



**IQRA IAS**  
AN INSTITUTE FOR CIVIL SERVICES

# CURRENT AFFAIRS

**WEEKLY 28<sup>th</sup> July - 3<sup>rd</sup> August (2025)**



# WEEKLY UPDATES

DATE : 28<sup>th</sup> July- 3<sup>rd</sup> August

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# POLITY

## Standing Committee Report on Panchayati Raj Fund Devolution (2025)

### ❖ Syllabus Mapping

- GS Paper II – Polity (Panchayati Raj, Devolution of Powers)
- GS Paper II – Governance (Local Government, Fiscal Federalism)
- GS Paper III – Inclusive Development

### 1. Context

- Parliamentary Standing Committee on Rural Development released its report on “**Devolution of Funds under Panchayati Raj System**.”
- Focus: Strengthening **fiscal decentralization** for **Rural Local Bodies (RLBs)** in line with the **73rd Constitutional Amendment (1992)**.

### 2. Constitutional Basis for Fund Devolution

Provision	Significance
Article 280	Finance Commission recommends <b>grants to PRIs</b>
73rd Amendment (1992)	Mandates <b>devolution of 3Fs – Functions, Funds, Functionaries</b>
11th Schedule	Lists <b>29 subjects</b> for Panchayati Raj Institutions (PRIs)

### 3. Key Concerns Raised

- Decline in Fund Allocation → Weakens **fiscal decentralization**.
- Reduction in Untied Grants → Limits PRIs' autonomy to address local needs.
- Partial Devolution of 3Fs → Uneven across states; weak local governance.
- Delayed State Finance Commissions (SFCs) → Some states yet to constitute **3rd-5th SFCs**.
- Weak Auditing & ATRs → E.g., Arunachal Pradesh and Chhattisgarh lag in reporting.

### 4. Recommendations of the Committee

- Ensure Adequate & Untied Resources**
  - Provide **performance-linked grants**
  - Ring-fence funds** to prevent diversion
- Timely Constitution of SFCs**
  - States must **regularly constitute SFCs**
  - Delays affect flow of **Finance Commission Grants**
- Roadmap for Devolution**
  - Each state to **publish time-bound plans** for transferring 3Fs to PRIs.
- Strengthen Transparency & Accountability**
  - Improve auditing, reporting & ATR submission.

### 5. XV Finance Commission Grants to RLBs

Type of Grant	Share	Usage
Untied Grants	40%	Location-specific needs under 29 subjects (11th Schedule)
Tied Grants	60%	Drinking water, sanitation, waste management, rainwater harvesting

### 6. Significance for UPSC

- Decentralization & Grassroots Democracy
- Fiscal Federalism in action
- Impact on SDGs: No poverty, clean water, sanitation, and strong institutions

### Mains Practice Question

**Q. Discuss the challenges and opportunities in the devolution of funds to Panchayati Raj Institutions (PRIs) in the context of the 73rd Constitutional Amendment. Suggest measures to strengthen fiscal decentralization.**

### Appointment of State DGPs – Single Window System

#### ❖ Syllabus Mapping

- GS Paper II – Governance, Polity, and Constitution (Police Reforms, Centre-State Relations)
- GS Paper III – Internal Security (Police Administration)

#### 1. Context

- The Union Government has launched a **Single Window System** for the **appointment of State Directors General of Police (DGPs)**.
- It seeks to streamline and **ensure timely and merit-based appointments**, in line with **Prakash Singh vs. Union of India (2006)** and **UPSC guidelines of 2009**.

#### 2. Constitutional & Legal Basis

- **Article 355:** Centre ensures that the governance of every State is carried on in accordance with the Constitution.
- **Prakash Singh Case (2006):**
  - Supreme Court directed **police reforms**, including **transparent DGP appointment**.
  - States must send a list of **eligible senior IPS officers** to UPSC for empanelment.

#### 3. Appointment Process (New System)

1. **State Government Proposal:**
  - Sends a list of **eligible IPS officers** to UPSC **6 months before** current DGP retires.
2. **Eligibility Criteria:**
  - **30+ years** of service or the **rank of police chief (and one below)** as per state cadre rules.
  - **Exclusion:** Officers with **<6 months** left before superannuation.
3. **UPSC Empanelment:**
  - **Empanelment Committee** prepares a panel:
    - **3 officers** for larger states
    - **2 officers** for smaller states
  - Selection is **merit-based** considering **service record, integrity, and experience**.
4. **State Government Appointment:**
  - Final appointment is made **from the UPSC panel**.
  - Ensures **merit, neutrality, and timely transition**.

