lakh in 2013**.
- Around **90%** of India's camels are concentrated in **Rajasthan and Gujarat**.
- Once a symbol of resilience in arid zones, camels are now facing a crisis of survival, threatening the livelihoods of pastoral communities and the ecological balance of desert ecosystems.

Source: Indian Express

News in Shorts

Cyclone Shakti	**News:** The India Meteorological Department (IMD) reported the formation of Cyclone Shakti, the first cyclonic storm of the 2025 season over the Arabian Sea. **About Cyclone Shakti:** ● It is a tropical cyclonic storm that developed in the northeast Arabian Sea, ~340 km west of Dwarka (Gujarat). ● Formed due to low-pressure development over warm Arabian Sea waters in early October 2025. ● It was classified as a Severe Cyclonic Storm (SCS) by the IMD. ● The naming of Cyclone Shakti follows the guidelines of the World Meteorological Organization (WMO) and the ESCAP Panel on Tropical Cyclones. The name "Shakti," proposed by Sri Lanka. **Source:** Times of India
Ram Air Turbine (RAT)	**News:** Recently a Boeing 787-8 flight experienced an unexpected deployment of its Ram Air Turbine (RAT) just before landing. **About Ram Air Turbine (RAT):** ● The **RAT** is a **small wind-powered turbine** stored in a compartment under the **aircraft fuselage**, behind the wings. ● It automatically deploys **only during emergencies** involving **total electrical or hydraulic failure**, or can be deployed **manually by pilots**. ● Once deployed, it generates sufficient power to keep **essential flight systems**, such as **controls, navigation, and communication instruments**, operational. **Source:** Indian Express
Exercise Konkan 	**News:** British and Indian warships begin four-day maritime exercise Konkan in the Indian Ocean. **About Exercise Konkan** ● **Exercise KONKAN** was first held in **2004** as a **bilateral naval drill** between India and the UK. ● Traditionally **biennial**, it has evolved into a high-end operational engagement. ● The **2025 edition** marks the **first-ever participation of carrier strike groups** from both nations - India's **INS Vikrant** and the UK's **HMS Prince of Wales**. ● The exercise aims to enhance joint maritime and air warfare capabilities between the two navies and deepen defence

	cooperation under the **India-UK Vision 2035 framework.** **Source:** PIB
NATPOLREX-X	News: The Indian Coast Guard (ICG) is conducting the 10th National Level Pollution Response Exercise (NATPOLREX-X) along with the 27th National Oil Spill Disaster Contingency Plan (NOSDCP) & Preparedness Meeting off the coast of Chennai, Tamil Nadu. **About NATPOLREX-X** ● NATPOLREX stands for National Level Pollution Response Exercise. ● It is a biennial flagship exercise conducted by the Indian Coast Guard under the National Oil Spill Disaster Contingency Plan (NOSDCP). ● **Objective:** The exercise aims to assess and strengthen India's national preparedness for responding to marine oil spill incidents and to test inter-agency coordination under the NOSDCP framework. **Source:** PIB

Mains Topics

Reducing Judicial Backlogs in India

Context

The government has renewed its focus on strengthening Alternative Dispute Resolution (ADR) to address India's growing judicial backlog and promote faster, cost-effective justice delivery.

What is Alternative Dispute Resolution (ADR)?

- **ADR** refers to mechanisms that allow resolution of disputes **outside traditional courtrooms**, using methods like:
    - **Arbitration** – A binding process where an arbitrator delivers a final award.
    - **Conciliation** – A flexible process with the help of a neutral conciliator.
    - **Mediation** – A voluntary process where parties arrive at a mutually acceptable settlement.
    - **Judicial Settlement / Lok Adalat** – Forums that provide quick settlements, often before litigation begins.
    - The focus of ADR is **speedy, participatory, and less adversarial justice**.

Lok Adalats

- Lok Adalats are inspired by the **Panchayat model** and aim for amicable settlements before formal litigation.
- Their **decisions are final and non-appealable**, as they arise from mutual consent.
- However, dissatisfied parties may still file a civil suit.
- Governed by the Legal Services Authorities Act, 1987.
- **Types:** Permanent Lok Adalat (Sec 22-B), National Lok Adalat, e-Lok Adalat.
- **Features:**
    - Resolves disputes **pre-litigation**, reducing court burden.
    - **Decisions are final**; no appeal is possible unless a formal suit is filed.
    - **First Lok Adalat in India:** Gujarat, 1999.

