

# WEEKLY UPDATES

DATE : 6<sup>th</sup> Jan- 12<sup>th</sup> Jan

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# **IQRA**

Wisdom leads to success

# POLITY & GOVERNANCE

## India to Host 28th Commonwealth CSPOC in 2026

**Syllabus:** GS Paper II – Polity and Governance, Parliamentary Processes, International Organizations

### Key Points

#### 1. Context of CSPOC

- **Announcement:** India will host the **28th Conference of Speakers and Presiding Officers of Parliaments of Commonwealth Countries (CSPOC)** in 2026.
- **Event Location:** **New Delhi**, as announced by Lok Sabha Speaker Om Birla during the Standing Committee Meeting in Guernsey.

#### 2. About CSPOC

- **Established:** In **1969** by Speaker Lucien Lamoureux (Canada).
- **Purpose:** Enhance **cooperation** and share **parliamentary practices** among Commonwealth nations.
- **Independence:** Operates independently from the **Commonwealth Secretariat** or **Parliamentary Association**.
- **Secretariat:** Supported by **Canada**.

#### 3. Objectives of CSPOC

- **Impartiality in Leadership:** Promote **fairness and neutrality** in parliamentary roles.
- **Knowledge Sharing:** Encourage understanding of **diverse forms of parliamentary democracy**.
- **Institutional Strengthening:** Foster growth and effectiveness of **parliamentary institutions**.

#### 4. Structure of CSPOC

- **Two-Year Cycle:**
  - **Full Membership Conference:** Held every **two years**.
  - **Standing Committee Meeting:** Conducted in the intervening year.
- **Chairperson:** Rotates based on the **host country**.

#### 5. About the 28th CSPOC (2026)

- **Host:** India, in **New Delhi**.
- **Focus Areas:**
  - **AI and Social Media:** Integration into **parliamentary processes**.
  - **Inclusivity:** Fostering diversity and inclusion in governance.
  - **Global Challenges:** Addressing **climate change, cybercrime**, and other global issues.

#### 6. Significance of India Hosting CSPOC

- **Economic Progress:** Highlights India's advancements in **AI, fintech**, and **research sectors**.
- **Cultural Diplomacy:** Showcases India's **cultural heritage** alongside its **developmental journey**.
- **Leadership Role:** Demonstrates India's active participation in strengthening **parliamentary democracy** globally.

## UGC Draft Regulations 2025: Reforms in Vice-Chancellor Appointments

**Syllabus:** GS Paper II – Education Policy, Governance

### Key Points

#### 1. Context of the UGC Draft Regulations 2025

- **Union Education Minister Dharmendra Pradhan** unveiled the **UGC Draft Regulations 2025**, focusing on reforms in the appointment of **Vice-Chancellors (VCs)** and academic staff in line with the **National Education Policy (NEP) 2020**.

## 2. Draft Guidelines for Vice-Chancellor Appointments

- i) **Organisation Involved:** University Grants Commission (UGC) is responsible for framing and implementing these regulations.
- ii) **Key Features of VC Appointment Guidelines**
  - a) **Authority for Selection:** Chancellors or Visitors empowered to form a **three-member search-cum-selection committee** for appointing VCs.
  - b) **Selection Process**
- **Applications:** Invited via **all-India newspaper advertisements** or through **nominations/talent searches**.
- **Committee Composition:**
  - **Chairperson:** Nominee of Visitor/Chancellor.
  - **UGC Chairperson.**
  - Representative from the university's **apex body** (e.g., Senate, Syndicate).

### c) Eligibility Criteria

- Open to **distinguished professionals** from **academia, industry, public administration, or policymaking**.
- Requires a track record of **academic contributions** and leadership.

d) **Inclusivity Provisions:** Encourages representation of **economically weaker sections (EWS), SC, ST, OBC, and persons with disabilities**.

e) **Transparency:** Mandates **public notification** and ensures **objective assessment methods** during the selection process.

## 3. Consequences of Non-Compliance

- Institutions failing to comply with these guidelines risk:
  - **Exclusion from UGC schemes.**
  - **Revocation of degree-granting authority.**

## 4. Significance of the Reforms

- i) **Alignment with NEP 2020:** Strengthens governance and leadership in higher education institutions, aligning with NEP's vision of **academic excellence**.
- ii) **Merit-Based Selection:** Ensures the appointment of **competent, diverse, and visionary leaders**.
- iii) **Transparency and Accountability:** Enhances trust in institutional governance through **objective and public processes**.
- iv) **Inclusivity:** Encourages equitable representation of **marginalized groups**, fostering diversity in educational leadership.

## 5. Challenges in Implementation

- i) **Resistance from Institutions:** Autonomy concerns among universities regarding external control in the VC selection process.
- ii) **Compliance Monitoring:** Ensuring adherence to guidelines across diverse institutions may require robust mechanisms.
- iii) **Balancing Merit and Inclusivity:** Finding a balance between **merit-based appointments** and **representation quotas**.

## 6. Way Forward

- i) **Capacity Building:** Conduct training programs for members of search committees to ensure effective implementation.
- ii) **Monitoring Mechanisms:** Establish UGC-led monitoring systems to track compliance and address grievances.
- iii) **Stakeholder Engagement:** Foster dialogue with universities to address concerns over autonomy while ensuring adherence to the guidelines.

## Draft Digital Personal Data Protection Rules: A Framework for Data Security

**Syllabus:** GS Paper II – Governance, Transparency, and Accountability in Digital Ecosystems

### Key Points

#### 1. Context of the Draft Rules

- The **Draft Digital Personal Data Protection Rules** operationalize the **Digital Personal Data Protection Act, 2023 (DPDP Act)** to establish a **robust framework** for safeguarding personal data in India.

#### 2. About the Draft Digital Personal Data Protection Rules

i) **What It Is:** A comprehensive framework designed to enforce the provisions of the **DPDP Act, 2023**, ensuring **digital data protection** for Indian citizens.

#### ii) Aim

- Empower citizens to exercise control over their personal data.



- Protect personal data and prevent its misuse.
- Build trust in **digital platforms** by promoting transparency and accountability.

iii) **Ministry Involved: Ministry of Electronics and Information Technology (MeitY).**

### 3. Key Features of the Draft Rules

#### i) Citizen-Centric Framework

- Emphasis on **informed consent** for data collection and processing.
- Rights for individuals to request **data erasure**.
- **User-friendly grievance mechanisms** for complaints.

ii) **Balance Between Regulation and Innovation: Startups and MSMEs** provided with **reduced compliance** to encourage innovation while safeguarding citizen welfare.

iii) **Digital-First Approach: Grievance redressal and adjudication** conducted digitally for **transparency and efficiency**.

iv) **Accountability for Data Fiduciaries: Annual audits and Data Protection Impact Assessments (DPIAs)** mandated for **Significant Data Fiduciaries (SDFs)**.

v) **Inclusive and Pragmatic:** Stakeholder feedback solicited via the **MyGov platform**, incorporating **global best practices** for a robust framework.

vi) **Awareness Campaigns:** Focus on educating citizens about their **digital rights and responsibilities** for informed participation.

### 4. Significance of the Draft Rules

- i) **Enhancing Citizen Empowerment:** Provides individuals with **greater control** over their personal data, fostering **trust in digital ecosystems**.
- ii) **Strengthening Data Security:** Mandates **impact assessments** and **annual audits**, reducing risks of data breaches and misuse.
- iii) **Boosting Economic Growth:** Balances regulatory measures with incentives for **startups** and **MSMEs**, promoting innovation in the **digital economy**.
- iv) **Global Relevance:** Aligns with **international data protection standards**, enhancing India's digital trade and technology partnerships.
- v) **Digital Governance:** Promotes **efficient grievance redressal** and **transparency** in handling personal data complaints.

### 5. Challenges and Way Forward

#### i) Challenges

- **Awareness Gaps:** Limited understanding of digital rights among citizens.
- **Implementation Capacity:** Ensuring compliance across diverse sectors, including MSMEs.
- **Data Localization Costs:** Mandating local storage might increase costs for global firms.

#### ii) Way Forward

- **Capacity Building:** Train businesses and regulators on compliance requirements.
- **Public Awareness Drives:** Conduct nationwide campaigns to educate citizens on data rights and responsibilities.
- **Stakeholder Collaboration:** Foster dialogue between government, industry, and civil society for effective implementation.
- **Technology Integration:** Leverage **AI and blockchain** to monitor compliance and secure personal data.

# INTERNATIONAL RELATIONS

## Sudan Humanitarian Crisis: Impact and Challenges

**Syllabus:** GS Paper II – International Relations, Global Humanitarian Issues

### Key Points

#### 1. Context of the Crisis

- **Conflict in Sudan:** Prolonged war between the **Sudanese Armed Forces (SAF)** and the **Rapid Support Forces (RSF)** has created a **severe humanitarian crisis**.
- **UNICEF Report (2025):** Highlights a grim future for children and widespread malnutrition.

#### 2. UN Report on Children Facing Malnutrition

- **Acute Malnutrition:**
  - **2 million children under five** expected to suffer from **acute malnutrition** in 2025.
  - **7,72,000 children** likely to face **severe acute malnutrition**, requiring urgent care.

- **Critical Areas:** Malnutrition exacerbated by conflict, food insecurity, and healthcare collapse.

### 3. Conflict Impact

- **Duration of War:** Ongoing for over 20 months.
- **Displacement Crisis:** 12 million people displaced, making it the world's largest displacement crisis.
- **Famine Conditions:** Five regions in Sudan already experiencing famine-like conditions.

### 4. Healthcare System Collapse

- **Attacks on Facilities:** Medical organizations, including **Doctors Without Borders**, forced to halt operations due to targeted attacks.
- **Result:** Breakdown of **healthcare infrastructure**, leaving millions without access to essential services.

## Indian Diaspora: A Global Asset

**Syllabus:** GS Paper II – International Relations, Role of Indian Diaspora

### Key Points

#### 1. Context of Indian Diaspora

- **Event:** At **Pravasi Bharatiya Divas 2025** in Odisha, the Prime Minister emphasized the **importance of the Indian diaspora** in shaping India's global role.

#### 2. What is the Indian Diaspora?

- Refers to individuals of **Indian origin residing outside India**, categorized as:
  - **Non-Resident Indians (NRIs):** Indian citizens living abroad temporarily.
  - **Overseas Citizens of India (OCIs):** Individuals of Indian origin with **permanent residency** in India.
  - **People of Indian Origin (PIOs):** Citizens of other countries with **Indian ancestry**.

#### 3. Global Distribution of Indian Diaspora

- Largest Diaspora:** 18 million Indians live abroad (Global Migration Report, 2020).
- Top Host Countries:** US, UK, UAE, Canada, Australia, and Saudi Arabia.
- Significant Share in Populations:** Indian-origin communities hold notable proportions in countries like **Mauritius, Fiji, Guyana, and Trinidad and Tobago**.

#### 4. Factors Leading to a Large Diaspora

##### i) Push Factors

- **Historical Migration:** Colonial-era indentured laborers sent to **Mauritius, Fiji, and the Caribbean**.
- **Political Instability:** Conflicts led to migration for safety and stability.
- **Rural-to-Urban Shift:** Migration to escape rural poverty and seek better living standards.

##### ii) Pull Factors

- **Economic Opportunities:** Gulf nations offer jobs in **construction, healthcare, and IT**.
- **Higher Education:** Indian students are attracted to universities in the **US, UK, and Australia**.
- **Family Networks:** Existing communities ease the transition for new migrants.

#### 5. Significance of the Indian Diaspora

- Economic Contributions:** Diaspora remittances: Contributed **~\$87 billion in 2021**, boosting India's economy.
- Cultural Influence:** Global popularity of **Indian traditions, cuisine, films, and music**.
- Political Impact:** Prominent leaders like **UK PM Rishi Sunak** foster stronger ties between India and their host nations.
- Diplomatic Leverage:** Diaspora acts as **cultural ambassadors**, enhancing bilateral relations.
- Soft Power:** Diaspora success projects a **positive global image of India**.

#### 6. Government Initiatives for the Diaspora

- Pravasi Bharatiya Divas:** Annual celebration honoring diaspora contributions.
- OCI Card:** Offers **lifelong visa** and property rights to people of Indian origin.
- Know India Program;** Engages the younger diaspora with **Indian culture and heritage**.

- iv) **Indian Community Welfare Fund (ICWF):** Provides financial aid to Indians abroad in emergencies.
- v) **Social Security Agreements:** Ensures welfare for Indian workers in countries with bilateral agreements.

### 7. Challenges Faced by the Diaspora

- i) **Exploitation:** Laborers in Gulf nations face **harsh working conditions** and **low pay**.
- ii) **Integration Issues:** **Cultural and linguistic differences** hinder smooth assimilation.
- iii) **Legal Protection:** Limited legal aid leaves migrants vulnerable to **exploitation**.
- iv) **Brain Drain:** Loss of skilled professionals benefits host nations while depriving India of talent.
- v) **Political Sensitivities:** Diaspora communities sometimes face challenges due to **tensions between India and host countries**.

### 8. Way Ahead

- i) **Strengthen Consular Services:** Improve the accessibility and efficiency of **Indian embassies**.
- ii) **Diaspora Engagement:** Foster regular interactions through **cultural and social programs**.
- iii) **Educational Initiatives:** Promote Indian **languages, traditions, and history** among diaspora communities.
- iv) **Policy Frameworks:** Strengthen protections against **labor exploitation** and ensure legal safeguards.
- v) **Leverage Diaspora for Growth:** Encourage **investments and knowledge-sharing** for India's development.

## Burkina Faso: A Landlocked Nation with Historical and Geopolitical Significance

**Syllabus:** GS Paper II – International Relations (Africa and Global Issues)

### Key Points

#### 1. Context of Burkina Faso

- **Burkina Faso**, located in **West Africa**, has historical significance as a **former French colony** and faces challenges of **political instability, poverty, and rising insecurity**.

#### 2. Geographical Overview

##### i) Location

- **Landlocked nation in West Africa.**
- **Borders:**
  - **Northwest:** Mali.
  - **Northeast:** Niger.
  - **Southeast:** Benin.
  - **South:** Togo and Ghana.
  - **Southwest:** Ivory Coast.

##### ii) Capital

- **Ouagadougou**, the administrative and cultural center.

##### iii) Geographic Features

- **Rivers:**
  - **Mouhoun** (Black Volta).
  - **Nakambe** (White Volta).
  - **Nazinon** (Red Volta).
- **Deserts:**
  - The northern region is part of the **Sahel**, with **semi-desert landscapes**.

#### 3. Historical Highlights

- i) **Colonial Past:** Formerly known as **Upper Volta** under **French colonial rule**.
- ii) **Renaming:** Renamed **Burkina Faso** in **1984** by President **Thomas Sankara**, symbolizing "Land of Incorruptible People."

#### 4. Languages and Ethnicities

##### i) Languages

- **Official Language:** French.
- **Indigenous Languages:** **Moore** widely spoken, along with other native languages.

### ii) Ethnic Groups

- The **Mossi** are the largest ethnic group, with significant influence on the country's culture and governance.

## 5. Contemporary Challenges

- Political Instability:** Frequent **military coups** and challenges in establishing **democratic governance**.
- Poverty:** One of the **world's poorest nations**, with a **low Human Development Index (HDI)**.
- Insecurity:** Increasing **jihadi insurgencies** in the Sahel region have led to **displacement** and rising **violence**.

# INTERNAL SECURITY & DEFENCE

## Interpol's Silver Notice: A Step Toward Recovering Illicit Assets

**Syllabus:** GS Paper III – Internal Security, Money Laundering, and International Organizations

### Key Points

#### 1. Context of Silver Notice

- **Introduction:** Interpol has launched the **Silver Notice**, its first initiative focused on tracking and recovering **laundered assets** across international borders.

#### 2. About the Silver Notice

- **Definition:** A **colour-coded alert** issued by **Interpol** to identify, track, and recover assets acquired through **criminal activities**.
- **Purpose:** Focused on assets such as **properties, vehicles, financial accounts, and businesses**.