#### 4. Significance of Single Window System

- **Timely Appointments:** Prevents delays and **avoidance of acting DGPs**.
- **Transparency & Meritocracy:** Reduces **political influence** in appointments.
- **Centre-State Coordination:** Streamlined communication through **UPSC**.
- **Compliance with SC Directives:** Upholds **police reform mandates**.

#### 5. Challenges & Criticism

- **State Autonomy Concerns:** States see it as **interference in their executive power** under **State List (Police)**.
- **Political Resistance:** Some states seek to **retain control over DGP postings**.
- **Implementation Issues:** Smaller states may face **limited officer pool**.

#### Mains Practice Question

- **Mains (GS II – Governance / Internal Security):**
  - *"Examine the significance of the Supreme Court's directions in Prakash Singh vs. Union of India (2006) for improving police accountability in India."*

## Fundamental Right to Safe and Motorable Roads

### 📌 Syllabus Mapping

- ✓ GS Paper II – Polity & Governance (Fundamental Rights, Judiciary)
- ✓ GS Paper III – Infrastructure, Road Safety, and Internal Security

### 1. Context

- In **UPP Tollways v. MP Road Development Corporation (2025)**, the Supreme Court ruled that:
  - Right to safe, motorable roads is a Fundamental Right.
  - It flows from Article 21 (Right to Life) and Article 19(1)(d)/(g) (Freedom of Movement & Trade).

### 2. Key Highlights of the Judgement

1. **Recognition of Fundamental Right**
  - Safe and motorable roads are **integral to Right to Life**.
  - Poorly maintained or unsafe roads **endanger life**.
2. **State's Duty**
  - Primary responsibility lies with the **State**, even if private contractors manage the roads.
  - Delegation of construction/maintenance does **not dilute State liability**.
3. **Freedom of Movement & Trade**
  - Unsafe roads **restrict free movement of citizens** (Art. 19(1)(d)) and **impede trade** (Art. 19(1)(g)).
4. **Public Duty of Road Development**
  - Road development and maintenance is a **public service obligation**.
  - The **State cannot escape accountability** citing private PPP arrangements.

### 3. Significance of the Ruling

- **Enhances Road Safety Accountability**
  - India records **1.68 lakh road fatalities annually** (MoRTH, 2024).
  - Imposes **legal responsibility on states** to prevent accidents caused by poor infrastructure.
- **Strengthens Citizen Rights**
  - Citizens can **seek legal remedy** for unsafe or poorly maintained roads.
  - Expands **scope of Article 21** like the Right to Clean Environment, Right to Health, etc.
- **Implications for PPP Projects**
  - Concessionaires and private toll operators **cannot evade liability**.
  - Strengthens **monitoring and inspection regimes** for BOT/PPP road projects.

### 4. Comparative & Contemporary Perspective

- **International Practices**
  - Countries like **Sweden** (Vision Zero) and **Japan** ensure **government liability** for road safety lapses.
- **Indian Context**
  - Aligns with **Supreme Court Committee on Road Safety** and **Bharat New Car Assessment Programme (NCAP)** initiatives.
  - Supports the **2030 UN SDG Target** of halving global road traffic deaths.

### Mains Practice Question

**Mains (GS II & III): "Discuss the significance of the Supreme Court's recognition of the Right to Safe Roads as a fundamental right in the context of infrastructure governance and road safety in India."**

## Apex Court on Speaker's Role in Disqualification of Legislators

### 📌 Syllabus Mapping

- ✓ GS Paper II – Indian Constitution, Polity, and Governance
- ✓ GS Paper II – Separation of Powers, Judicial Review, and Parliament Functioning

### 1. Context

- **Case:** *Padi Kaushik Reddy v. State of Telangana* (2025)

- **Issue:** Significant delay by the **Speaker** in deciding **disqualification petitions of 10 Telangana MLAs** under the **Tenth Schedule (Anti-Defection Law)**.
- **SC Recommendation:** Parliament should **reconsider entrusting the Speaker** with this responsibility due to persistent delays.