Constitutional and Legal Basis of ADR

- **Article 39A (DPSP)**: Mandates equal justice and free legal aid, providing the constitutional foundation for ADR.
- **Section 89, Code of Civil Procedure (CPC), 1908**: Legally recognises arbitration, conciliation, mediation, and Lok Adalat as formal dispute resolution options.
- **Arbitration and Conciliation Act, 1996 (amended 2021):**
    - Regulates arbitration and conciliation in India.
    - Sets a **maximum time limit of 180 days** for dispute resolution.
    - Provides for the creation of the **Indian Arbitration Council**.
    - Makes arbitral awards binding and enforceable.
- **Legal Services Authorities Act, 1987:**

  - Governs **Lok Adalats** and ensures access to justice for weaker sections.
  - Section 22-B provides for **Permanent Lok Adalats**.
- **Mediation Act, 2023 (recent development):**
  - Introduces **pre-litigation mediation** for civil and commercial disputes.
  - Parties can withdraw after two mediation sessions if no consensus is reached.

Why Strengthening ADR is Crucial

- **Reduces Judicial Backlog:**
  - India's judiciary faces over **4.57 crore pending cases**.
  - Vacancy rates: **33% in High Courts** and **21% in District Courts**.
  - ADR can divert minor civil and commercial disputes away from courts.
- **Ensures Speedy Justice:** ADR mechanisms typically resolve disputes **within 3–6 months**, compared to years in traditional litigation.
- **Cost-Effective and Accessible:** Reduces litigation costs and provides justice to weaker sections who cannot afford prolonged trials.
- **Culturally Rooted:** Reflects India's traditional **consensus-based conflict resolution systems** like Panchayats.
- **Social Harmony:** Mediation promotes mutual understanding, preserving interpersonal and business relationships.
- **Judicial Endorsement:** Former CJI **D.Y. Chandrachud** termed mediation a **"tool for social change"**, aligning social norms with constitutional values.

India Justice Report 2025: Key Findings

- **Total pending cases:** 4.57 crore.
- **Long-term pendency:** Many cases pending **over 10 years** in High Courts and subordinate courts.
- **Workload:** Judges in **Uttar Pradesh, Himachal Pradesh, and Kerala** handle over **4,000 cases each**.
- **Vacancy crisis:** 33% in High Courts and 21% in district judiciary.
- **Inter-state disparities:**
  - High pendency in **Uttar Pradesh, Andhra Pradesh, and Bihar**.
  - States with better ADR promotion show faster dispute resolution and lesser backlog.

Challenges to Effective ADR Implementation

- **Low Awareness:** Many citizens, especially in rural areas, are unaware of ADR mechanisms.
- **Lack of trained mediators and arbitrators:** Professional capacity remains limited.
- **Enforcement Issues:** Arbitration awards are often challenged in courts, delaying finality.
- **Institutional Gaps:** Few dedicated ADR centres exist outside metro cities.
- **Perception of Informality:** Some parties prefer traditional litigation for perceived legal sanctity.

Way Forward

- **Institutionalise ADR Infrastructure:**

  - Establish mediation and arbitration centres at every district court.
  - Integrate ADR into Digital India and e-Courts programmes.

- **Mandatory Pre-Litigation Mediation:** Make mediation compulsory for civil and commercial disputes before they reach courts.
- **Training and Accreditation:** Develop a national cadre of trained mediators and arbitrators.
- **Public Awareness Campaigns:** Promote ADR through legal literacy drives, especially in rural India.
- **Strengthen e-Lok Adalats:** Use technology to settle cases online, reducing logistical barriers.
- **Legislative Reforms:** Streamline enforcement of arbitral awards and strengthen the autonomy of ADR institutions.

Source: The Hindu

How is AI Transforming Teaching and Learning Practices in Indian Classrooms?

Context

Artificial Intelligence (AI) is rapidly redefining education across the world, and India is no exception. With initiatives like the India AI Mission, and global giants such as OpenAI, NVIDIA, Google, and Microsoft investing in India, classrooms are increasingly becoming sites of AI-assisted learning.

AI and the Changing Pedagogical Landscape

AI is transforming teaching and learning in Indian classrooms through:

- **Personalised Learning:** AI-based systems can assess each student's pace, strengths, and weaknesses to design personalised learning plans.
- **Automated Assessment and Feedback:** Tools such as ChatGPT and adaptive testing platforms help teachers evaluate assignments, identify errors, and provide feedback faster.
- **Smart Content Creation:** Teachers use AI to create lesson plans, quizzes, and visual aids, enhancing classroom engagement and efficiency.
- **Virtual Classrooms and Tutoring:** AI-driven platforms enable interactive digital learning experiences and 24/7 student support.
- **Language and Accessibility Tools:** AI applications like speech-to-text, translation, and audio lessons improve inclusivity for differently-abled and linguistically diverse students.