#### 3. How the Silver Notice Works

- **Issuance:** Member countries can issue a **Silver Notice** to request information about assets linked to criminal activities.
- **Asset Recovery Process:** Facilitates the **identification, location, seizure, confiscation, or recovery** of assets under the legal frameworks of respective countries.
- **Review Mechanism:** Interpol's **General Secretariat** reviews notices to ensure compliance with its rules and prevent **political misuse**.

#### 4. Need for Silver Notices

- **Addressing Transnational Crime:** Tackles the growing issue of **transnational organized crime** that involves cross-border money laundering.
- **Asset Recovery:** Focuses on retrieving **illicit wealth** generated through crimes like **fraud, corruption, and drug trafficking**.
- **Preventing Financial Crimes:** Deters offenders by facilitating **global collaboration** for tracing stolen or laundered assets.

#### 5. Other Interpol Notices

- **Red Notice:** For locating and provisionally arresting fugitives for extradition.
- **Blue Notice:** To collect additional information about a person's identity or location.
- **Green Notice:** For warnings about a person's criminal activities, especially if they are a threat to public safety.
- **Yellow Notice:** For locating missing persons or identifying persons unable to identify themselves.
- **Purple Notice:** To seek or provide information about modus operandi, objects, or concealment methods used in crimes.



## BHARATPOL Portal: Revolutionizing International Police Cooperation

**Syllabus:** GS Paper III – Internal Security and Technology Integration

### Key Points

#### 1. Context of BHARATPOL Portal Launch

- The **Union Home Minister** launched the **BHARATPOL Portal** in **New Delhi**, aiming to enhance **real-time international police cooperation** via INTERPOL.

#### 2. About BHARATPOL Portal

- Ministry Involved:** Launched by the **Ministry of Home Affairs (MHA)** in collaboration with the **Central Bureau of Investigation (CBI)**, which acts as the **National Central Bureau (NCB)** for INTERPOL in India.
- Aim:** Streamline **international police assistance** and enable **real-time information sharing** to address **transnational crimes**.

#### 3. Features of the BHARATPOL Portal

i) **Centralized Platform:** Processes INTERPOL requests, including **Red Notices** and other **color-coded notices**.

ii) **Accessibility:** Available via the **CBI's official website**, ensuring seamless communication among:

- **CBI,**
- **INTERPOL Liaison Officers (ILOs),** and
- **Unit Officers (UOs).**

iii) **Enhanced Efficiency**

- Assists field-level officers in tackling crimes such as:
  - **Cybercrime**
  - **Drug trafficking**
  - **Human trafficking**
  - **Financial fraud**

iv) **Reduction in Traditional Methods:** Minimizes reliance on outdated communication methods like **letters, emails, and faxes**.

v) **Faster International Assistance:** Facilitates expedited access to **international police support** for criminal investigations.

#### 4. Significance of the Portal

- Strengthening Internal Security:** Aids in combating **transnational crimes** by enabling **timely coordination** with global agencies.
- Efficiency in Investigations:** Reduces delays in obtaining **INTERPOL support**, improving the pace of investigations.
- Technological Advancement:** Represents a step toward **digitization** in law enforcement operations, enhancing transparency and accountability.
- Global Cooperation:** Reinforces India's commitment to **international policing standards** and partnerships through INTERPOL.

#### 5. Challenges and Way Forward

i) **Challenges**

- **Training Needs:** Field officers may require specialized training to leverage the portal effectively.
- **Cybersecurity Concerns:** Safeguarding sensitive data shared on the portal is critical.

ii) **Way Forward**

- **Capacity Building:** Organize workshops and training sessions for law enforcement agencies.
- **Robust Security Framework:** Implement advanced **cybersecurity protocols** to protect data integrity.
- **Wider Integration:** Expand portal functionalities to include data from allied agencies for holistic crime prevention.

## Pig-Butchering Scam: Rising Cybercrime Threat

**Syllabus:** GS Paper III – Internal Security and Cybersecurity

### Key Points

#### 1. Context of Pig-Butchering Scams

- The **Union Home Ministry** has flagged the growing threat of **pig-butchering scams** in India, where fraudsters manipulate victims into investing in **fake online trading platforms**.

#### 2. About Pig-Butchering Scam

##### i) What It Is

- A **sophisticated cybercrime** where organized scammers use **deceptive online trading platforms** to **defraud investors**.
- Term "pig-butchering" comes from the analogy of "**fattening up**" victims with promises of profits before stealing their money.

##### ii) How It Works

###### a) Initial Contact

- Fraudsters approach victims through:
  - **Social media**.
  - **Dating apps**.
  - Deceptive **advertisements** on platforms like **Google** and **Facebook**.

###### b) Building Trust

- Scammers build a **personal relationship** with victims, often posing as friends or advisors.
- They lure victims into **fabricated online trading apps**, exploiting the **ambiguity of cryptocurrency**.

###### c) The Scam

- Victims are shown **fake profits** to encourage larger investments.
- When victims attempt to withdraw funds, they find their money has been **stolen**.

#### 3. Features of the Scam

- **Fake Trading Platforms:** Fraudulent apps and websites are designed to simulate real trading activities.
- **Fabricated Blockchain Transactions:** Fake cryptocurrency transactions make recovery **nearly impossible**.
- **Psychological Manipulation:** Scammers exploit victims' desire for **quick financial returns**.
- **Cyber Slavery:** Victims or coerced workers in scam operations are forced to defraud others, often linked to **money laundering**.

#### 4. Impact of Pig-Butchering Scams

- Financial Losses:** Victims lose **substantial amounts** of money, often their **entire savings**.
- Mental Health Struggles:** Victims face **psychological trauma** due to financial ruin and betrayal.
- National Security:** Linked to **money laundering networks**, these scams can undermine the **financial ecosystem**.
- Cybersecurity Challenges:** Difficulties in tracking **cryptocurrency transactions** hinder recovery efforts.

#### 5. Government Measures and Recommendations

##### i) Government Initiatives

- Awareness campaigns by the **Ministry of Home Affairs (MHA)** on cyber fraud.
- Strengthening the **Indian Cyber Crime Coordination Centre (I4C)** for faster response.

##### ii) Recommendations for Citizens

- **Verify Platforms:** Only invest in **regulated platforms** approved by recognized authorities.
- **Caution with Online Contacts:** Be skeptical of unsolicited financial advice from strangers.
- **Report Fraud:** Use platforms like **cybercrime.gov.in** to report suspicious activities.

##### iii) Strengthen Cybersecurity Infrastructure

- Collaborate with **global organizations** to track and combat scams.

- Increase **cyber-policing capabilities** and develop specialized training for cybercrime units.

## ECONOMY

### India's Road Infrastructure Growth: Transforming Connectivity and Economy

#### Syllabus:

- **GS Paper II:** Governance, Policy, and Development
- **GS Paper III:** Infrastructure and Economic Development

#### Key Points

##### 1. Context of India's Road Infrastructure Growth

- India's **National Highways network** expanded by **60% in the last decade**, now the **second-largest road network globally**.

##### 2. Highlights of India's Road Infrastructure Growth

###### i) Growth of National Highways

- **Length Increase:** From **91,287 km in 2014** to **146,195 km in 2024 (+60%)**.
- **High-Speed Corridors:** Expanded from **93 km (2014)** to **2,474 km (2024)**.

###### ii) Asset Monetization

- **Revenue Generated (2023-24):** ₹15,968 crore under the **Toll Operate and Transfer (TOT) model**.
- **Major Projects:** ₹6,661 crore awarded for NH-44's **Hyderabad-Nagpur corridor** in FY 2024-25.

###### iii) Vehicle Scrapping Initiative

- **Facilities Operational:** Registered Vehicle Scrapping Centres in **19 states/UTs**.
- **Expansion:** **66 additional centres under construction**.

##### 3. Key Government Initiatives

- Bharatmala Pariyojana:** Focus on **highway connectivity**, border roads, and economic corridors.
- Port Connectivity Masterplan:** Enhances **trade efficiency** by linking ports to highways and industrial clusters.
- International Collaboration:** Supported by **World Bank, JICA, and ADB** for funding and technical expertise in infrastructure projects.

##### 4. Economic and Developmental Significance

- Economic Growth Driver:** **National Highways and High-Speed Corridors** boost **trade, logistics, and industrial development**.
- Employment Generation:** Large-scale projects create **millions of jobs** in construction and allied sectors.
- Asset Monetization Model:** TOT projects provide sustainable revenue for **future infrastructure investments**.
- Multimodal Logistics Parks:** Improve **freight efficiency** by integrating rail, road, and port connectivity.

### ICEGATE Systems: Streamlining India's Trade Data Management

#### Syllabus:

- **GS Paper II:** Governance and E-Governance
- **GS Paper III:** Economic Development and Infrastructure

#### Key Points

##### 1. Context of ICEGATE Systems and Data Revision

- **Recent Development:** India's November 2024 **gold import figures** were revised from **\$14.9 billion to \$9.9 billion**, revealing an **overestimation** due to:
  - **Double counting** of imports into **Special Economic Zones (SEZs)** and their clearance into the **Domestic Tariff Area (DTA)**.
  - **Data migration errors** between **SEZ Online** and **ICEGATE** systems.

## 2. About ICEGATE Systems

- i) **Full Form: Indian Customs Electronic Gateway (ICEGATE).**
- ii) **Purpose:** A unified platform for capturing and managing **trade data** from various entry points like **ports, airports, and container depots.**
- iii) **How it Works**
  - **Data Collection:** Aggregates **EXIM (Export-Import)** data from over **500 locations** across India.
  - **Real-Time Transmission:** Sends data to the **Directorate General of Commercial Intelligence and Statistics (DGCIS)** for accurate tracking and reporting.

## 3. Departments Involved in ICEGATE

- **Directorate General of Commercial Intelligence and Statistics (DGCIS):** Responsible for compiling national trade statistics.
- **Directorate General of Systems (DG Systems):** Manages the IT infrastructure and ensures data integrity.
- **Special Economic Zones (SEZs):** Contribute trade data for reconciliation and reporting.

## 4. Aims of Data Migration via ICEGATE

- i) **Streamlined Data Collection:** Consolidates data from **SEZs** and **non-SEZs** to create a unified trade dataset.
- ii) **Consistency and Accuracy:** Eliminates **data duplication** and ensures accurate statistics.

## 5. Functions of ICEGATE Systems

- i) **Trade Data Capture:** Collects **import and export data** from all ports, including **SEZs.**
- ii) **Data Reconciliation:** Transmits reconciled data to **DGCIS** to avoid errors in trade statistics.
- iii) **Duplication Prevention:** Integrates data streams from **SEZ Online** and non-SEZ systems to prevent **double counting.**

## Future of Jobs Report, 2025: Labor Market Trends and Technological Disruptions

### Syllabus:

- **GS Paper II: Governance, Global Institutions, and Social Justice**
- **GS Paper III: Economy, Employment, and Technological Developments**

### Key Points

#### 1. Context of the Future of Jobs Report, 2025

- Released by the **World Economic Forum (WEF)**, this report provides a comprehensive analysis of **global labor market trends (2025–2030)** and the **impact of technology and societal shifts** on employment.

#### 2. About the Future of Jobs Report, 2025

- i) **Released By:** Published by the **World Economic Forum (WEF).**
- ii) **Frequency:** **Bi-annual** (every two years).
- iii) **Aim**
  - **Analyze Labor Trends:** Understand **global occupational disruptions** and **emerging employment patterns.**
  - **Actionable Insights:** Equip workers, organizations, and policymakers for **future workforce challenges.**

#### 3. About the World Economic Forum (WEF)

- i) **Established In:** **1971** by **Klaus Schwab**, a German engineer and economist.
- ii) **Headquarters:** Located in **Cologne, Canton of Geneva, Switzerland.**
- iii) **Aim: Improve the State of the World:** Engage leaders to shape **regional, industry, and global agendas.**

#### 4. Functions of the WEF

- i) **Annual Davos Meeting:** Brings together global leaders to discuss **economic, environmental, and societal challenges.**
- ii) **Multistakeholder Dialogue:** Provides platforms for collaboration on **pressing global issues.**
- iii) **Report Publications:** Publishes key reports like:
  - **Future of Jobs Report.**
  - **Global Risks Report.**



- iv) **Initiatives:** Launches programs addressing **technological disruptions, climate change, and economic inequalities.**

## Public Distribution System: Ensuring Food Security Amidst Challenges

**Syllabus:** GS Paper III – Indian Economy, Food Security, and Welfare Schemes

### Key Points

#### 1. Context of the Public Distribution System (PDS)

- Reports from **Jharkhand, Odisha, and Bihar** reveal challenges such as **exclusion, inefficiency, and corruption** in the PDS.
- Marginalized groups like the **Musahars** face severe hardships due to **digitization barriers** and **documentation demands**.

#### 2. Recent Issues in PDS Implementation

- Exclusion from Ration Cards:** **5.8 crore ration cards** were removed during digitization, Aadhaar-seeding, and e-KYC processes.
- Marginalized Communities Affected:** Groups like the **Musahars** struggle with enrolment due to lack of documentation and **digital access**.
- Corruption in Distribution:** Instances of **lower food grain quantities** or **poor-quality rice** distributed at Fair Price Shops (FPS).
- Document Overload:** States like Bihar and Uttar Pradesh demand **unnecessary documents**, violating the **National Food Security Act (NFSA), 2013**.

#### 3. About the Public Distribution System (PDS)

i) **Historical Context:** Established during the **inter-war period** and expanded in the **1960s** to address food shortages.

ii) **Evolution:** Expanded focus from **urban areas** to **rural poverty zones** with the **Revamped PDS (RPDS)** in **1992**.

iii) **Structure**

- **Central Government:** Handles procurement, storage, and bulk allocation via the **Food Corporation of India (FCI)**.
- **State Governments:** Manage distribution through **Fair Price Shops (FPS)**.

iv) **Coverage:** Over **80 crore beneficiaries** served through **5.4 lakh FPS**, offering subsidized grains like **rice, wheat, and sugar**.

#### 4. Challenges Faced by PDS

- Exclusion Errors:** Aadhaar-based authentication excludes millions, especially **marginalized groups**.
- Leakages and Corruption:** **28% of food grains** fail to reach beneficiaries due to **theft and inefficiency**.
- Limited Nutritional Focus:** Staples like **rice and wheat** dominate, neglecting **diverse nutritional needs**.
- Infrastructure Issues:** **Poor storage and transport** facilities hinder timely delivery.
- Over-Coverage and Mismanagement:** High coverage leads to **inefficiency** and **misuse**, diverting resources from those in need.

#### 5. Measures Taken by the Government

- Digitization:** Aadhaar seeding and **e-KYC** reduce duplication and target delivery.
- Point-of-Sale (PoS) Machines:** Installed at FPS to track transactions and reduce leakages.
- National Food Security Act (NFSA), 2013:** Covers **75% of rural** and **50% of urban populations**, providing subsidized grains.
- Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY):** Ensured **free food grains** to over **80 crore beneficiaries** during COVID-19.
- Integration of Technology:** Real-time tracking and **inventory management** enhance supply chain efficiency.

#### 6. Judgment and Right to Food

- **Case:** Recognized as a fundamental right in **People's Union of Civil Liberties vs Union of India (2001)**.
- **Mandate:** Ensures government accountability in providing food access, leading to the **NFSA, 2013**.

#### 7. Way Ahead

- Enhance Coverage:** Simplify documentation to prevent exclusion due to **digitization barriers**.
- Strengthen Monitoring:** Leverage **technology** for real-time distribution tracking and reducing corruption.
- Diversify Offerings:** Include **pulses, millets, and fortified foods** for better nutritional security.
- Community Involvement:** Engage **local stakeholders** for grassroots-level monitoring and grievance redressal.
- Invest in Infrastructure:** Modernize **storage and transport** facilities to minimize wastage and delays.