## 2. Key Highlights of the Judgment

1. **Criticism of Delay:**
  - Speaker's prolonged inaction undermines the **Tenth Schedule's objective**.
  - Warned against the "**operation successful, patient died**" scenario where delayed decisions render the law ineffective.
2. **Timeline for Decision:**
  - Directed Speaker to **conclude proceedings within 3 months** (by Oct 2025).
3. **Recommendation to Parliament:**
  - Suggested **exploring alternative independent mechanisms**, e.g., **independent tribunal** to decide disqualification petitions.

## 3. Relevant Judicial Precedents

Case	Key Observations
<b>Kihoto Hollohan v. Zachillhu (1992)</b>	Speaker acts as a <b>Tribunal</b> , subject to <b>judicial review for jurisdictional errors</b> ; "quia timet actions" (preventive injunctions) not encouraged before Speaker's decision.
<b>Keisham Meghachandra Singh (2020)</b>	Directed Speakers to <b>decide disqualification within 3 months</b> ; also suggested <b>independent tribunal</b> for impartiality.

## 4. About the Disqualification of Legislators

**Constitutional Basis:** Tenth Schedule, added by 52nd Constitutional Amendment (1985).

**Grounds for Disqualification:**

1. **Voluntarily giving up party membership**
2. **Voting/abstaining against party whip** without prior permission
3. **Independent member joining a party** after election
4. **Nominated member joining a party** after 6 months of assuming office

**Objective:** Prevent political defections, maintain **stability of governments**, and protect electoral mandate.

## 5. Issues with Current Framework

- **Conflict of Interest:** Speaker often belongs to the **ruling party**, raising questions of neutrality.
- **Chronic Delays:** Defection cases remain undecided for months, enabling **defectors to continue in office**.
- **Judicial Overload:** Delayed Speaker decisions push **defectors' cases to courts**, undermining legislative autonomy.

## 6. Way Forward / Recommendations

1. **Independent Tribunal:**
  - Like Election Commission or a Judicial Tribunal for swifter, impartial decisions.
2. **Statutory Time Limit:**
  - Mandatory **3-month disposal** of disqualification cases, as recommended in *Keisham Meghachandra Singh*.
3. **Strengthen Judicial Review:**
  - Clear **guidelines for courts to intervene** in cases of Speaker inaction.

### Mains Practice Question

**Mains (GS II):**

*"Examine the challenges in enforcing the Tenth Schedule and critically analyze the Supreme Court's suggestion to replace the Speaker with an independent tribunal for disqualification decisions."*

## Nomination of Panel of Chairpersons

📌 **Syllabus Mapping**

✓ **GS Paper II – Polity & Governance (Parliamentary Procedures)**

## 1. Context

- The **Lok Sabha Speaker** has nominated a Member of Parliament (MP) to the **Panel of Chairpersons** to preside over proceedings in the absence of the Speaker and Deputy Speaker.

## 2. Constitutional & Procedural Basis

- **Source:** Rule 9 of the Rules of Procedure and Conduct of Business in Lok Sabha
- **Provision:**
  1. Speaker nominates **up to 10 MPs** at the start of a session (or when required).
  2. Nominated MPs **may preside** over House proceedings **in the absence of the Speaker and Deputy Speaker**.
  3. They **hold office** until a new panel is appointed.

## 3. Key Provisions of Panel of Chairpersons

Aspect	Details
<b>Nomination Authority</b>	<b>Speaker of Lok Sabha</b>
<b>Maximum Members</b>	10 MPs
<b>Function</b>	Preside in <b>absence of Speaker &amp; Deputy Speaker</b>
<b>Duration</b>	Until a <b>new panel is nominated</b>
<b>Request to Preside</b>	Only when <b>requested by Speaker or Deputy Speaker</b>
<b>Vacancy Case</b>	If <b>Speaker/Deputy Speaker office is vacant</b> , the <b>President appoints a member</b> to act as Speaker for the session (Art. 95).
<b>Last Resort</b>	If none of the Panel Members are available, <b>any other MP</b> as determined by the House can preside temporarily.

## 4. Limitations

- Panel members **cannot act as Speaker** in case of a **vacancy** of Speaker/Deputy Speaker.
- Their role is **temporary and session-based**, not a substitute for elected presiding officers.

## 5. Significance

- Ensures **uninterrupted functioning** of the House.
- Reduces dependency on Speaker and Deputy Speaker for **routine proceedings**.
- Provides **experience in chairing sessions** to senior MPs.