A **Central Square Foundation report (2024)** found that nearly **70% of Indian teachers** now use AI tools to prepare teaching material, showing how deeply technology has penetrated pedagogy.

Philosophical and Ethical Dimensions of AI in Education

Despite these advances, uncritical adoption of AI risks undermining the humanistic and ethical foundations of teaching.

- Education, as envisioned by thinkers like **Rabindranath Tagore** and **Bell Hooks**, is a **dialogue of empathy and critical thought**, not just information transfer.
- AI, if used mechanically, may reduce learning to **data-driven efficiency** rather than **intellectual curiosity and creativity**.
- According to the **Centre for Teacher Accreditation (CENTA)**, most teachers use AI primarily for administrative convenience, not to deepen learning.

Ethical Concerns

- **Dependence and Dishonesty:** Students increasingly use AI for plagiarism or shortcuts, prompting the CBSE to ban tools like ChatGPT during exams.
- **Erosion of Teacher-Student Interaction:** Overuse of digital interfaces can reduce emotional and social connection in classrooms.
- **Bias and Privacy:** AI tools may reproduce societal biases or compromise data privacy if used without regulation.

Thus, while AI enhances efficiency, it must not replace the **dialogical and transformative spirit** of education.

India's Policy Framework: The India AI Mission

India's **National AI Mission** envisions building an ecosystem for **trusted, inclusive, and socially anchored AI**, with a strong focus on education.

Key Pillars:

- **India AI Compute Capacity:** Establishes national infrastructure for AI innovation.
- **India AI Future Skills:** Aims to train teachers, researchers, and students in AI literacy and application.
- **Centres of Excellence (CoEs):** To be set up in leading educational institutions to promote AI-based pedagogy, content creation, and ethics training.
- **Application Development Initiative:** Focused on designing context-specific AI solutions for socio-economic transformation, including education.

If implemented effectively, these initiatives can bridge the skill gap, make AI tools accessible, and promote digital inclusion.

Benefits of AI Integration

When applied thoughtfully, AI offers immense potential:

Dimension	AI Contribution
● Personalization	Tailored lessons and adaptive learning paths
● AI Accessibility	Multilingual support and assistive technologies for differently-abled learners
● Efficiency	Automated grading, analytics, and real-time performance tracking.
● Inclusivity	Online learning opportunities for remote students
● Teacher Support	Reduces administrative burden, allowing focus on mentoring

Challenges in Integrating AI in Indian Classrooms

- **Digital Divide:**
  - The **National Sample Survey (2024)** shows that while Internet access has expanded, **meaningful digital participation** remains uneven.
  - Rural schools often lack infrastructure, power supply, and high-speed Internet.
  - This creates a "dual India" - one AI-driven, another digitally excluded.
- **Ethical and Pedagogical Issues:**
  - Teachers use AI for convenience rather than creativity.
  - Risk of **over-dependence on technology**, neglecting values like empathy, dialogue, and human judgment.
- **Lack of AI Literacy and Training:**
  - Teachers need in-service training to critically and responsibly integrate AI into pedagogy.
  - Without ethical orientation, AI could amplify inequalities or promote rote learning.
- **Inequality in Access:** Privileged urban schools adopt AI-based smart classrooms, while government schools struggle to provide digital infrastructure - reinforcing educational inequality.

Way Forward

- **Human-Centred AI in Education:** AI should be viewed as a supplementary tool, not a substitute for teachers. The classroom must remain a space of empathy, creativity, and critical inquiry.
- **Strengthen Teacher Training:**
  - Introduce **AI ethics and pedagogy modules** in B.Ed and in-service training.
  - Promote capacity-building through **AI Centres of Excellence**.
- **Bridge the Digital Divide:**
  - Invest in infrastructure: electricity, broadband, and affordable devices in rural schools.
  - Promote **cloud-based learning solutions** accessible to all.
- **Promote Ethical AI Use:**
  - Establish regulatory frameworks to prevent misuse, plagiarism, and data exploitation.
  - Encourage **student awareness** about responsible AI usage.
- **Contextual and Inclusive Design:**
  - Develop **AI tools in Indian languages**, suited to diverse socio-cultural and regional contexts.
- **Foster Research and Innovation:** Encourage collaboration between academia, startups, and government for developing **India-specific AI solutions** in education.

Source: The Hindu