## Anji Khad Bridge: India's First Cable-Stayed Rail Bridge

**Syllabus:** GS Paper III – Infrastructure Development, Science and Technology

### Key Points

#### 1. Context of the Anji Khad Bridge

- The **Indian Railways** achieved a major milestone with the completion of the **Anji Khad Bridge**, India's first **cable-stayed rail bridge**, enhancing connectivity in the **Reasi district of Jammu and Kashmir**.

#### 2. About Anji Khad Bridge

- Location:** Situated in the **Reasi district, Jammu and Kashmir**, spanning the **Anji River Valley**.
- Connectivity:** Links **Katra** and **Reasi** as part of the **Udhampur-Srinagar-Baramulla Rail Link (USBRL) Project**.
- Height and Elevation:** **Height:** 331 meters above the **riverbed**, making it one of the **tallest rail bridges in the world**.
- Builder:** Constructed by the **Indian Railways**, showcasing indigenous engineering prowess.

#### 3. Key Features of the Bridge

- Length:** Total length: **725.5 meters**.
- Cable-Stayed Design:** **Cable-Stayed Span:** **473.25 meters**, supported by **96 cables** ranging from **82 meters to 295 meters** in length.
- Main Pylon:** **Height:** 193 meters from the foundation, offering **stability** and **aesthetic appeal**.
- Advanced Engineering:** Designed to withstand **seismic activity**, high winds, and **challenging Himalayan terrain**.

#### 4. Significance of the Anji Khad Bridge

- Strategic Importance:** Enhances **connectivity to the Kashmir Valley**, critical for **national security** and **regional integration**.
- Economic Impact:** Facilitates trade, tourism, and transport, boosting the **local economy** and creating job opportunities.
- Engineering Marvel:** Demonstrates India's capability in **innovative infrastructure projects**, reducing reliance on foreign expertise.
- Environmental Considerations:** Minimizes impact on the **Anji River Valley ecosystem** through advanced construction techniques.

#### 5. Challenges Faced During Construction

- Geographical Terrain:** Building in the **Himalayan landscape** required innovative techniques to address rugged terrain and **steep gorges**.
- Seismic Activity:** Designed to withstand **Zone-V seismic conditions**, ensuring long-term durability.
- Weather Extremes:** Construction teams faced **adverse weather** and **logistical challenges** in the remote region.

## PLI Scheme 1.1: Boosting India's Specialty Steel Production

**Syllabus:** GS Paper III – Economic Development, Industrial Growth, and Atmanirbhar Bharat

### Key Points

#### 1. Context of PLI Scheme 1.1

- The **Union Minister of Steel and Heavy Industries** launched **PLI Scheme 1.1** under **Atmanirbhar Bharat**, focusing on enhancing **self-reliance** in **specialty steel production**.

#### 2. About PLI Scheme 1.1

i) **What It Is:** A **Production Linked Incentive (PLI)** scheme aimed at promoting **domestic production** of **specialty steel** across five key product categories.

ii) **Launched By:** **Union Ministry of Steel and Heavy Industries**.

iii) **Aim**

- Reduce dependency on **imports** of specialty steel.
- Promote **high-value steel manufacturing**.
- Strengthen India's position as a **global steel powerhouse**.

#### 3. Key Features of PLI Scheme 1.1

i) **Five Product Categories**

- Coated/Plated Steel.
- High Strength/Wear Resistant Steel.
- Specialty Rails.
- Alloy Steel Products & Steel Wires.
- Electrical Steel.

## ii) Reduced Thresholds

- **Investment Threshold:** For CRGO steel, reduced to ₹3,000 crore.
- **Production Threshold:** Reduced to 50,000 tonnes, allowing broader participation.

iii) **Carry Forward Excess Production:** Companies can carry forward surplus production to the next year to remain eligible for incentives.

iv) **Focus on Existing Capacities:** Investments aimed at augmenting existing steel facilities are eligible for participation.

v) **Incentive Period:** The scheme covers the period from FY 2025-26 to FY 2029-30.

## 4. Significance of PLI Scheme 1.1

- Reducing Import Dependency:** Focuses on producing specialty steel domestically, reducing reliance on expensive imports.
- Industrial Growth:** Boosts investment in high-value steel manufacturing, enhancing industrial output.
- Global Competitiveness:** Strengthens India's position as a global leader in steel production.
- Economic Development:** Contributes to economic growth by promoting employment and exports in the steel sector.
- Atmanirbhar Bharat Goals:** Aligns with the mission of self-reliance by encouraging domestic capabilities.

## 5. Challenges and Way Forward

### i) Challenges

- **High Initial Costs:** Investment requirements may deter smaller players.
- **Global Competition:** Competing with established global producers remains a challenge.
- **Environmental Concerns:** Steel production's environmental impact needs mitigation strategies.

### ii) Way Forward

- **Ease Financing:** Provide low-interest loans or subsidies to encourage private participation.
- **R&D Focus:** Invest in research and development for sustainable steel manufacturing.
- **Skill Development:** Train workers in advanced steel production technologies.
- **International Collaboration:** Engage in technology transfers and partnerships to enhance production capabilities.

# SOCIETY AND SOCIAL JUSTICE

## Southern Nicobar: Balancing Biodiversity Conservation and Tribal Rights

**Syllabus:** GS Paper I – Geography and Culture; GS Paper II – Governance and Vulnerable Sections

### Key Points

#### 1. Context of Southern Nicobar Conservation Efforts

- The proposed establishment of three wildlife sanctuaries in southern Nicobar has raised concerns about the potential displacement of indigenous tribes from their ancestral lands.

#### 2. Islands in Focus

##### i) Meroë Island (Piruii)

- **Cultural Significance:** Revered by the Nicobarese as a spiritual site and the legendary abode of their ancestors.
- **Proposed Sanctuary:** Coral Sanctuary.

##### ii) Menchal Island (Pingaeyak)

- **Community Management:** Sustainably managed and spiritually protected by community elders.
- **Proposed Sanctuary:** Megapode Sanctuary.

### iii) Little Nicobar Island

- **Biodiversity Hotspot:** Home to globally endangered species like the **Leatherback Turtle**.
- **Livelihood Importance:** Vital to the **Southern Nicobarese Tribe**, offering resources for traditional sustenance.
- **Proposed Sanctuary:** Leatherback Turtle Sanctuary.

## 3. Tribes in the Spotlight

### i) Shompen Tribe

- **Designation:** Classified as a **Particularly Vulnerable Tribal Group (PVTG)**.
- **Lifestyle:** Relies on **hunting and foraging**.
- **Threat:** Risk of **displacement** due to proposed sanctuaries and **mega-projects** in the region.

### ii) Southern Nicobarese Tribe

- **Cultural Custodians:** Indigenous protectors of the islands.
- **Sustainable Practices:** Utilize natural resources guided by **spiritual beliefs** and **traditional knowledge**.
- **Challenge:** Possible disruption of their **ancestral connection** to the land.

## 4. Proposed Wildlife Sanctuaries

### i) Coral Sanctuary

- **Location:** Meroë Island.
- **Objective:** Protect the region's unique coral ecosystems.

### ii) Megapode Sanctuary

- **Location:** Menchal Island.
- **Focus:** Conservation of the **Nicobar Megapode**, a rare bird species.

### iii) Leatherback Turtle Sanctuary

- **Location:** Little Nicobar Island.
- **Purpose:** Preserve nesting grounds of **Leatherback Turtles**, a globally endangered species.

## 5. Concerns Raised

### i) Impact on Indigenous Tribes

- **Loss of Ancestral Lands:** Sanctuaries may displace tribes from territories they have lived in sustainably for centuries.
- **Cultural Erosion:** Disruption of spiritual practices tied to the land.

### ii) Livelihood Challenges:

Restriction on **hunting, foraging**, and other **traditional practices** essential for survival.

### iii) Conservation vs. Development:

Potential **mega-projects** threaten both **tribal rights** and **environmental integrity**.

## 6. Way Forward

- Inclusive Conservation:** Involve indigenous tribes in **sanctuary planning and management** to balance conservation and cultural preservation.
- Recognition of Tribal Rights:** Ensure adherence to the **Forest Rights Act (FRA), 2006**, recognizing the **rights of indigenous communities** over their lands.
- Sustainable Development:** Promote eco-sensitive infrastructure and projects that benefit both **local tribes** and the environment.
- Tribal Welfare Programs:** Introduce **livelihood programs** and **skill development** initiatives for affected tribes.

## Animal Welfare Board of India (AWBI): Promoting Animal Rights

### Syllabus:

- **GS Paper II:** Governance and Social Justice
- **GS Paper III:** Environment and Biodiversity

## Key Points

### 1. Context of AWBI's Recent Initiative



- **Partnership:** AWBI and NALSAR University of Law, Hyderabad, have collaborated to provide **legal training** to volunteers combating **animal cruelty**.

## 2. About the Animal Welfare Board of India (AWBI)

### i) Establishment

- **Founded:** In 1962, under Section 4 of the **Prevention of Cruelty to Animals Act, 1960**.
- **Founder:** Late Smt. **Rukmini Devi Arundale**, a noted animal rights activist.

### ii) Headquarters

- Located in **Chennai, Tamil Nadu**.

## 3. Aims of AWBI

- **Animal Welfare Promotion:** Advocate for animal rights and well-being.
- **Law Compliance:** Ensure adherence to **animal welfare laws**.
- **Supportive Role:** Assist organizations and institutions working for animal welfare.

## 4. Functions of AWBI

- Advisory Role:** Provides recommendations to the **Government of India** on issues related to **animal welfare**.
- Grants:** Offers financial aid to **animal welfare organizations** for their initiatives.
- Compliance Oversight:** Ensures strict implementation of **animal welfare laws** across the country.
- State and District Support:** Assists **State Animal Welfare Boards** and **District Society for Prevention of Cruelty to Animals (SPCAs)** in their functioning.

## 5. Ministry and Legal Framework

- **Ministry:** Operates under the **Ministry of Fisheries, Animal Husbandry, and Dairying**.
- **Legal Basis:** Functions as per the **Prevention of Cruelty to Animals Act, 1960**.

## Section 479 of BNSS, 2023: Relief for Undertrial Prisoners

**Syllabus:** GS Paper II – Governance, Justice System, and Social Justice

### Key Points

#### 1. Context of Section 479 of BNSS, 2023

- The **Ministry of Home Affairs (MHA)** directed all **states and Union Territories (UTs)** to implement **Section 479** of the **Bharatiya Nagarik Suraksha Sanhita (BNSS), 2023**, aimed at providing relief to **undertrial prisoners (UTPs)**.

#### 2. Purpose of Section 479

- To **reduce overcrowding in prisons** and provide **bail or bond relief** to **eligible undertrial prisoners**, ensuring **justice and fairness** in the judicial process.

#### 3. Key Provisions of Section 479

##### i) Subsection (1)

- **Eligibility Criteria for Bail or Bond:**
  - **Undertrial Prisoners (UTPs)** who have served **half the maximum sentence** prescribed for the offense (except those punishable by **death** or **life imprisonment**) shall be released on bail.
  - For **first-time offenders**, UTPs who have served **one-third of the maximum sentence** are eligible for release on bond.

##### ii) Subsection (3)

- **Mandatory Application by Prison Superintendents:**
  - Prison authorities must file **applications** in the **concerned court** for the release of eligible prisoners.

#### 4. Responsibilities of the Superintendent of Jail

- **Timely Action:** Ensure **prompt application** for bail or bond to the **court** for prisoners eligible under Section 479.
- **Accountability:** Monitor **compliance** with legal requirements to ensure that no eligible prisoner is overlooked.

## 5. Significance of Section 479

- Decongesting Prisons:** Addresses the issue of **overcrowding** in jails by facilitating the release of **eligible undertrial prisoners**.
- Timely Justice:** Reduces the undue **detention of UTPs**, ensuring alignment with the principle of “**justice delayed is justice denied.**”
- Focus on Reformative Justice:** Prioritizes the **reformation** of first-time offenders by providing early relief through bonds.
- Enhanced Accountability:** Strengthens the role of **prison authorities** in ensuring legal compliance and **access to justice** for prisoners.
- Social Equity:** Benefits economically weaker prisoners who cannot afford prolonged legal battles or high bail amounts.

## 6. Challenges in Implementation

- Administrative Bottlenecks:** Delays in filing applications due to **lack of resources** or **personnel in prisons**.
- Awareness Gap:** Many eligible prisoners remain uninformed about their rights under this provision.
- Judicial Backlog:** Courts may face additional pressure to process the increased number of applications for bail or bond.
- Lack of Monitoring Mechanisms:** Absence of robust systems to ensure compliance by prison authorities.

## 7. Way Forward

- Awareness Campaigns:** Educate prisoners and their families about **rights** under Section 479.
- Capacity Building:** Train prison authorities and judicial staff to handle **implementation challenges** effectively.
- Streamlined Processes:** Establish fast-track mechanisms for processing bail applications for eligible prisoners.
- Monitoring Systems:** Create a central database to track **compliance** with Section 479 provisions.
- Judicial Reforms:** Enhance court capacity to handle **increased bail applications** efficiently.

## Conclusion

Section 479 of BNSS, 2023, is a significant step toward **prison reform** and ensuring **justice for undertrial prisoners**. While its implementation poses challenges, effective **awareness, capacity building, and streamlined processes** can ensure that it serves as a milestone in India’s journey toward a **fair and equitable justice system**.

# AGRICULTURE

## Minimum Support Price (MSP): Ensuring Farmer Welfare Amidst Challenges

**Syllabus:** GS Paper III – Agriculture, Inclusive Growth, and Food Security

### Key Points

#### 1. Context of MSP Debate

- Farmer leader **Jagjit Singh Dallewal** has been on an **indefinite fast** demanding a **legally binding MSP**, while the **Parliamentary Standing Committee on Agriculture** has recommended the same.

#### 2. What is MSP?

i) **Definition:** MSP is the price at which the **government purchases crops** from farmers, ensuring they do not incur losses.

ii) **Established By**

- Recommended by the **Commission for Agricultural Costs and Prices (CACP)** under the **Ministry of Agriculture**, and approved by the **Cabinet Committee on Economic Affairs (CCEA)**.

iii) **Crops Covered:** Declared for **23 crops**, including cereals, pulses, oilseeds, and commercial crops like **cotton and jute**.

- Purpose:** Protects farmers from **price fluctuations**, provides **income stability**, and ensures **agricultural growth**.

## 3. Need for MSP for Farmers

### i) Income Stability

- Protects farmers from market price dips caused by **overproduction** or **low demand**.
  - *Example:* In **2024**, moong prices in Rajasthan fell to **₹6,467 per quintal**, far below the MSP of **₹8,682**.

### ii) Inequitable Market Dynamics

- Farmers lack bargaining power against traders, leading to **low price realization**.
  - *Data:* Over **80%** of farmers rely on **local markets** where prices often fall below MSP.

### iii) Rising Input Costs

- Increased prices of fertilizers and diesel reduce profitability.
  - *Data:* Fertilizer and diesel prices rose by **15-20%** between 2020 and 2024.

### iv) Addressing Rural Poverty

- With **86%** of farmers being **smallholders**, MSP prevents distress sales and ensures **sustainable livelihoods**.

## 4. Feasibility of Legalizing MSP

- High Fiscal Cost:** Procuring all MSP crops could cost **₹7.5 lakh crore annually**, consuming **17% of the Union Budget**.
- Direct Compensation Model:** A **price difference compensation mechanism** could cost **₹30,000-₹50,000 crore annually**, a more viable option.
- Market Interventions:** Establish **floor prices** in APMC auctions to stabilize market prices and reduce reliance on government procurement.
- Private Sector Role:** Mandate private buyers to purchase at or above MSP, distributing the **financial burden**.
- Deficit Payment Scheme:** Compensate farmers for the gap between **market price** and MSP without procuring all crops.