### Mains Practice Question

**Mains (GS II): "Discuss the significance of the Panel of Chairpersons in ensuring the smooth functioning of the Lok Sabha."**



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# GOVERNANCE

## Banking Laws (Amendment) Act, 2025

### ❖ Syllabus Mapping

- GS Paper II – Governance & Constitution (Cooperative Societies, 97th Amendment)
- GS Paper III – Economy (Banking Sector, Financial Governance, RBI Regulation)

### 1. Context

- **Effective Date:** 1st August 2025 (as notified by the Centre).
- **Objective:** Strengthening **banking governance, compliance, and investor protection**.
- **Amended Acts:**
  1. Reserve Bank of India Act, 1934
  2. Banking Regulation Act, 1949
  3. State Bank of India Act, 1955
  4. Banking Companies (Acquisition & Transfer of Undertakings) Acts, 1970 & 1980

### 2. Key Changes Introduced

1. **Substantial Interest Limit Revised**
  - Raised from ₹5 lakh to ₹2 crore (first revision since 1968).
  - **Impact:** Ensures updated thresholds for determining conflict of interest in banking governance.
2. **Tenure of Cooperative Bank Directors**
  - Increased from 8 years to 10 years (excluding Chairpersons & full-time Directors).
  - **Alignment:** With 97th Constitutional Amendment that strengthened cooperative governance.
3. **Public Sector Banks (PSBs)**
  - **Transfer of Unclaimed Shares/Funds:**
    - Can now be credited to Investor Education and Protection Fund (IEPF), improving transparency.
  - **Auditor Payments:**
    - PSBs can directly pay statutory auditors, attracting high-quality auditors and reducing delays.

### 3. Significance of the Amendment

- **Modernizes Banking Governance**
  - Updates **outdated monetary limits** and streamlines **compliance norms**.
- **Enhances Cooperative Bank Efficiency**
  - Longer tenure ensures **continuity and experience** in management.
- **Protects Investor Interests**
  - Transfer to IEPF prevents misuse of **dormant funds**.
- **Boosts Transparency in PSBs**
  - Timely auditor payments ensure **better financial oversight** and attract skilled auditors.

### 4. Wider Implications

- **Financial Sector Reform**
  - Supports **RBI's focus** on strong governance and risk management in PSBs and cooperatives.
- **Investor Confidence**
  - Enhances trust in PSBs by ensuring **protection of unclaimed funds**.
- **Ease of Doing Business in Banking**
  - Brings Indian banking regulations **closer to global standards**.

### Mains Practice Question

- **Prelims:**
  - 97th Amendment (cooperative societies), IEPF, Banking Regulation Act basics.
- **Mains (GS III – Economy):**
  - *"Discuss how the Banking Laws (Amendment) Act, 2025 seeks to strengthen governance in Indian banks and its implications for investors and cooperative banking."*

### TCS Bench Policy 2025: Balancing Efficiency & Employee Security

#### 📌 Syllabus Mapping

- ✓ GS Paper II – Governance & Social Justice (Corporate Governance, CSR, Labour Welfare)
- ✓ GS Paper III – Indian Economy (Employment, IT industry trends, Business environment)
- ✓ GS Paper IV – Ethics (Workplace ethics, Corporate responsibility)

## 1. Context

Tata Consultancy Services (TCS), India's largest IT services firm, has **revised its bench policy, limiting bench time to 36 business days annually.**

- **Bench Policy:** Refers to the period when an IT employee is **not deployed on billable client projects.**
- **Concerns Raised:**
  - Increased **fear of layoffs** among employees
  - Pressure to **quickly secure projects**
  - Potential **mental health implications**

This move reflects **broader trends in the IT industry**, as firms like **Infosys, Wipro, and Accenture** have also **reduced bench sizes to defend profit margins.**

## 2. Why IT Firms Are Revisiting Benching Policies

1. **Cost Management:**
  - Non-billable employees **strain finances** in periods of **low client demand.**
  - Example: During **global economic slowdown**, maintaining a large bench impacts margins.
2. **Demand-Supply Realignment:**
  - **Automation and AI** are **reducing manpower requirements** for repetitive tasks.
  - **Project delays or cancellations** create **underutilized human resources.**
3. **Improving Utilization Rates:**
  - Higher **project-to-employee ratios** lead to **better profitability.**
  - Bench reduction is **aligned with shareholder and market expectations.**