## 5. Limitations of Legalizing MSP

- Budgetary Stress:** Allocating **17% of the budget** to MSP could affect **health, education, and infrastructure investments**.
- Market Disruption:** Enforcing MSP might deter **private sector engagement**, reducing efficiency in agricultural markets.
- Administrative Challenges:** Monitoring and implementing MSP for millions of farmers and crops requires significant infrastructure.
- Regional Inequity:** Current MSP procurement benefits states like **Punjab, Haryana, and UP**, marginalizing farmers in less developed regions.
- Risk of Overproduction:** Guaranteed MSP could lead to **over-cultivation** of certain crops, worsening **water scarcity** and **environmental degradation**.

## 6. Way Forward

- Targeted Procurement:** Expand MSP-backed procurement to **pulses, oilseeds, and millets** for inclusivity.
- FPO Strengthening:** Empower **Farmer Producer Organizations (FPOs)** for collective bargaining and market access.
- Digital Platforms:** Use **e-NAM** and **blockchain** for transparent price discovery and monitoring.
- Market Reforms:** Enhance **APMC efficiency** and integrate them with **global markets** to stabilize prices.
- Awareness Campaigns:** Educate farmers on MSP mechanisms and alternative income sources like **agro-processing**.

## India's First Organic Fisheries Cluster: A Sustainable Step Towards Blue Economy

**Syllabus:** GS Paper III – Agriculture, Blue Economy, and Sustainable Development

### Key Points

#### 1. Context of Organic Fisheries Cluster

- **Union Minister** inaugurated India's **first Organic Fisheries Cluster** in **Soreng District, Sikkim**, under the **Pradhan Mantri Matsya Sampada Yojana (PMMSY)**.

#### 2. About India's First Organic Fisheries Cluster

i) **What It Is:** A fisheries cluster designed to promote **sustainable** and **eco-friendly fish farming** using **organic practices**.

#### ii) Features

- **Environmental Focus:** Minimal environmental pollution and sustainable fish production.
- **Species Cultivation:** Includes **amur carp** and other species for organic fish farming.
- **Support Mechanism:** Funded by **NABARD** for:

- Infrastructure development.
- Capacity building.
- Formation of **Farmer Producer Organizations (FFPOs)**.

### 3. About Pradhan Mantri Matsya Sampada Yojana (PMMSY)

i) **Launched By:** Department of Fisheries, under the **Ministry of Fisheries, Animal Husbandry & Dairying**, in 2020.

ii) **Aim:** Accelerate growth in the **fisheries sector**.

- Enhance productivity and promote a **Blue Economy vision**.

iii) **Key Features**

a) **Cluster-Based Approach:** Promotes **economies of scale**, enhances competitiveness, and strengthens the **fisheries value chain**.

b) **Comprehensive Coverage**

- Supports production, processing, and marketing for:
  - Freshwater fisheries.
  - Brackish water fisheries.
  - Ornamental fisheries.
  - Organic fisheries.

c) **Scheme Components**

- **Central Sector Scheme (CS):** 100% funded by the **Central Government**.
- **Centrally Sponsored Scheme (CSS):** Shared funding between **Centre and States**, divided into:
  - **Beneficiary-Oriented Subcomponents**.
  - **Non-Beneficiary-Oriented Subcomponents**.

d) **Technological Focus**

- Promotes **innovative technologies** like:
  - **Biofloc Systems:** Enhances water quality and productivity.
  - **Recirculatory Aquaculture Systems (RAS):** Reduces water use while increasing yield.

### 4. Significance of the Organic Fisheries Cluster

- Sustainability:** Promotes **eco-friendly practices**, reducing reliance on chemicals and preserving biodiversity.
- Economic Empowerment:** Boosts **income for farmers** through high-value organic fish production.
- Alignment with Blue Economy Vision:** Contributes to the sustainable use of water resources for **economic growth** and **livelihoods**.
- Regional Development:** Positions Sikkim as a **model state** for organic aquaculture, boosting local employment and tourism.
- Food Security:** Strengthens the availability of **nutritious fish products**, contributing to food security.

### 5. Challenges and Way Forward

i) **Challenges**

- **High Initial Costs:** Infrastructure development for organic farming can be expensive.
- **Knowledge Gaps:** Farmers require extensive training in organic fish farming practices.
- **Market Accessibility:** Ensuring fair prices and market linkage for organic fish products.

ii) **Way Forward**

- **Capacity Building:** Train farmers on organic techniques and modern technologies.
- **Financial Support:** Provide subsidies and affordable credit options.
- **Market Development:** Create a robust market for organic fish products through branding and certification.
- **Research and Innovation:** Invest in R&D to enhance organic aquaculture practices.



# GEOGRAPHY AND DISASTER

## National River Interlinking Project: Balancing Water Needs and Sustainability

**Syllabus:** GS Paper I – Geography (Water Resources and Disaster Management)

### Key Points

#### 1. Context of the National River Interlinking Project

- The **Ken-Betwa River Link Project**, aimed at solving water scarcity in **Bundelkhand**, was inaugurated by the **Prime Minister** in December.

#### 2. Origin of the Idea of Interlinking Rivers

##### i) Historical Proposals

- **Sir Arthur Cotton (19th Century):** Advocated **inter-basin water transfer** for irrigation.
- **M. Visvesvaraya (Early 20th Century):** Suggested linking rivers to address **water scarcity and flooding**.
- **K.L. Rao (1970s):** Proposed a **National Water Grid** to connect surplus and deficit areas.
- **Dinshaw J. Dastur (1980):** Expanded the concept with plans for **Himalayan and Peninsular links**.

ii) **National Perspective Plan (1980):** Formalized by the **Ministry of Water Resources**, leading to the establishment of the **National Water Development Agency (NWDA)** in 1982.

#### 3. Components of the Interlinking of Rivers Project

##### i) Himalayan Rivers Component

- **Links:** 14 proposed links, including **Ganga-Brahmaputra basin rivers**.
- **Focus:** Flood control, hydropower, and water redistribution to central India.

##### ii) Peninsular Rivers Component

- **Links:** 16 proposed links, including **Krishna, Godavari, and Cauvery rivers**.
- **Aim:** Drought mitigation, irrigation, and water sharing among southern states.

##### iii) Intra-State Links

- Focused on **state-specific water demands** to address localized water scarcity.

#### 4. Features of the ILR Project

- **Infrastructure Development:** Includes **canals, dams, reservoirs**, and hydropower facilities.
- **Integrated Approach:** Combines **irrigation, hydroelectric power**, and water supply.
- **Massive Scale:** Covers **30 river links** with a projected cost of **₹5.5 lakh crore**.

#### 5. Benefits of the Interlinking of Rivers

- Flood and Drought Mitigation:** Redistributes water from **flood-prone areas** (e.g., Bihar) to **drought-prone regions** (e.g., Bundelkhand).
- Agricultural Productivity:** Increases **irrigated land**, ensuring **food security** and reducing reliance on monsoons.
- Hydropower Potential:** Facilitates **renewable energy generation** from dams and reservoirs.
- Economic Growth:** Enhances water availability for **industries** and regional development.
- Waterway Expansion:** Promotes **inland navigation**, reducing transportation costs and environmental damage.

#### 6. Challenges of the Interlinking of Rivers

- Environmental Concerns:** **Biodiversity loss**, deforestation, and risks to protected areas like the **Panna Tiger Reserve**.
- High Costs:** Financial burden for **construction, maintenance**, and rehabilitation.
- Social Displacement:** Displaces **communities**, impacting livelihoods and social structures.
- Inter-State Disputes:** Potential for conflicts over **water-sharing agreements**, as seen in **Cauvery and Krishna disputes**.
- Ecosystem Disruption:** Alters **riverine ecosystems**, affecting aquatic life and downstream deltas.

## 7. Way Ahead

- i) **Comprehensive Impact Assessment:** Conduct multidisciplinary studies to evaluate **environmental, social, and economic impacts**.
- ii) **Stakeholder Engagement:** Collaborate with **states, communities, and experts** for equitable water-sharing solutions.
- iii) **Modern Water Management:** Use advanced techniques like **drip irrigation**, watershed management, and desalination.
- iv) **Climate Change Adaptation:** Integrate **climate-resilient policies** for sustainable water resource management.
- v) **Focus on Regional Projects:** Implement **smaller, state-specific water-sharing initiatives** to minimize risks.

## Polar Vortex: Understanding Its Formation and Impacts

**Syllabus:** GS Paper I – Geography (Climatology and Weather Phenomena)

### Key Points

#### 1. Context of Polar Vortex

- A recent **severe winter storm** in the **United States** affected **60 million people** across **30 states**, causing **power outages** and dangerous road conditions due to the polar vortex's influence.

#### 2. What is the Polar Vortex?

##### i) Definition

- A massive **low-pressure, cold air system** swirling in the **Earth's polar regions**.
- Categorized into:
  - **Tropospheric Polar Vortex** (surface to 15 km).
  - **Stratospheric Polar Vortex** (15 to 50 km).

##### ii) Formation

- Driven by:
  - **Earth's Rotation**.
  - **Temperature Differences** between polar and equatorial regions.
- Stabilized by a **jet stream** that separates **cold Arctic air** from warmer regions.

#### 3. Characteristics of the Polar Vortex

##### i) Behavior

- Typically confined to the **polar regions**.
- Can **weaken and expand southward**, bringing cold air to lower latitudes.

##### ii) Jet Stream Dynamics

- **Strong Vortex:** Maintains a steady, circular jet stream, keeping cold air confined.
- **Weakened Vortex:** Causes a **wavy jet stream**, allowing cold air to move southward.

#### 4. Impacts of the Polar Vortex

i) **Cold Weather:** Weakening allows **Arctic air** to travel south, affecting regions as far as **Florida**.

##### ii) Extreme Weather Patterns

- Disrupts jet streams, leading to:
  - **Severe storms**.
  - **Prolonged cold spells**.

##### iii) Economic and Social Disruptions

- **Power Outages:** Increased strain on power grids during severe weather.
- **Travel Delays:** Dangerous road conditions and flight cancellations.
- **Heating Costs:** Spike in energy demand, raising costs for households.

## Recalculated Coastline of India: A Revised Perspective

**Syllabus:** GS Paper I – Geography (Physical Geography of India)  
GS Paper III – Infrastructure and Security

### Key Points

#### 1. Context of the Recalculated Coastline

- India's coastline has expanded by 47.6%, from 7,516 km (1970) to 11,098 km (2023-24), as per the Ministry of Home Affairs (MHA).

#### 2. Old vs. New Coastline Length

- Historical Measurement (1970):** The earlier methodology considered **straight-line measurements** for the coastline.
- Revised Length (2023-24):** Includes **bays, estuaries, inlets, and geomorphological features**, leading to a more accurate figure of **11,098 km**.

#### 3. Key Revisions in Leading States

##### i) Gujarat

- Previous Length:** 1,214 km.
- Revised Length:** 2,340 km.
- Contribution:** Largest increase in coastline length.

##### ii) West Bengal

- Previous Length:** 157 km.
- Revised Length:** 721 km.
- Percentage Increase:** A massive **357% rise**.

##### iii) Tamil Nadu

- Revised Length:** 1,068 km, overtaking **Andhra Pradesh** (1,053 km).

##### iv) Puducherry

- Decrease:** Coastline contracted by **4.9 km (10.4%)**.

##### v) Kerala

- Smallest Increase:** Addition of just **30 km (5%)**.

i) **Sources of Data:** Measurements derived from the **National Hydrographic Office** and **Survey of India**.

##### ii) Technology Integration

- Utilized **advanced technologies** for precise and dynamic measurements.
- Bays, estuaries, inlets,** and other features were incorporated into the calculation.

iii) **Supervision:** Conducted under the **Ministry of Home Affairs (MHA)** and guided by the **National Maritime Security Coordinator**.

#### 5. Significance of the Recalculated Coastline

- Strategic and Security Implications:** Improves understanding of India's **maritime boundaries** for better **national security planning**.
- Economic Impact:** Facilitates **coastal development** by identifying areas for **infrastructure and trade expansion**.
- Environmental Management:** Enables precise **coastal conservation planning** by recognizing **dynamic shoreline changes**.
- Disaster Mitigation:** Enhances **preparedness** for challenges like **sea-level rise** and **cyclonic events**.

## Flamingo Festival 2025: Celebrating Biodiversity and Culture

**Syllabus:** GS Paper I – Geography (Biodiversity), GS Paper III – Environment and Conservation

### Key Points

#### 1. Context of Flamingo Festival 2025

- After a **four-year hiatus**, the **Flamingo Festival 2025** is returning to **Andhra Pradesh**, focusing on **migratory birds** like flamingos at **Pulicat Lake** and **Nelapattu Bird Sanctuary**.

## 2. About the Flamingo Festival

i) **Definition:** An **annual event** celebrating the arrival of **migratory birds**, particularly flamingos, to the region.

ii) **Locations**

- Spread across **five key sites**:
  - **Nelapattu Bird Sanctuary**.
  - **Pulicat Lake** (Atakanithippa, BV Palem).
  - **Government Junior College, Sullurpet**.
  - **Sri City**.

iii) **Features**

- **Bird-Watching Tours:** Guided tours for observing flamingos and other migratory birds.
- **Eco-Friendly Activities:** Biodiversity sessions and boating.
- **Cultural Programs:** Competitions, stalls promoting local art, and heritage.
- **Collaborations:** With organizations like the **Bombay Natural History Society (BNHS)**.

## 3. About Pulicat Lake

i) **Significance:** India's **second-largest brackish water lake** after Chilika Lake (Odisha).

ii) **Location:** Situated on the **Andhra Pradesh-Tamil Nadu border**, with **96% of the lake in Andhra Pradesh**.

iii) **Biodiversity**

- A **critical feeding and breeding ground** for migratory birds, including flamingos.
- Home to diverse **flora and fauna**, supporting ecological balance.

iv) **Economic Importance:** Supports **fisheries**, providing livelihoods for local communities.

## 4. About Nelapattu Bird Sanctuary

i) **Importance:** Southeast Asia's **largest breeding site** for **spot-billed pelicans (Pelecanus philippensis)**.

ii) **Location:** Located **20 km north of Pulicat Lake** on the Andhra Pradesh-Tamil Nadu border.

iii) **Biodiversity**

- Hosts **189 bird species**, including migratory birds like **painted storks** and **glossy ibises**.
- Features **Barringtonia swamp forests** and **southern dry evergreen scrub**.

iv) **Ecological Role:** Enhances biodiversity conservation and supports agriculture through natural fertilizers like **guano**.

## Gulf of Mexico: Geography, Resources, and Recent Controversy

**Syllabus:** GS Paper I – Geography, Geopolitics

### Key Points

#### 1. Context of the Gulf of Mexico

- **Recent Debate:** US President-elect Donald Trump proposed renaming the **Gulf of Mexico** to the **Gulf of America**, sparking discussions on the **geopolitical and historical implications** of such a change.

#### 2. Geographical Overview

i) **Location**

- A **marginal sea of the Atlantic Ocean**, bordered by:
  - **North and Northwest:** United States.
  - **South and Southwest:** Mexico.
  - **Southeast:** Cuba.



## ii) Shape and Size

- **Shape:** Oval-shaped basin.
- **Area:** Approximately 1.6 million km<sup>2</sup>.

## iii) Geological Features

- **Floor Composition:** Sedimentary rocks and layers of **recent sediments**.

## 3. Rivers Draining into the Gulf

- Mississippi River:** Largest contributor, delivering vast amounts of **sediment** and **nutrients**.
- Other Rivers:** **Brazos, Rio Grande, and Mobile River** also drain into the Gulf.

## 4. Economic Significance

### i) Energy Resources

- Major hub for **offshore petroleum production**.
- Contributes 14% of **US crude oil production**.