## 3. Ethical and Societal Concerns

1. **Corporate Social Responsibility (CSR):**
  - IT companies invest heavily in **training employees**; abrupt layoffs undermine **employee trust.**
2. **Worker Rights and Job Security:**
  - Balancing **business efficiency** with **employee well-being** is critical.
  - A harsh bench policy risks promoting a "hire and fire" culture.
3. **Psychological Impact on Workforce:**
  - **Stress, anxiety, and insecurity** among employees
  - Reduced **morale and loyalty**, impacting **productivity**

## 4. Broader Implications for the Indian IT Sector

- **Positive:**
  - **Operational efficiency** and **profit margin improvement**
  - **Faster deployment** of resources on live projects
- **Negative:**
  - Risk of **talent attrition** and **employee dissatisfaction**
  - Potential **loss of India's soft power** as an **ethical IT outsourcing hub**

♦ **Insight:** The IT sector is facing a **transition period** driven by **AI, automation, and global slowdown**, requiring new workforce strategies.

## 5. Way Forward

1. **Balanced HR Policies:**
  - Combine **flexible benching** with **career upskilling programs.**
2. **Focus on Reskilling:**
  - Train employees in **emerging technologies** like **AI, Cloud, and Cybersecurity** to reduce bench dependency.
3. **Transparent Communication:**
  - Clear communication on **policy rationale** and **employee support measures.**
4. **Employee Assistance Programs (EAPs):**
  - Counseling and **mental health support** to reduce anxiety.

### 5. Ethical Corporate Governance:

- Align workforce policies with **CSR principles** for long-term sustainability.

### Mains Practice Question

- Discuss the ethical and economic dimensions of bench policies in India's IT sector in the context of workforce security. (GS II & IV)
- Analyze how automation and global market trends are reshaping employment models in the Indian IT industry. (GS III)
- "Sustainable growth of India's IT sector requires balancing business efficiency with employee well-being." Elaborate with examples. (GS II & III)

## Five Years of National Education Policy (NEP) 2020

### ❖ Syllabus Mapping

- GS Paper II – Governance & Social Justice (Education Policy, Issues in Education)
- GS Paper II – Government Policies & Interventions
- GS Paper I – Indian Society (Human Resource Development)

### 1. Context

- The National Education Policy (NEP) 2020, launched after 34 years of policy stagnation, aims to transform India into an **equitable, vibrant knowledge society** rooted in Indian ethos.
- 2025 marks five years of NEP implementation, highlighting **key reforms, digital adoption, inclusivity, and remaining challenges**.

### 2. Key Achievements of NEP 2020 (2020–2025)

- Curriculum and Pedagogy Reform**
  - Introduced the **5+3+3+4 structure** replacing 10+2 system.
  - National Curriculum Framework – School Education (NCF-SE)** emphasizes **experiential, competency-based, and skill-oriented learning**.
- Foundational Literacy and Numeracy (FLN)**
  - NIPUN Bharat & Vidya Pravesh** programs benefitted **4.2 crore students in 8.9 lakh schools**.
  - Aligns with **UN SDG 4.1 (Quality Education)**.
- Inclusivity & Equity**
  - 1.15 lakh SEDG students and 7.58 lakh girls** enrolled in **residential schools**.
  - PRASHAST App** introduced for **disability screening** and early support.
- Teacher Development**
  - 4+ lakh teachers** trained under **NISHTHA**, fostering **capacity-building & modern teaching methods**.
- Digital and Technological Integration**
  - 72% schools now have internet access**.
  - Key initiatives:
    - DIKSHA, PM e-VIDYA, Vidyanjali**
    - AI-powered learning tools** like *e-Jaadui Pitara, Katha Sakhi, Teacher Tara*.
- Higher Education Reform**
  - CUET (Common University Entrance Test)** implemented in 2022 for **uniform undergraduate admissions**.
  - Multidisciplinary approach promoted through **Academic Bank of Credits (ABC)** and **Multiple Entry-Exit System (MEES)**.

### 3. Major Challenges

- Centre-State Policy Divide**
  - Example: **Kerala & West Bengal** refused to sign MoUs for **PM-SHRI Schools**, citing **NEP non-alignment**.
- Three-Language Formula**
  - Implementation difficulties due to **regional language sensitivities and political opposition**.
- Institutional Delays**
  - Higher Education Commission of India (HECI)** – still pending.
  - National Curriculum Framework for Teacher Education (NCF-TE)** – delayed.
- Digital Divide & Infrastructure Gaps**
  - 28% of schools **still lack internet access**; rural areas remain underserved.

### 4. Significance

- Human Capital Development:** Aligns with India's **demographic dividend**.
- Global Competitiveness:** Integrates **skill-based, multidisciplinary learning**.
- Inclusive Growth:** Targets **SEDGs, girls, and differently-abled students**.
- Digital Education Ecosystem:** AI and EdTech integration strengthens **future-ready learning**.

### 5. Way Forward

- **Accelerate Institutional Reforms:** Fast-track **HECI, NCF-TE**, and teacher training mechanisms.
- **State Collaboration:** Ensure **federal consensus** for NEP adoption.
- **Digital Equity:** Expand internet & smart classroom access in **rural & remote schools**.
- **Periodic Evaluation:** Implement **performance-based monitoring** for NEP initiatives.

### Mains Practice Question

**Q. "Five years of NEP 2020 reflect both transformative progress and persistent implementation challenges." Discuss with reference to school and higher education reforms in India. (GS II – 250 words)**

### Skill Impact Bond (SIB)

#### ❖ Syllabus Mapping

**GS Paper II – Governance: Welfare Schemes, Human Resource Development**  
 **GS Paper III – Economy: Skill Development & Employment**

### 1. Context

- Minister of State for Skill Development and Entrepreneurship highlighted **Skill Impact Bond (SIB)** as a **pioneering model** for delivering **measurable social impact**.
- It represents India's first **Development Impact Bond (DIB)** in the **skill training sector**.

### 2. About Skill Impact Bond (SIB)

Feature	Details
Launch Year	2021
Implementing Ministry	Ministry of Skill Development & Entrepreneurship (MSDE)
Nodal Agency	National Skill Development Corporation (NSDC)
Objective	To <b>train and provide jobs to 50,000 young Indians</b> (60% women) over 4 years
Focus	Skill development <b>linked to employment and measurable outcomes</b>
Target Group	Youth, with special focus on <b>women and marginalized communities</b>

### 3. How Skill Impact Bonds Work

- **Public-Private Partnership model** in which:
  1. **Investors (private sector/philanthropists)** provide upfront funding for skill programs.
  2. **Implementing partners** deliver training and job placements.
  3. **Outcome funders (Govt./Donors)** repay investors **only if pre-agreed results are achieved**, such as employment and retention.

### 4. Significance of SIB

- **Outcome-Oriented Funding:** Shifts focus from **input-based spending** to **measurable results**.
- **Women Empowerment:** 60% of beneficiaries are women → Enhances **female labor force participation**.
- **Job-Linked Training:** Reduces the mismatch between **skills and employment opportunities**.
- **Innovation in Financing Social Impact:** Encourages private sector participation in skill development.

### 5. Contemporary Relevance

- Aligns with **Skill India Mission** and **Atmanirbhar Bharat**.
- Helps address **India's demographic dividend** by skilling the youth.
- Global recognition as a **blended finance tool** for achieving **SDG 4 (Quality Education)** and **SDG 8 (Decent Work & Economic Growth)**.

### 6. Challenges

- **Scalability:** Limited reach compared to the total skill gap in India.
- **Data & Monitoring:** Success depends on robust **tracking of outcomes**.
- **Private Sector Confidence:** Investors require assurance of **timely result verification and repayment**.

### 7. Way Forward

- Expand SIBs to sectors like **healthcare, green jobs, and digital skilling**.

- Strengthen **data-driven monitoring** for employment outcomes.
- Foster **multi-stakeholder collaborations** with industry and state governments.

## Mains Practice Question

**Q. Skill Impact Bonds (SIBs) represent a paradigm shift in financing skill development in India. Discuss how such models can enhance employment generation and women empowerment.**

# INTERNATIONAL RELATIONS

## India–Nepal Mutual Legal Assistance: Strengthening Cross-Border Security

### Syllabus Mapping

- ✓ GS Paper II – International Relations (India and its neighborhood, Bilateral Agreements)
- ✓ GS Paper III – Internal Security (Cross-border terrorism, Organized Crime, Extradition & Legal Cooperation)

### 1. Context

India and Nepal have **finalized the Agreement on Mutual Legal Assistance (MLA) in Criminal Matters**, marking a new chapter in bilateral security cooperation.