## 5. Geopolitical Significance of the Renaming Proposal

- **Historical Identity:** The Gulf has been known as the **Gulf of Mexico** for centuries, reflecting the shared history of the region among **Mexico, the US, and Cuba**.
- **Diplomatic Impact:** A name change could strain relations with **Mexico and Cuba**, highlighting **nationalist undertones**.
- **Public Reaction:** The proposal has triggered debates over **cultural heritage** and **geopolitical boundaries**.

## California Wildfires: Causes, Impacts, and Mitigation Strategies

**Syllabus:** GS Paper III – Natural Disasters, Environment, and Climate Change

## Key Points

### 1. Context of California Wildfires

- **Los Angeles Wildfires (2025):** Devastated the region, claiming **seven lives** and destroying over **10,000 structures**.

### 2. What Are Wildfires?

- **Definition:**
  - **Uncontrolled fires** spreading rapidly through forests, grasslands, or urban areas.
  - **Natural occurrence**, but exacerbated by **human activities** and **climate change**.

### 3. Geographic Conditions Aiding Wildfires

- Dry Climate:** Prolonged droughts create **arid conditions**, drying vegetation and increasing flammability.
- Santa Ana Winds:** **Hot, strong winds** spread embers, intensifying flames and expanding the fire's reach.
- Vegetation Density:** Dense forests and dry shrubs act as **natural fuel**, accelerating fire intensity.
- Topography:** Hilly terrains funnel winds, causing fires to move faster and cover **larger areas**.
- Lack of Rainfall:** Extended dry spells weaken vegetation and reduce **soil moisture**, increasing ignition risks.

### 4. Causes of Wildfires

#### i) In California

- **Electrical Equipment Failures:** Sparks from power lines in dry, windy conditions.
- **Urban Expansion:** Human activity near fire-prone areas raises ignition risks.
- **Arson:** Intentional or accidental acts, such as improper disposal of flammable materials.

#### ii) General Causes

- **Lightning Strikes:** Natural ignitions during thunderstorms.
- **Climate Change:** Rising temperatures and droughts increase fire frequency.
- **Agricultural Burns:** Poorly managed field-clearing burns can escalate into wildfires.

## 5. Consequences of Wildfires

- i) **Human and Economic Losses:** Lives lost, communities displaced, and financial damages running into **billions of dollars**.
- ii) **Environmental Impact:** Destroys ecosystems, **biodiversity**, and vegetation, degrading **soil health**.
- iii) **Air Quality Deterioration:** Smoke and particulate matter cause **respiratory and cardiovascular issues**.
- iv) **Water Contamination:** Ash and debris pollute **drinking water sources** and harm aquatic ecosystems.
- v) **Insurance Challenges:** Frequent wildfires strain the **insurance industry**, raising costs for property owners.

## 6. Measures to Mitigate Wildfires

- i) **Improved Fire Management:** Use advanced tools like **drones, satellite monitoring**, and **fire-retardant chemicals**.
- ii) **Vegetation Control:** Remove dry vegetation, conduct **controlled burns**, and maintain **firebreaks**.
- iii) **Climate Adaptation:** Implement long-term policies to address **climate change**, such as reducing carbon emissions.
- iv) **Public Awareness:** Educate communities on **fire prevention** and **evacuation plans**.
- v) **Stronger Regulations:** Enforce strict **building codes, land use policies**, and activity restrictions in fire-prone areas.

## Conclusion:

Wildfires are an escalating threat due to **climate change** and **urbanization**. Proactive strategies such as **improved fire management, public education, and climate action** are essential to reduce their devastating effects on **lives, economies, and ecosystems**.

## Artesian Condition: A Key to Groundwater Dynamics

**Syllabus:** GS Paper I – Geography (Water Resources and Geomorphology)

### Key Points

#### 1. Context of Artesian Condition

- In **December 2024**, artesian water flow in **Taranagar, Jaisalmer (Rajasthan)** revealed unique **geological features**, dispelling myths like the presence of the **Saraswati River**.

#### 2. What is an Artesian Condition?

i) **Definition:** An artesian condition occurs when **groundwater** is confined under **pressure** between layers of **impermeable rocks**, known as an **artesian aquifer**.

ii) **Factors Leading to Artesian Condition**

- **Confined Aquifer:** Water trapped between **impermeable rock layers**.
- **Pressure Gradient:** Natural **geological pressure** created by the weight of overlying impermeable layers.
- **Rupture or Drilling:** Pressure release when the **confining layer** is breached, such as during **drilling**.

#### 3. How It Works

- When the **confining layer** is breached:
  - **Water flows naturally** to the surface due to internal pressure.
  - The flow can be **gushing** or steady, depending on the **pressure gradient** and **depth** of the aquifer.

#### 4. Significance of Artesian Conditions

- i) **Water Source in Arid Regions:** Critical for accessing **groundwater** in deserts like **Rajasthan**, providing **sustainable water supply**.
- ii) **Geological Insight:** Offers valuable data on **subsurface hydrogeological conditions**, aiding scientific exploration.
- iii) **Agricultural Utility:** Facilitates **irrigation** in confined aquifers without requiring pumping, reducing energy costs.
- iv) **Global Examples:** Found in regions like **Australia** (Great Artesian Basin), parts of **Africa**, and historical wells like **Artois** in France (origin of the term "artesian").

#### 5. Challenges and Conservation

- i) **Overexploitation:** Excessive tapping can reduce pressure and deplete confined aquifers.
- ii) **Salinity Issues:** Artesian water in some regions can have **high salinity**, limiting its usability.
- iii) **Infrastructure for Utilization:** Requires careful planning to avoid wastage and ensure sustainable use.

#### 6. Way Forward

- i) **Sustainable Management:** Monitor and regulate groundwater extraction to maintain **natural pressure**.
- ii) **Technological Integration:** Use **remote sensing** and **geophysical surveys** to locate and assess artesian aquifers.
- iii) **Research and Awareness:** Promote studies on artesian conditions to enhance **water resource planning** in arid regions.

## INDIAN HERITAGE & CULTURE

### Craft Products Celebrating 75 Years of India's Republic

**Syllabus:** GS Paper I – Indian Heritage and Culture

#### Key Points

##### 1. Context of Craft Products

- **Event:** As part of the **75th Republic Day celebrations**, a unique “**At Home**” reception has been introduced by the President.
- **Highlight:** Invitees will receive a curated box featuring **handcrafted items** that showcase the rich heritage of **southern India**.
- **Scheme:** The crafts are created under the “**One District One Product**” initiative.

##### 2. Craft Products in the Box

###### i) Kalamkari Painted Bamboo Box (Andhra Pradesh)

- **Features:** Handcrafted with **Nimmalakunta Kalamkari paintings**, showcasing intricate traditional art.
- **GI Tag State:** Andhra Pradesh.

###### ii) Ikat-Pochampalli Cover (Telangana)

- **Features:** **Reusable cover** crafted using the **Ikat weaving tradition**.
- **GI Tag State:** Telangana.

###### iii) Ganjifa Art Magnet (Karnataka)

- **Features:** Inspired by **Ganjifa art**, associated with **traditional playing cards**.
- **GI Tag State:** Karnataka.

###### iv) Kanjeevaram Silk Pouch (Tamil Nadu)

- **Features:** **Handmade silk pouch**, symbolizing the elegance of **Kanjeevaram weaving**.
- **GI Tag State:** Tamil Nadu.

###### v) Etikopakka Dolls (Andhra Pradesh)

- **Features:** **Eco-friendly wooden dolls** crafted traditionally.
- **GI Tag State:** Andhra Pradesh.

###### vi) Screwpine Leaf Bookmark (Kerala)

- **Features:** Woven from **sustainable screwpine leaves**, promoting eco-friendliness.
- **GI Tag State:** Kerala.

### Saint Narahari Tirtha: Philosopher, Statesman, and Vaishnavite Proponent

**Syllabus:** GS Paper I – Indian Culture, Philosophy, and Historical Personalities

#### Key Points

##### 1. Context of Saint Narahari Tirtha

- The discovery of a **13th-century idol** of **Saint Narahari Tirtha** has revived interest in his diverse contributions as a **philosopher, statesman, poet, and Vaishnavite leader**.

## 2. About Saint Narahari Tirtha

### i) Birth and Origin

- **Born:** Circa 1243 CE.
- **Hometown:** Believed to be from **Chikakolu** (modern-day **Srikakulam, Andhra Pradesh**).

ii) **Place of Significance:** Associated with both **Andhra Pradesh** and **Odisha (Kalinga)** due to his influence in these regions.

iii) **Guru:** A prominent disciple of **Shri Madhvacharya (Ananda Tirtha)**, founder of the **Dvaita philosophy**.

## 3. Philosophy and Contributions

### i) Dvaita Philosophy

- Advocate of **Madhvacharya's dualistic philosophy** and Vaishnavism.
- Wrote **commentaries** and propagated **Bhagavata Dharma**.

### ii) Administrative Role

- Served as a **minister** in the **Kalinga Kingdom** for **12 years**.
- Aligned governance with **Sanatana Dharma**, combining spiritual and administrative duties.

### iii) Haridasa Movement

- Regarded as the **progenitor** of this devotional movement.
- Popularized **Kannada devotional songs** under the pen name **Raghukulatilaka**.

### iv) Cultural Legacy

- Promoted:
  - **Yakshagana Bayalata** (a traditional dance-drama form).
  - **Kuchipudi dance** in classical traditions.

v) **Educational Reforms:** Revamped the **Simhachalam temple** into an educational center for **Vaishnavism studies**.

vi) **Religious Leadership:** Played a key role in safeguarding **sacred idols** like **Moolarama** and **Moola Sita** for **Madhvacharya**.

## 4. Legacy and Cultural Importance

- Spiritual Influence:** Integral to the spread of **Vaishnavism** and **Dvaita philosophy** in Eastern India.
- Syncretic Contributions:** Bridged governance, philosophy, and culture, ensuring a **holistic legacy**.
- Pen Name:** Known as **Raghukulatilaka** in devotional and literary circles.

## Indus Valley Script: Unraveling the Mystery of an Ancient Writing System

**Syllabus:** GS Paper I – Ancient History and Culture

### Key Points

#### 1. Context of the Indus Valley Script Decipherment

- Tamil Nadu's Chief Minister has announced a **\$1 million prize** for deciphering the **Indus Valley script**, emphasizing the significance of solving this ancient mystery.

#### 2. About the Harappan Script

##### i) What It Is

- The **Harappan Script** is the undeciphered **writing system** of the **Indus Valley Civilization** (c. 2600–1900 BCE).
- No confirmed linguistic association has been established, making it one of the **great mysteries** of ancient history.

##### ii) Material Used

- Found on diverse materials, including:
  - **Steatite seals** and clay impressions.
  - **Pottery, bronze tools, and stoneware bangles**.



- **Shells, ivory, and small copper tablets.**
- Seals were typically **square-shaped** (2.54 cm) and occasionally made from **silver, faience, or calcite.**

### iii) Features of the Script

- **Short inscriptions:** Average length is **five symbols**, with the longest known inscription having **26 symbols.**
- **Development Timeline:**
  - Early forms during the **Ravi and Kot Diji phases** (c. 3500–2700 BCE).
  - Fully developed by the **Urban period** (c. 2600–1900 BCE).

### iv) Motifs Found on the Script

- **Animal Motifs:** Unicorns, bulls, tigers, elephants, and mythical creatures.
- **Human Figures:** Depictions of **combat, rituals, or symbolic narratives.**

## 3. Significance of Deciphering the Indus Valley Script

- Historical Understanding:** Provides insights into the **language, culture, and governance** of the **Indus Valley Civilization.**
- Civilizational Linkages:** Can reveal connections between **Harappan culture** and contemporary civilizations like **Mesopotamia and Egypt.**
- Linguistic Evolution:** Decipherment could trace the roots of **modern Indian languages and scripts.**
- Cultural Identity:** Resolving the script's meaning could strengthen **regional and national heritage.**

## 4. Challenges in Decipherment

- No Bilingual Texts:** Unlike the **Rosetta Stone** for Egyptian hieroglyphs, no bilingual or multilingual inscriptions exist for the Harappan script.
- Short Inscriptions:** The brevity of inscriptions limits linguistic analysis.
- Unknown Linguistic Family:** No consensus on whether the script is linked to **Dravidian, Indo-European, or other language families.**
- Material Degradation:** Many artifacts are **damaged or incomplete**, complicating study.

## 5. Way Forward

- Technology Integration:** Utilize **AI and machine learning** for pattern recognition and linguistic analysis.
- Collaborative Research:** Encourage collaboration among **linguists, archaeologists, and computer scientists.**
- Comparative Studies:** Compare the script with contemporary civilizations like **Mesopotamia** to find potential links.
- Preservation Efforts:** Protect artifacts to ensure **long-term access** for research.

# ENVIRONMENT & ECOLOGY

## India's Biennial Update Report (BUR-4): Progress and Challenges

**Syllabus:** GS Paper III – Environment, Climate Change, Conservation, and Sustainable Development

### Key Points

#### 1. What are Biennial Update Reports (BURs)?

- **Definition:** BURs are periodic reports submitted by developing countries to the **UNFCCC** as part of obligations under the Paris Agreement.
- **Key Components:**
  - **National GHG Inventory:** Details of emission sources, sinks, and trends.
  - **Climate Action Plans:** Updates on policies to mitigate emissions.
  - **Support Received:** Financial, technical, and capacity-building assistance.
  - **Socioeconomic and Forestry Data:** Insights into national circumstances affecting emissions.

#### 2. Highlights of India's BUR-4

- **GHG Inventory for 2020:**
  - **Total GHG Emissions:** 2,959 million tonnes of CO<sub>2</sub> equivalent.
  - **Net Emissions:** 2,437 million tonnes after forestry absorption.
  - **Emissions Intensity of GDP:** Reduced by **36% from 2005 levels.**
- **Sectoral Contributions:**
  - **Energy:** 75.66% (Electricity: 39%).
  - **Agriculture:** 13.72%.
  - **Industry and Waste:** 10.62%.

### 3. Progress on Commitments

- **Reduction in GDP Emissions Intensity:** Achieved **36% reduction** (target: 45% by 2030).
- **Non-Fossil Fuel Power Capacity:** **46.52% as of 2024**.
- **Carbon Sink Creation:** **2.29 billion tonnes CO<sub>2</sub> equivalent** (2005–2021).

### 4. Energy Efficiency Schemes

- **Perform, Achieve, and Trade (PAT):**
  - Saved **7.72 Mtoe**.
  - Reduced **28.74 million tonnes** of CO<sub>2</sub> emissions.

### 5. Technological Needs

- Requirements for advanced technologies like:
  - **Ultra-efficient photovoltaics.**
  - **Floating wind turbines.**
  - **Carbon capture technologies** for industrial sectors.

### 6. India's Climate Commitments and Status

- **Reduce GDP Emissions Intensity by 45% by 2030:** Achieved **36% reduction** (2005–2020).
- **50% Power Capacity from Non-Fossil Fuels:** **46.52% achieved** (as of October 2024).
- **Create 2.5–3 Billion Tonnes CO<sub>2</sub> Sink by 2030:** **2.29 billion tonnes achieved** (2005–2021).
- **Net-Zero Emissions by 2070:** Incremental progress underway.

### 7. Challenges in Achieving Commitments

- **Technology Barriers:** Limited access to **low-carbon technologies** due to high costs.
- **Financial Constraints:** Insufficient funding for **renewable energy projects** and afforestation.
- **Fossil Fuel Dependency:** Transition in **transportation and industry** remains slow.
- **Agricultural Emissions:** Methane emissions from **livestock and rice cultivation**.
- **Urbanization and Population Growth:** Increasing **energy demand** and **waste generation**.

### 8. Way Ahead

- **Strengthen Technology Transfer:** Ensure **affordable access** to climate technologies.
- **Expand Renewable Energy:** Invest in **solar, wind, and other non-fossil sources**.
- **Enhance Forest Cover:** Implement robust **afforestation programs**.
- **Promote Circular Economy:** Foster sustainable practices in industries and waste management.
- **Collaborate Globally:** Seek **financial and technological support** from international forums.