- **Key Development:**
  - **MLA Agreement** finalized to facilitate faster evidence sharing and investigations.
  - **1953 Extradition Treaty** to be revised, as it has become **outdated** in addressing modern crimes like **cybercrime** and **terror financing**.

This move comes amid rising concerns over **cross-border criminal activities**, particularly through the **1,751 km open border**.

### 2. Extradition: A Quick Overview

- **Definition:**  
Extradition is the **formal surrender of a criminal** by one state to another, to face **trial or punishment** for crimes committed in the requesting country.
- **Nodal Agency in India: Ministry of External Affairs (MEA).**

◆ **Relevance:** India's **1953 treaty** with Nepal lacks provisions for **modern transnational crimes**, leading to delays in handing over fugitives.

### 3. Mutual Legal Assistance (MLA) – Importance

- **Definition:**  
MLA in criminal matters refers to **formal intergovernmental cooperation** for:
  1. **Collecting evidence**
  2. **Exchanging intelligence**
  3. **Assisting in investigations and prosecutions**
- **Nodal Agency in India: Ministry of Home Affairs (MHA)**
- **Global Context:**
  - India has signed **42 MLA treaties** with countries like:
    - **United States (2005)**
    - **Israel (2015)**
    - **United Kingdom (1995)**

### ◆ Benefits for India–Nepal

1. **Formalized Legal Framework** – Eliminates ad-hoc reliance on goodwill.
2. **Faster Investigations & Trials** – Evidence can be shared promptly.
3. **Curbing Transnational Crimes** – Targets **terrorism, drug trafficking, human smuggling, and fake currency rackets**.

### 4. Challenges Before the Agreement

1. **Open Border Exploitation**
  - Militants and criminals used Nepal as a **transit route or safe hideout**.

- Example: **Indian Mujahideen operatives** escaped to Nepal before fleeing to third countries.
- 2. **Criminal Safe Havens**
  - Nepal (besides Bhutan) was the **only neighbor without an MLA**.
  - Led to **Pakistani nationals** using Nepal for **fake currency and smuggling**.
- 3. **Uncertain Reciprocity**
  - Without a binding framework, cooperation **depended on mutual goodwill** rather than legal obligation.

## 5. Strategic & Security Implications for India

- **Enhanced Internal Security:**  
Tackles **terror financing, cybercrime, narcotics, and organized crime**.
- **Stronger Diplomatic Relations:**  
Positions India as a **responsible regional security partner**.
- **Economic & Social Stability:**  
Safer borders encourage **trade, tourism, and regional connectivity**.

## 6. Way Forward

1. **Revise 1953 Extradition Treaty**
  - Include **cybercrime, digital fraud, and terror funding** as extraditable offenses.
2. **Digital Evidence-Sharing Mechanism**
  - Use **secure portals** for real-time intelligence and document transfer.
3. **Joint Task Forces and Border Surveillance**
  - Combine **legal frameworks with smart border monitoring**.
4. **Regional Legal Integration**
  - Extend MLA frameworks with **other South Asian neighbors** for collective security.

## Mains Practice Question

1. Discuss the significance of the India-Nepal Mutual Legal Assistance Agreement in enhancing cross-border security. (GS II)
2. Examine the challenges posed by the open India-Nepal border in tackling transnational crime. Suggest measures to strengthen bilateral cooperation. (GS III)
3. "The revision of the 1953 Extradition Treaty is crucial for India's internal security." Critically analyze. (GS II & III)

## BRICS Culture Ministers' Meeting – 2025

❖ Syllabus Mapping

✓ GS Paper I – Indian Culture: Art and Cultural Exchange

✓ GS Paper II – International Relations and Multilateral Groupings



### 1. Context

- BRICS Culture Ministers' Meeting was recently held in Brasilia, Brazil.
- The meeting emphasized **cultural cooperation, creative industries, and post-2030 development priorities** among BRICS nations.

### 2. Key Highlights

#### a) New BRICS Cultural Platform

- Decision to **establish a platform** to:
  - Promote **cultural and creative industries** within BRICS.
  - Develop **cultural infrastructure and content sharing mechanisms**.
  - Facilitate **artist exchanges and joint cultural projects**.

#### b) Culture in Post-2030 Development Agenda

- Endorses **culture as a standalone goal** in the post-2030 SDG framework,
  - Aligning with **UNESCO MONDIACULT (World Conference on Cultural Policies and Sustainable Development)**.