## Blue Flag Certification: Promoting Sustainable Beaches

#### Syllabus:

- **GS Paper III: Environment, Conservation, and Sustainable Development**
- **GS Paper II: Governance and Policies**

### Key Points

#### 1. Context of Blue Flag Certification

- **Kerala Beaches Certified:** **Kappad and Chal beaches** in Kerala received the prestigious **Blue Flag certification**, indicating adherence to **stringent environmental and safety standards**.

#### 2. About Blue Flag Certification

- Origin: Initiated:** In France (1985) and expanded globally in 2001.
- Awarded By:** Denmark-based **Foundation for Environmental Education (FEE)**.
- Aim: Promote Sustainable Practices:** Focuses on marine and freshwater **ecosystem preservation**.

#### 3. Key Criteria for Blue Flag Certification

- Water Quality:** Ensures **clean, safe, and pollutant-free waters**.

- ii) **Environmental Management:** Implements **eco-friendly initiatives** for sustainability.
- iii) **Safety Measures:** Prioritizes **visitor security, emergency accessibility,** and safe infrastructure.
- iv) **Education:** Promotes **environmental awareness** and encourages **responsible tourism.**

## 4. Significance of Blue Flag Certification

- i) **Global Recognition:** Enhances the **international appeal** of certified beaches, attracting global attention.
- ii) **Tourism Boost:** Draws eco-conscious travelers, boosting **sustainable tourism.**
- iii) **Environmental Protection:** Encourages practices that preserve **ecosystems and biodiversity.**
- iv) **Local Development:** Promotes improvements in **hygiene, safety, and infrastructure,** benefiting local communities.

## Miyawaki Technique: A Revolutionary Approach to Urban Reforestation

**Syllabus:** GS Paper III – Environment, Conservation, and Urbanization

### Key Points

#### 1. Context of Miyawaki Technique

- The **Prayagraj Municipal Corporation** utilized the **Miyawaki Technique** to transform **56,000 square meters** of garbage dumps and barren lands into **lush green forests.**

#### 2. About the Miyawaki Technique

- i) **Definition:** Developed by Japanese botanist **Akira Miyawaki** in the **1970s,** this method mimics **natural ecosystems** to create **dense and fast-growing forests.**
- ii) **Also Known As:** Referred to as the **'pot plantation method'** due to its focus on **close planting** to accelerate growth.

#### 3. Features of the Miyawaki Technique

- i) **Dense Planting:** Trees and shrubs are planted **close together** using **native species,** ensuring natural harmony.
- ii) **Accelerated Growth:** Forests grow **10 times faster** compared to traditional afforestation methods.
- iii) **Soil Restoration:** Enhances **soil fertility** and promotes **natural regeneration.**
- iv) **Biodiversity Boost:** Supports diverse **flora and fauna,** contributing to a balanced ecosystem.

#### 4. Significance of the Miyawaki Technique

i) **Urban Reforestation:** Converts **barren and polluted lands** into **green spaces,** addressing urban environmental challenges.

ii) **Environmental Benefits**

- **Reduces air and water pollution.**
- Absorbs **more carbon dioxide.**
- Lowers surrounding temperatures by **4-7°C.**

iii) **Sustainability:** Prevents **soil erosion** and restores ecological balance, fostering **long-term environmental resilience.**

## Water Cycle and Climate Change: Impacts and Mitigation

**Syllabus:** GS Paper III – Environment, Climate Change, and Disaster Management

### Key Points

#### 1. Context of the Water Cycle and Climate Change

- The **2024 Global Water Monitor Report** reveals that **climate change** is intensifying the **Earth's water cycle,** resulting in **extreme precipitation, severe droughts,** and disruptions in water availability.

#### 2. What is the Water Cycle?

- The **water cycle** involves the continuous movement of water in its various states (**solid, liquid, gas**) across the Earth and atmosphere, driven by **solar energy** and **gravity.**
- It ensures **water availability** and regulates **weather patterns.**

### 3. Components of the Water Cycle

- i) **Evaporation:** Transformation of water from **liquid to vapor**, primarily from oceans, due to **solar energy**.
- ii) **Transpiration:** Plants release **water vapor** into the atmosphere, increasing **moisture content**.
- iii) **Condensation:** Cooling of **water vapor** in the atmosphere forms **clouds**.
- iv) **Precipitation:** Water returns to Earth as **rain, snow, or sleet**, replenishing surface and groundwater.
- v) **Infiltration:** Water seeps into the **soil**, recharging aquifers and supporting vegetation.
- vi) **Runoff:** Water flows over the land into **rivers, lakes, and seas**, maintaining the **hydrological balance**.

### 4. Recent Data on Water Cycle and Climate Change

- i) **Water Disasters (2024):** **8,700 fatalities** and **40 million displaced** due to water-related disasters.
- ii) **Record-Dry Months:** **38% increase** in record-dry months (2024 vs. 1995–2005).
- iii) **Rainfall Intensity:** Rainfall records broken **52% more often** in 2024 than in 2000.
- iv) **Economic Losses:** **\$550 billion** in global damages due to water-related disasters.
- v) **IPCC Findings:** Climate change intensified the **water cycle by 7.4%**, altering rainfall and drought patterns.

### 5. Impacts of Climate Change on the Water Cycle

#### i) Negative Impacts

- **Increased Evaporation:** Triggers frequent storms and floods.
- **Drought:** Leads to prolonged aridity and dry soils.
- **Glacial Melt:** Reduces freshwater sources and raises sea levels.
- **Water Scarcity:** Affects **3 billion people** globally.
- **Soil Erosion:** Heavy rainfall washes away fertile soil, disrupting agriculture.

#### ii) Positive Impacts

- **Enhanced Vegetation:** Areas like the **Sahara Desert** show signs of greening.
- **Improved Rainfall:** Regions like the **Sahel** benefit from increased water availability.

### 6. Solutions to Mitigate Impacts

- i) **Improved Water Management:** Efficient **irrigation** and **conservation practices** for sustainable use.
- ii) **Reforestation:** Restores **green water sources** and enhances **carbon sequestration**.
- iii) **Reducing Emissions:** Lowering **greenhouse gases** to slow climate-driven water cycle changes.
- iv) **Enhancing Infrastructure:** Build **resilient infrastructure** to manage floods and store water during droughts.
- v) **Global Cooperation:** Enforce **water-sharing treaties** and adhere to **climate agreements**.
- vi) **Public Awareness:** Promote **water conservation** methods like **rainwater harvesting** through community education.

## Electricity (Green Energy Open Access) Rules, 2022: A Legal and Policy Perspective

**Syllabus:** GS Paper II – Governance (Federalism)  
GS Paper III – Environment (Renewable Energy Policies)

### Key Points

#### 1. Context of the Karnataka High Court Judgment

- The **Karnataka High Court** struck down the **Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2022**, ruling that the Centre exceeded its legislative authority under the **Electricity Act, 2003**.

#### 2. Details of the Judgment

- i) **State Electricity Commissions' Exclusive Domain:** The HC ruled that regulating **open access** falls under the jurisdiction of **State Electricity Commissions (SERCs)** as per **Sections 42(2) and 181** of the **Electricity Act, 2003**.
- ii) **Centre's Overreach:** The Centre cannot **override state commissions' powers** without amending the **Electricity Act**, even to meet **international climate commitments**.



## 3. About Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2022

i) Launched By: Ministry of Power, Government of India, in 2022.

ii) Key Features

- a) **Objective:** Promote **renewable energy generation** and reduce emissions, including from **waste-to-energy plants**.
- b) **Consumer Access: Open Access Limit Reduced:** From **1 MW** to **100 kW**, enabling **small consumers** to participate.
- c) **Approval Process:** Streamlined with a **national portal** and a **15-day timeline** for approval; deemed approval if delayed.
- d) **Charges:** Transparent definition of **transmission, wheeling, cross-subsidy**, and other charges.
- e) **Green Power Demand:** Consumers can demand **green power** from Discoms, which are obligated to provide it.
- f) **Incentives:** Caps on **cross-subsidy surcharges** and removal of **additional surcharges** to encourage green energy adoption.
- g) **Renewable Purchase Obligation (RPO):** Uniform **RPOs** for all entities, including green hydrogen and ammonia.
- h) **Green Certificates:** Consumers using green power are eligible for **green certificates**.

## 4. Significance of the Rules

- i) **Environmental Impact:** Encourages transition to **renewable energy** sources, contributing to **climate goals**.
- ii) **Consumer Empowerment:** Smaller consumers gain access to **green energy**, democratizing the renewable energy market.
- iii) **Streamlined Processes:** Simplified approval mechanisms reduce delays and enhance **operational efficiency**.
- iv) **Economic Benefits:** Incentives like reduced surcharges encourage investments in **renewable energy projects**.

## 5. Challenges Highlighted by the Judgment

- i) **Federalism and Jurisdiction:** The rules **infringe on states' authority**, challenging the federal balance under the Electricity Act.
- ii) **Legal Overreach:** Rules bypassed **state-level electricity commissions**, undermining decentralized governance.
- iii) **Implementation Issues:** Lack of clarity in **coordination** between central and state regulatory bodies.

## 6. Way Forward

- i) **Amendment of Electricity Act, 2003:** To align the Act with **renewable energy goals**, ensuring clarity in **Centre-state roles**.
- ii) **State-Centric Policies:** Encourage states to adopt **tailored renewable energy policies** in line with **local needs**.
- iii) **Collaborative Governance:** Strengthen **Centre-state coordination** to avoid conflicts and ensure seamless implementation.
- iv) **Public Awareness:** Educate stakeholders, including **small consumers**, on the benefits of open access to **green energy**.

## Environment Relief Fund (Amendment) Scheme, 2024: Enhancing Environmental Restoration

**Syllabus:** GS Paper III – Environment, Governance, and Disaster Management

### Key Points

#### 1. Context of the Amendment

- The **Environment Relief Fund Scheme, 2008**, was revised through the **Environment Relief Fund (Amendment) Scheme, 2024**, to enhance **fund management**, streamline **disbursements**, and improve **environmental restoration efforts**.

#### 2. About Environment Relief Fund (Amendment) Scheme, 2024

i) Launched By: Ministry of Environment, Forest and Climate Change (MoEFCC).

ii) Aim

- **Improve Fund Management:** Streamline fund usage and ensure efficient disbursements.
- **Enhance Restoration Efforts:** Support effective **environmental restoration**.

#### 3. Key Features of the Scheme

i) **Fund Management:** **Central Pollution Control Board (CPCB)** appointed as Fund Manager for **five years**, replacing **United Insurance Company Limited**.

ii) **Funding Sources**

- **Compensation** under **Section 24** of the National Green Tribunal Act, 2010.
- **Penalties** under **Sections 14, 15, or 17** of the Public Liability Insurance Act.
- **Returns** from fund investments.

- iii) **Digital Integration:** Introduction of an **online portal** for fund tracking and scheme implementation.
- iv) **Disbursement Process:** Funds to be released within **30 days** of orders by the **District Collector** or **Central Government**.
- v) **Investment Strategy:** Funds to be invested in **public financial institutions** and **savings accounts** to maintain liquidity and enable reinvestment.
- vi) **Environmental Restoration**
  - CPCB and State Pollution Control Boards (SPCBs) to prepare **restoration plans** for **Central Government approval**.
  - Funds allocated based on approved plans.
- vii) **Auditing:** An **independent auditor** appointed by the Central Government, with oversight from the **Comptroller and Auditor-General (CAG)**.
- viii) **Administrative Allocation:** Administrative expense allocation increased from **1% to 2%**.

## 4. Significance of the Amendments

- i) **Efficient Fund Management:** Centralized control with CPCB ensures **transparency** and **accountability**.
- ii) **Quick Disbursements:** Ensures timely release of funds for **environmental restoration projects**.
- iii) **Enhanced Restoration Efforts:** Funds allocated based on **comprehensive restoration plans**, improving the ecological balance.
- iv) **Digital Integration:** Use of an online portal promotes **transparency** and facilitates real-time monitoring.
- v) **Accountability:** Regular audits ensure **financial integrity** and proper utilization of funds.

## 5. Challenges and Way Forward

### i) Challenges

- **Implementation Bottlenecks:** Coordination between CPCB, SPCBs, and local authorities.
- **Capacity Issues:** SPCBs may lack resources for preparing effective restoration plans.

### ii) Way Forward

- **Capacity Building:** Strengthen SPCBs for better restoration planning and execution.
- **Public Awareness:** Inform stakeholders about fund utilization and restoration efforts.
- **Periodic Reviews:** Monitor and evaluate scheme effectiveness regularly.

## Groundwater Conservation: A Step Towards Sustainable Water Management

**Syllabus:** GS Paper III – Water Resources, Environmental Conservation, and Sustainable Development

### Key Points

#### 1. Context of Groundwater Conservation

- **Central Ground Water Board (CGWB)** reports indicate positive trends in **groundwater recharge** and **reduced extraction**, highlighting the impact of **collaborative efforts** and **policy innovations**.

#### 2. Improvements in Groundwater (2017–2024)

- i) **Groundwater Recharge:** Increased by **15 Billion Cubic Meters (BCM)**.
- ii) **Extraction Reduction:** Decreased by **3 BCM**.
- iii) **Safe Assessment Units:** Increased from **62.6% (2017)** to **73.4% (2024)**.
- iv) **Decline in Over-Exploited Units:** Reduced from **17.24%** to **11.13%**.

*(Source: National Compilation on Dynamic Ground Water Resources of India, 2024)*

#### 3. Government Initiatives for Groundwater Conservation

- i) **Jal Shakti Abhiyan:** Focus on **rainwater harvesting** and conservation under the “**Catch the Rain**” campaign.
- ii) **Atal Bhujal Yojana (2020):** Targets groundwater management in **water-stressed regions** across **seven states**.
- iii) **Mission Amrit Sarovar (2022):** Aims to create/rejuvenate **75 Amrit Sarovars** in each district for **water harvesting**.
- iv) **Pradhan Mantri Krishi Sinchai Yojana (PMKSY):** Expands **irrigation coverage** and enhances **water-use efficiency**.
- v) **National Aquifer Mapping (NAQUIM):** Covers **25 lakh sq. km**, aiding in **groundwater recharge planning**.
- vi) **Master Plan for Artificial Recharge (2020):** Proposes **42 crore rainwater harvesting structures** to harness **185 BCM** of rainfall.
- vii) **Watershed Development Component of PMKSY (WDC-PMKSY):** Promotes **soil conservation** and **rainwater harvesting**.
- viii) **National Water Policy (2012):** Advocates for **rainwater harvesting** and **efficient water use**.

## 4. Challenges Facing Groundwater Conservation

- i) **Over-Extraction:** Excessive use for **irrigation** and **domestic needs** depletes reserves faster than recharge rates.
- ii) **Pollution:** Contamination by **arsenic, fluoride, nitrates**, and industrial pollutants impacts **health** and **agriculture**.
- iii) **Declining Water Tables:** Unsustainable practices in **urban** and **rural areas** lead to a sharp drop in groundwater levels.
- iv) **Climate Change:** Alters **rainfall patterns**, disrupting natural recharge cycles and intensifying water scarcity.
- v) **Urbanization:** Expansion reduces **recharge zones**, limiting infiltration and exacerbating depletion.

## 5. Way Ahead for Groundwater Conservation

- i) **Policy Interventions:** Implement **sustainable use laws** and incentivize **conservation techniques** like efficient irrigation.
- ii) **Technology Integration:** Use **AI and IoT** for real-time monitoring of groundwater resources and optimized management.
- iii) **Community Engagement:** Foster **awareness campaigns** and involve **local communities** in conservation initiatives.
- iv) **Integrated Water Management:** Promote a balance of **surface water, rainwater**, and groundwater usage to reduce over-dependence.

## Umred-Pauni-Karhandla Wildlife Sanctuary: A Crucial Tiger Conservation Hub

**Syllabus:** GS Paper III – Environment and Biodiversity Conservation

### Key Points

#### 1. Context of the Incident

- The **Bombay High Court** took **suo moto cognizance** of tourists **cornering a tigress and her cubs** in the **Umred-Pauni-Karhandla Wildlife Sanctuary**, exposing lapses in **wildlife protection** and **monitoring protocols**.

#### 2. About Umred-Pauni-Karhandla Wildlife Sanctuary

##### i) Location

- Situated in:
  - **Pauni Tahsil**, Bhandara district.
  - **Umred, Kuhi, and Bhivapur Talukas**, Nagpur district, Maharashtra.

##### ii) Connection to Other Reserves

- Linked to the **Tadoba Andhari Tiger Reserve** via forests along the **Wainganga River**, forming a **tiger conservation corridor**.

##### iii) Geographical Features

- **Boundaries:**
  - Northeast: **Wainganga River** and **Gose Khurd Dam**.

#### 3. Flora and Fauna of the Sanctuary

##### i) Flora

- Dense **deciduous forests**, primarily comprising: **Teak**, bamboo, and other hardwood species.

##### ii) Fauna

- **Mammals:** **Tigers**, leopards, sloth bears, wild dogs, Indian gaur, sambar deer, and spotted deer.
- **Birds:** Hosts a **diverse avian population**, including **endemic** and **migratory species**.
- **Reptiles:** Cobras, pythons, and other reptilian species contribute to the rich **biodiversity**.

#### 4. Significance of the Sanctuary

##### i) Tiger Conservation

- Forms a **vital corridor** for tiger movement between Tadoba Andhari Tiger Reserve and other protected areas, aiding in:
  - **Genetic diversity**.
  - Mitigation of **human-tiger conflicts** through improved connectivity.

##### ii) Biodiversity Hotspot:

Home to **diverse flora and fauna**, including **endangered species**, contributing to ecological balance.

##### iii) Ecotourism Potential:

Offers opportunities for **responsible tourism**, creating awareness about **wildlife conservation**.

## 5. Challenges and Way Forward

### i) Challenges

- **Tourist Behavior:** Incidents like **cornering wildlife** highlight the need for stricter monitoring.
- **Human-Wildlife Conflicts:** Proximity to human settlements increases the risk of encounters.
- **Resource Constraints:** Limited funding and manpower for effective patrolling and monitoring.

### ii) Way Forward

- **Enhanced Monitoring:** Deploy advanced technologies like **camera traps** and **drones** for surveillance.
- **Tourism Regulation:** Enforce **strict guidelines** for visitors, including penalties for rule violations.
- **Community Engagement:** Involve local communities in **conservation efforts** to reduce conflicts.
- **Staff Training:** Regularly train forest personnel in **wildlife protection** and **emergency response**.

# BIOTECHNOLOGY & HEALTH

## National Organ and Tissue Transplant Organisation (NOTTO): Promoting Organ Donation

**Syllabus:** GS Paper II – Governance, Health, and Social Justice

### Key Points

#### 1. Context of NOTTO

- **New Policy:** The **Central Government** allows **42 days of leave** for its employees who donate organs, recognizing their contribution to saving lives.

#### 2. About NOTTO

- **Definition:** NOTTO is a **national-level organization** under the **Directorate General of Health Services**, Ministry of Health and Family Welfare.
- **Ministry:** Operates under the **Ministry of Health and Family Welfare**.
- **Headquarters:** Located in the **Institute of Pathology (ICMR) Building**, Safdarjung Hospital, New Delhi.

#### 3. Aims of NOTTO

- **Coordination and Regulation:** **Promote and regulate organ and tissue donation** and transplantation across India.
- **Safe Allocation:** Facilitate the **safe and efficient allocation** and utilization of donated organs and tissues.

#### 4. Functions of NOTTO

- Policy Formation:** Develops **guidelines and protocols** for organ donation and transplantation to ensure transparency and ethical practices.
- Coordination and Networking:** Acts as the **apex body** to coordinate **organ procurement, allocation, and distribution** among regions.
- Registry Maintenance:** Maintains a **National Organ and Tissue Donation and Transplant Registry** for monitoring and surveillance.
- Awareness Campaigns:** Conducts **public awareness initiatives** to promote **voluntary organ donation**.
- Training and Support**

- Organizes **training programs** for healthcare workers.
- Provides consultancy on **legal and non-legal aspects** of organ donation.

vi) **Monitoring:** Monitors transplantation activities and maintains a **data bank** for surveillance and evaluation.

## Genome India Project: A Milestone in Biotechnology

**Syllabus:**

- **GS Paper III:** Science and Technology, Health, and Biotechnology

### Key Points



## 1. Context of the Genome India Project

- **Completion Announced:** The **Prime Minister** celebrated the successful completion of the **Genome India Project**, highlighting its role in advancing India's biotechnology landscape.

## 2. About the Genome India Project

- Definition:** A national initiative to decode India's genetic diversity through large-scale genome sequencing.
- Launched In:** January 2020.
- Ministry:** Funded by the **Department of Biotechnology, Ministry of Science and Technology**.

## 3. Aims of the Project

- **Map Genetic Diversity:** Create a **comprehensive genetic landscape** of Indian populations.
- **Enable Precision Medicine:** Support **targeted clinical interventions** and **personalized healthcare**.

## 4. Key Features of the Project

- Genome Sequencing:** **10,074 genomes** sequenced from **99 ethnic groups**.
- Data Repository:** Genetic data securely stored at the **Indian Biological Data Centre**.
- Sample Collection:** Over **19,000 blood samples** collected and stored in the **GenomeIndia Biobank**.
- Phase 1 Findings:** Identified **rare genetic variations** unique to Indian populations.

## 5. Significance of the Genome India Project

- Healthcare Revolution:** Facilitates **precision medicine** and **targeted clinical interventions**, improving patient outcomes.
- Research Resource:** Provides a **genetic reference database** for researchers and institutions.
- Global Recognition:** Positions India as a **leader in genomics** and **biotech innovation**.
- Bioeconomy Growth:** Supports the growth of India's **bioeconomy**, which expanded from **\$10 billion (2014)** to **\$150 billion (2024)**.

## MicroRNAs (miRNAs): Revolutionizing Gene Regulation Research

**Syllabus:** GS Paper III – Science and Technology (Biotechnology and Genetic Research)

### Key Points

#### 1. Context of MicroRNAs Discovery

- The discovery of **microRNAs (miRNAs)** in **Caenorhabditis elegans** has transformed our understanding of **gene regulation**, earning the **2024 Nobel Prize in Physiology or Medicine** for **Victor Ambros** and **Gary Ruvkun**.

#### 2. About MicroRNAs (miRNAs)

i) **Definition:** miRNAs are **small, non-coding RNA molecules** that regulate **gene expression** at the **post-transcriptional level**.

ii) **Functions**

- **Gene Expression Regulation:** Bind to **complementary mRNA sequences**, suppressing **protein production**.
- **Developmental Precision:** Ensure **precise gene expression** during developmental and physiological processes.

iii) **Role in Gene Suppression**

- Reduce **protein synthesis** by:
  - Promoting **mRNA degradation**.
  - Hindering **translation**.

iv) **Applications**

- **Diagnostics:** Potential use in detecting **cancer** and **genetic disorders**.
- **Therapeutics:** Developing treatments for diseases caused by dysregulated gene expression.

### 3. About *Caenorhabditis elegans*

i) **Definition:** A 1-mm transparent nematode, widely used in **genetic and developmental research**.

ii) **Role in Research**

- **Simple Yet Complex:** Despite being simple, its processes are comparable to humans.
- **Transparency:** Facilitates tracking of **cell lineage** during development.

iii) **2024 Nobel Prize Winners:** Victor Ambros and Gary Ruvkun discovered **miRNAs** in *C. elegans*, highlighting their **gene-regulatory role**.

### 4. Significance of the Discovery

i) **Foundational Understanding:** Elucidated mechanisms of **gene suppression**, ageing, **cell death**, and neuronal circuits.

ii) **Model Organism:** *C. elegans* has contributed to breakthroughs in:

- **Programmed cell death.**
- **Genome sequencing.**

iii) **Advancements in Research:** Opened avenues in studying **disease pathways**, **cancer progression**, and **neurodegenerative disorders**.

## Homo juluensis: A New Chapter in Human Evolution

**Syllabus:** GS Paper I – History of Human Evolution

### Key Points

#### 1. Context of the Discovery

- Researchers from the **University of Hawai'i** identified a potential new human species, **Homo juluensis**, based on fossils from **eastern Asia**, dating back to the **Middle to Late Pleistocene (300,000–50,000 years ago)**.

#### 2. About *Homo juluensis*

i) **What It Is:** A newly proposed human species that coexisted with **Denisovans** during the **Pleistocene epoch**.

ii) **Habitation**

- Inhabited regions of **eastern Asia**, including: **China, Korea, Japan, and Southeast Asia**.
- Likely lived in **small groups**, hunting wild horses and utilizing stone tools for survival.

iii) **Features**

- **Physical Characteristics:** Jaw and teeth fossils suggest similarities with **Denisovans**.
- **Cultural Practices:**
  - Crafted **stone tools** for hunting.
  - Likely processed **animal hides** for sustenance and survival.

#### 3. Relation to Other Human Species

- i) **Shared Ancestry:** Related to **Homo sapiens**, **Homo neanderthalensis**, and **Denisovans**.
- ii) **Evolutionary Insights:** Provides clues about the complex **interactions and coexistence** of ancient human relatives in **Asia**.
- iii) **Cultural Advancements:** Demonstrates technological and survival adaptations similar to **modern humans**.

#### 4. Significance of the Discovery

- i) **Understanding Human Evolution:** Highlights the **diversity of human species** and their adaptations during the Pleistocene epoch.
- ii) **Interaction Between Species:** Offers evidence of potential **interbreeding** or cultural exchanges with **Denisovans** and **Homo sapiens**.
- iii) **Regional Evolution:** Expands understanding of **human evolution in Asia**, a region less explored compared to Africa and Europe.

#### 5. Challenges and Future Research

i) **Challenges**

- **Limited Fossil Evidence:** Scarcity of remains makes definitive classification difficult.

- **Overlap with Other Species:** Determining unique traits of **Homo juluensis** amidst similarities with other species.

## ii) Future Research Directions

- **Genetic Studies:** Extract ancient DNA to confirm relations with Denisovans and Homo sapiens.
- **Archaeological Surveys:** Explore additional fossil sites in eastern Asia for more evidence.
- **Cultural Insights:** Investigate tool-making techniques and survival strategies of the species.

# SCIENCE & TECHNOLOGY

## Indigenous Surgical Robotic System: SSI Mantra 3 Revolutionizing Healthcare

**Syllabus:** GS Paper III – Science and Technology, Health, and Innovation

### Key Points

#### 1. Context of the Milestone

- **Robotic Cardiac Surgeries:** India successfully performed **telesurgery using SSI Mantra 3**, an **indigenous surgical robotic system**, marking a significant achievement in healthcare technology.

#### 2. About SSI Mantra 3

- **Definition:** A state-of-the-art **surgical robotic system** designed for **advanced robotic surgeries**, including **telesurgery**.
- **Developer:** Created by **SS Innovations**, a pioneer in healthcare robotics.

#### 3. Key Features of SSI Mantra 3

- Ultra-Low Latency:** Operates at **35-40 milliseconds latency**, ensuring **seamless real-time remote surgical procedures**.
- High Precision:** Enables complex surgeries like **Totally Endoscopic Coronary Artery Bypass (TECAB)** with unmatched accuracy.
- Telesurgery and Tele-proctoring Approved:** **First robotic system globally** to receive regulatory approval for **telesurgery** from the **Central Drugs Standard Control Organization (CDSCO)**.

#### 4. How SSI Mantra Works

- **Remote Control:** Operates through **advanced robotic arms** controlled remotely by surgeons over a **secure network**.
- **Efficient Data Transmission:** High-speed transmission ensures **minimal delay** and enhances **surgical precision**.
- **Collaboration:** Supports **tele-proctoring** for surgical education and mentorship, enabling real-time guidance.

#### 5. Significance of SSI Mantra 3

- Bridges Healthcare Gaps:** Extends access to **expert surgical care** in **remote and underserved areas**.
- Enhances Patient Outcomes:** Provides **minimally invasive procedures** with higher accuracy, reducing recovery time.
- Transformative for India:** Addresses **healthcare disparities** by connecting rural populations to advanced care.
- Global Potential:** Showcases scalability for **global adoption**, revolutionizing **medical education** and **remote surgical practices**.

## Meta's Adoption of Community Notes for Content Moderation

**Syllabus:** GS Paper III – Science and Technology, Social Media, and Cybersecurity

### Key Points

#### 1. Context of Community Notes

- **Introduction:** Meta has announced the integration of **Community Notes**, a crowdsourced content moderation system, for platforms like **Facebook, Instagram, and Threads**.
- **Replacement:** Serves as an alternative to its **fact-checking program** in the US, similar to Twitter's (X) approach.

#### 2. About Community Notes

- **What is Community Notes?**

- A **crowdsourced fact-checking system** where users add context or facts to posts.
- **Origin:**
  - First introduced by **Twitter (as Birdwatch)** in **2021**, rebranded as X.
  - Now being adopted by Meta for its platforms.

### 3. How Community Notes Work

- **Contributor Role:** Users provide **additional context** below specific posts.
- **Validation Process:** **Notes appear** only if a diverse group of users agree on their helpfulness.
- **Transparency:** All data is **publicly accessible**, enabling anyone to analyze the contributions.

### 4. Significance of Community Notes

- **Scalable Content Moderation:** Reduces dependency on **centralized fact-checkers**.
- **Community-Driven Transparency:** **Empowers users** to actively counter misinformation.
- **Adaptability:** Improves accuracy with **user participation** and **algorithmic refinements**.

## Scorpene-Class Submarines: Advancing India's Naval Capabilities

**Syllabus:** GS Paper III – Science and Technology, Defense Technology, Internal Security

### Key Points

#### 1. Context of Scorpene-Class Submarines

- **Recent Development:** India's **Mazagon Dock Shipbuilders Limited (MDL)** delivered the **sixth Scorpene-class submarine, Vaghsheer**, to the Indian Navy under **Project P-75**.

#### 2. About Scorpene-Class Submarines

- **Definition:** **Diesel-electric attack submarines** designed for **stealth operations**, **intelligence gathering**, and **anti-vessel warfare**.
- **Project P-75:** Initiated in **2005** under a **\$3.75 billion agreement** between MDL and French firm **Naval Group** with **technology transfer**.

#### 3. Submarines Under Project P-75

- **INS Kalvari:** Commissioned in **2017**.
- **INS Khanderi:** Commissioned in **2019**.
- **INS Karanj:** Commissioned in **2021**.
- **INS Vela:** Commissioned in **2021**.
- **INS Vagir:** Commissioned in **January 2023**.
- **INS Vaghsheer:** Delivered in **2024** after sea trials in **2023**.

#### 4. Features of Scorpene-Class Submarines

- **Capabilities:**
  - **Anti-Surface and Anti-Submarine Warfare** capabilities.
  - Equipped for **intelligence gathering** and **area surveillance**.
  - Can launch **torpedoes** and **tube-launched anti-ship missiles**.
- **Propulsion System:**
  - **Diesel-electric propulsion** providing endurance of **~50 days**.
  - To be retrofitted with **Air Independent Propulsion (AIP)** systems starting **2024** for enhanced stealth and underwater endurance.
- **Advanced Systems:**
  - High **automation** with Integrated Platform and Combat Management Systems.
  - From **INS Vaghsheer onwards**, features indigenously developed **Air Conditioning Plant** and **Internal Communication System**.
- **Stealth Technology:**
  - Incorporates **superior stealth features** to avoid detection by adversaries.

## AnemiaPhone: Transforming Anaemia Diagnosis and Management

**Syllabus:** GS Paper III – Science and Technology, Health, and Social Justice

### Key Points

#### 1. Context of AnemiaPhone



- Developed by **Cornell University researchers**, AnemiaPhone is a **portable, cost-effective technology** transferred to the **Indian Council of Medical Research (ICMR)** for use in **anaemia alleviation programs**.

## 2. About AnemiaPhone

i) **Developed By:** Created by researchers at **Cornell University**.

ii) **Features**

- **Portable:** Compact and easy to use in remote areas.
- **Rapid and Cost-Effective:** Provides results within minutes.
- **Digital Integration:** Results uploaded to a **clinical database** via mobile, tablet, or computer.
- **On-the-Spot Interventions:** Enables healthcare workers to **screen, diagnose, and guide** immediate treatments.

iii) **How It Works**

- **Sample Collection:** Requires a **finger prick** and a drop of blood on a **test strip**.
- **Analysis:** The AnemiaPhone **reader analyzes the sample**.
- **Data Processing:** Results are **uploaded to a clinical database** for action or referral.

## 3. About Anaemia

i) **Definition:** A **blood disorder** caused by insufficient or dysfunctional **red blood cells**.

ii) **Causes**

- **Iron Deficiency:** The most common cause globally.
- **Inherited:** Certain types passed **genetically** (e.g., sickle cell anemia).
- **Acquired:** From injuries, illnesses, or **nutritional deficiencies**.

iii) **Symptoms:** **Fatigue**, chest pain, headache, pale skin, dizziness, shortness of breath, and heart palpitations.

## 4. Significance of AnemiaPhone

- Improved Accessibility:** Reaches **remote areas** where traditional diagnostic facilities are unavailable.
- Early Detection:** Enables **timely diagnosis** and intervention, reducing complications.
- Data Integration:** Facilitates real-time data for **policy formulation** and program monitoring.
- Cost Efficiency:** Reduces the financial burden on **public health systems** by minimizing testing costs.

## 5. Relevance for India

- High Prevalence of Anaemia:** Anaemia affects **over 50% of women** and children in India, as per **NFHS-5**.
- Support for Government Programs:** Strengthens initiatives like **Anaemia Mukt Bharat** and other **maternal and child health programs**.
- Potential for Scale:** AnemiaPhone offers scalable solutions for **widespread deployment** in rural and urban areas.

## Microsoft and IndiaAI Collaboration: Advancing AI Ecosystem in India

**Syllabus:** GS Paper III – Science and Technology, IT and AI Innovations, Inclusive Development

### Key Points

#### 1. Context of Microsoft and IndiaAI Collaboration

- **IndiaAI**, under the **Digital India Corporation**, has partnered with **Microsoft** to leverage **Artificial Intelligence (AI)** for **inclusive development and economic transformation**.

#### 2. About the Microsoft and IndiaAI Partnership

i) **Nature of Collaboration:** A **strategic partnership** aimed at advancing **India's AI ecosystem** through **training, innovation, and responsible AI development**.

ii) **Key Features**

- **Skill Development:** Train **500,000 individuals** by 2026, including **students, educators, women entrepreneurs, and developers**.
- **AI Catalysts:** Establish **Centers of Excellence** in Tier 2 and Tier 3 cities, fostering **rural AI innovation** and empowering **100,000 AI innovators and developers**.

- **AI Productivity Labs:** Set up labs in **20 training institutes** across **10 states** to train **20,000 educators** and **100,000 students** in foundational AI skills.
- **Support for Startups:** Provide **Azure credits, mentorship,** and support to **1,000 AI startups** through Microsoft's **Founders Hub program**.

### 3. About IndiaAI Mission

i) **Launch and Governance:** Launched under the **Digital India Corporation, Ministry of Electronics and Information Technology (MeitY)**.

#### ii) Aims

- Create an ecosystem for **AI innovation** through **public-private partnerships**.
- **Democratize AI** to promote **inclusive and sustainable growth**.
- Deploy over **10,000 GPUs** for advanced **AI computing infrastructure**.

#### iii) Key Features

- Promote **responsible and indigenous AI capabilities**.
- Enhance **data quality** and **accessibility** for AI solutions.
- Foster AI adoption in **underserved areas**.
- Drive **AI applications** in sectors like **healthcare** and **education**.

### 4. Significance of the Collaboration

- i) **Skill Empowerment:** Trains a diverse range of beneficiaries, reducing the **digital divide** and empowering rural areas.
- ii) **Startup Support:** Provides critical resources and mentorship to **AI startups**, fostering innovation and entrepreneurship.
- iii) **AI Democratization:** Focuses on **inclusive AI development**, bringing technology to **Tier 2 and Tier 3 cities** and underserved areas.
- iv) **Global Competitiveness:** Positions India as a **global leader** in AI, enhancing its **tech ecosystem** and economic growth.
- v) **Citizen-Centric Development:** Drives **AI adoption** in critical sectors like **healthcare** and **education**, improving public service delivery.

## Bhashini Initiative: Bridging Language Barriers with AI

**Syllabus:** GS Paper III – Science and Technology, IT and Innovations, Digital Governance

### Key Points

#### 1. Context of Bhashini Initiative

- The **e-Shram portal** has integrated **multilingual functionality** across **22 scheduled languages**, leveraging the **Bhashini Initiative** to improve access for unorganized workers.

#### 2. About Bhashini Initiative

- i) **Launched In:** Introduced in **2022** under the **Ministry of Electronics and Information Technology (MeitY)**.
- ii) **Definition:** A **government initiative** providing **AI and Natural Language Processing (NLP)** tools for translation and **digital service accessibility** in Indian languages.
- iii) **Aim:** To **eliminate language barriers** in accessing digital services by making **AI and NLP tools** publicly available.

#### 3. Features of Bhashini Initiative

- i) **Local Language Translation Mission:** Enables **seamless multilingual communication** for diverse digital services.
- ii) **Open AI and NLP Resources:** Provides tools and datasets for **MSMEs, startups,** and **innovators** to foster innovation in Indian languages.
- iii) **Data Repositories and Open Models:** Develops and maintains a robust ecosystem of **linguistic datasets, tools,** and **models**.
- iv) **Bhashadaan Crowdsourcing Platform**
  - Allows citizens to contribute linguistic datasets through activities like:
    - **Suno India:** Listening to audio datasets.
    - **Likho India:** Text transcription.
    - **Bolo India:** Voice data collection.
    - **Dekho India:** Visual data annotation.
- v) **Accessibility:** Available via an **online platform** and **dedicated mobile apps** for widespread usability.

#### 4. Significance of Bhashini Initiative

- i) **Digital Inclusion:** Empowers people across **linguistic and regional divides** by enabling access to **digital services** in their native languages.
- ii) **Support for MSMEs and Startups:** Provides **affordable AI resources**, fostering innovation in the **local language ecosystem**.
- iii) **Cultural Preservation:** Promotes **linguistic diversity** and preserves **Indian languages** in the digital domain.
- iv) **Enhanced Governance:** Improves delivery of **government services** like the e-Shram portal, ensuring inclusivity for unorganized workers.
- v) **Global Positioning:** Positions India as a leader in **multilingual AI and NLP technology**, enhancing its global competitiveness.

## AI Deepfakes and Women: A Threat to Privacy and Representation

**Syllabus:** GS Paper III – Science and Technology, Gender Equality, and Ethics

### Key Points

#### 1. Context of AI Deepfakes and Women

- **AI-generated deepfakes** are increasingly being used to target **women**, especially female politicians, to **tarnish reputations** and **discourage public participation**.

#### 2. Issues Related to Deepfake Misuse

- i) **Misuse of AI:** Cheap **AI tools** and apps are being used to create **non-consensual sexualized content**, leaving women vulnerable.
- ii) **Targeted Harassment:** Women in politics are frequent targets, e.g.: **Angela Rayner** (UK) and **Giorgia Meloni** (Italy) faced harm through **deepfake porn**.
- iii) **Lack of Regulation:** Many countries, such as **Pakistan**, lack **specific legislation** to counter deepfake misuse.

#### 3. Impacts of AI Deepfakes on Women

- i) **Personal Trauma:** Victims like **Azma Bukhari** (Pakistan) suffer **public humiliation** and emotional distress due to deepfake videos.
- ii) **Silencing Effect:** Fear of **harassment and reputational damage** discourages women's participation in politics, threatening **gender equality** in governance.
- iii) **Global Security Risks:** Deepfakes enable **blackmail** and spread **disinformation**, especially in **culturally sensitive cases** like that of **Meena Majeed** (Pakistan).
- iv) **Widening Privilege Gap:** Wealthier women, such as **U.S. Congress members**, can afford **legal recourse** to remove fake content, while those with fewer resources remain vulnerable.

#### 4. Steps to Address the Deepfake Crisis

- i) **Legislative Measures:** Enact specific laws criminalizing **non-consensual deepfake content** with severe penalties.
- ii) **Global Cooperation:** Countries should collaborate to create **international frameworks** for combating deepfakes.
- iii) **AI Regulation:** Enforce strict oversight on **AI development** to prevent misuse of **deepfake tools**.
- iv) **Awareness Campaigns:** Educate the public on identifying and reporting **deepfake content**.
- v) **Support Systems:** Establish **victim support networks** offering **legal aid, counseling**, and assistance with content removal.
- vi) **Empowering Platforms:** Hold social media and content-hosting platforms accountable for **rapid detection** and removal of harmful content.

## Tidal Tail: Unlocking the Secrets of Galactic Interactions

**Syllabus:** GS Paper III – Science and Technology (Space Science and Astronomy)

### Key Points

#### 1. Context of the Tidal Tail Discovery

- Astronomers have identified the **longest tidal tail ever observed**, spanning **1.27 million light-years** from the galaxy **NGC 3785** in the **Leo constellation**.

#### 2. What is a Tidal Tail?

i) **Definition:** A **tidal tail** is a **long, thin stream** of stars, gas, and interstellar material, formed due to **gravitational interactions** between galaxies.

ii) **Characteristics**

- Typically features **two tails**:
  - One **leading tail**.
  - One **trailing tail**.



### 3. Formation of Tidal Tails

- Created during **close encounters** or **mergers** of galaxies.
- **Gravitational forces** strip stars, gas, and dust from the **outer regions** of interacting galaxies, forming elongated streams.

### 4. Significance of Tidal Tails

- Galaxy Formation:** Offers insights into the creation of **ultra-diffuse galaxies** with **low surface brightness**.
- Galaxy Evolution:** Reveals how **interactions and mergers** influence a galaxy's **structure** and **star formation**.
- Cosmic History:** Acts as a **marker of past galactic mergers**, helping trace the **evolutionary history of galaxies**.

### 5. Example: NGC 3785 Discovery

- The newly discovered **tidal tail** is the **longest ever recorded**, extending **1.27 million light-years**, providing critical data on the **Leo constellation's galactic interactions**.

## POEM-4 Mission: Advancing Space Agriculture and Technology

**Syllabus:** GS Paper III – Science & Technology, Space Technology, and Innovation

### Key Points

#### 1. Context of POEM-4 Mission

- ISRO's PSLV-C60 **POEM-4 Mission** achieved a significant milestone by successfully **germinating cowpea seeds in space** and operating **India's first space robotic arm**, advancing research in **space technology** and **extraterrestrial agriculture**.

#### 2. About the Cowpea Seeds Experiment

- What It Is:** Cowpea seeds (*Vigna unguiculata*), commonly known as **lobia**, are nutrient-rich legumes recognized for their **robustness** and adaptability.
- Mission Overview:** Conducted under the **Compact Research Module for Orbital Plant Studies (CROPS)** developed by the **Vikram Sarabhai Space Centre (VSSC)** as part of the **POEM-4 Mission**.
- Significance of the Experiment**
  - Space Agriculture:** Provides foundational knowledge for **growing crops in microgravity**, essential for long-term space missions and **extraterrestrial settlements**.
  - Sustainability in Space:** Paves the way for **self-sufficient habitats** in space, reducing reliance on **Earth-based resources**.
  - Scientific Advancement:** Demonstrates India's growing **expertise in space research**, opening avenues for **global collaborations**.
  - Future Missions:** Contributes to extended space exploration and the feasibility of **human settlements** on celestial bodies like the **Moon or Mars**.

#### 3. POEM-4 Mission Achievements

- India's First Space Robotic Arm:** Successfully operated a **space robotic arm**, showcasing India's advancements in **autonomous technology** for space exploration.
- Microgravity Experiments:** Enabled real-time studies in **microgravity** to understand biological and physical changes in space.
- Technological Innovation:** Enhanced India's capability in **developing compact research modules** for conducting experiments in **orbit**.

#### 4. Significance of the Mission

- Technological Milestone:** Positions India among the leading nations in **space technology innovation**.
- Food Security for Space Missions:** Essential for sustaining human life during **extended space missions** by enabling **in-situ food production**.
- Global Collaboration:** Enhances India's role in **international space research**, offering shared insights into **space agriculture**.
- Inspiration for Future Missions:** Demonstrates readiness for **complex missions** like lunar or Martian settlements.

#### 5. Challenges and Way Forward

##### i) Challenges

- **Microgravity Impact:** Understanding long-term effects on plant growth and genetic stability.
- **Resource Optimization:** Efficient use of space and energy for agricultural modules.
- **Scalability:** Transitioning from experimental to practical large-scale food production.

##### ii) Way Forward

- **Advanced Research:** Conduct further experiments with diverse crops to enhance adaptability in space conditions.
- **Technological Integration:** Develop autonomous systems for continuous monitoring and resource management.



- **Global Partnerships:** Collaborate with leading space agencies for knowledge exchange and joint missions.

## India's First Robotic Telesurgeries: A Milestone in Healthcare Innovation

**Syllabus:** GS Paper III – Science & Technology, Health Innovation

### Key Points

#### 1. Context

- India's **indigenous robotic system, SSI Mantra**, achieved a global milestone by performing **two robotic cardiac telesurgeries** over a distance of **286 km** with a latency of only **40 milliseconds**.

#### 2. About SSI Mantra

##### i) Unique Features

- **First in the World:** The only robotic system globally with **regulatory approval for telesurgery and tele-proctoring**.
- Approved by **Central Drugs Standard Control Organization (CDSCO)** under the **Drugs & Cosmetics Act, 1940**.
- Performed **Totally Endoscopic Coronary Artery Bypass (TECAB)**, one of the most complex cardiac surgeries.

ii) **Significance of Telesurgery:** Enables surgeons to perform operations from **any location** using robotics and high-speed data connections.

#### 3. Applications of Robotics in Healthcare

- Safety & Monitoring Robots:** Use **telepresence systems** with computer vision technology to monitor **patient vitals** remotely.
- Robotic Prosthetics:** Advanced prosthetics enhance mobility and functionality for amputees, including **robotic limbs** and **exoskeletons**.
- Sanitation & Disinfection Robots:** Utilize **ultraviolet-C (UV-C) light** or **hydrogen peroxide vapour (HPV)** to disinfect areas, ensuring **infection control**.
- Medical Transportation Robots:** Deliver supplies, medications, and meals to patients, improving **efficiency** in hospitals.

#### 4. Challenges Associated with Robotics in Healthcare

- **High Initial Costs:** Installation and maintenance of robotic systems are expensive.
- **Skill & Training Gap:** Surgeons and staff require specialized training to operate intricate robotic systems.
- **Ethical Concerns:** Accountability for potential errors in robotic procedures remains unclear.
- **Patient Trust:** Resistance to robotic involvement in critical surgeries.

#### 5. Indian Initiatives to Integrate Robotics in Healthcare

i) **National Health Policy, 2017:** Recognizes the **role of technology** in improving **healthcare delivery**.

ii) **Draft National Strategy on Robotics, 2023**

- Focuses on promoting robotics across sectors, including healthcare.
- Proposes the establishment of the **Robotics Innovation Unit (RIU)**.

iii) **Artificial Intelligence & Robotics Technology Park (ARTPARK):** Located in **IISc Bengaluru**, ARTPARK fosters **innovation** in AI and robotics.