#### c) Culture-Based Climate Action

- BRICS noted **UNFCCC's Group of Friends of Culture-Based Climate Action (GFCBCA)** initiative.
- Recognizes the **role of cultural heritage in sustainability and climate adaptation**.

### 3. Significance

1. **Strengthening Soft Power**
  - Enhances BRICS **cultural diplomacy** and soft power in the Global South.
2. **Economic & Creative Growth**
  - Cultural industries contribute to **jobs, tourism, and innovation** in creative sectors.
3. **Global Cultural Leadership**
  - Push for **culture in SDGs** positions BRICS as a leader in **inclusive development frameworks**.
4. **Climate & Heritage Link**
  - Supports the narrative that **culture and heritage are vital for climate resilience**.

### 4. India's Perspective

- **Showcasing Indian Heritage:** Opportunity to promote **Yoga, Ayurveda, GI-tagged crafts, and classical arts**.
- **Collaboration Potential:** Partnerships in **film co-productions, digital museums, and heritage tourism**.
- **Strategic Dimension:** Aligns with India's **cultural diplomacy** under '**Vasudhaiva Kutumbakam**' philosophy.

### Mains Practice Question

**Q. "Cultural diplomacy is an emerging pillar of BRICS cooperation." Discuss the potential of the new BRICS Cultural Platform in advancing India's soft power.**

## UN Deputy Secretary-General Calls for Urgent Reform in Global Food Systems

### 📌 Syllabus Mapping

**GS Paper II – International Institutions and Global Governance**  
 **GS Paper III – Food Security, Agriculture, and Environment**

### 1. Context

- At the **UN Food Systems Summit +4 Stocktake (UNFSS+4)** in Addis Ababa, Ethiopia (2025),
  - UN Deputy Secretary-General urged **urgent reforms in global food systems**.
  - **Second biennial UNFSS+4 report** launched to review progress since **UNFSS 2021**.

### 2. About Global Food Systems

- **Definition:**
  - Entire chain of **production → processing → distribution → consumption → disposal** of food products from **agriculture, forestry, fisheries**, etc.
- **Significance:**
  - **Social:** 783 million people are chronically hungry; impacts **SDG 2 – Zero Hunger**.
  - **Economic:** Major source of **livelihood for agricultural households**.
  - **Environmental:**
    - 30% of global **GHG emissions**
    - 80% of **biodiversity loss**
    - 70% of **freshwater use**
  - **Hidden cost:** \$11.6 trillion annually in **social, economic, and environmental damages**.

### 3. Why Current Food Systems Are Failing?

Challenge	Impact
Climate Shocks	Disasters like floods & droughts damage crops & disrupt supply chains.
Rising Debt	LDCs' debt rose from 3.1% → 12% of revenue (2010–2023), limiting investment in health & food security.
Weak Infrastructure	1/3rd of food <b>lost/wasted</b> due to <b>poor storage, transport, market access</b> .

### 4. Way Forward for Resilient Food Systems

1. **Private Investment & Local Capacity Building**
2. **Integrated Approach** – Linking **emergency aid with long-term development**
3. **Community-Led Solutions** – Focus on **women and youth participation**
4. **Sustainable Practices** – Reduce **food loss**, promote **climate-smart agriculture**

### 5. Key Global Initiatives

Initiative	Objective
<b>COP28 UAE Declaration</b>	160 nations linked <b>food systems</b> with <b>climate action plans</b> .
<b>COP15 &amp; COP16 Biodiversity Frameworks</b>	23 targets to reform <b>agri-food systems</b> and fund biodiversity-friendly farming.
<b>World Food Programme (WFP)</b>	Trains <b>smallholder farmers</b> on sustainable practices and market linkages.
<b>G7 Apulia Food Systems Initiative (2024)</b>	Boosts <b>climate-resilient agriculture &amp; food security</b> .
<b>G20 Global Alliance Against Hunger</b>	Focuses on <b>coordinated action</b> against food insecurity and malnutrition.

### Mains Practice Question

- **Prelims:**
  - UNFSS, WFP, COP28 Food Declaration, Global food loss statistics
- **Mains (GS II/III):**
  - *"Examine the challenges of global food systems and suggest measures for creating sustainable and resilient food systems."*

## UNSC 1267 Sanctions Committee

### ❖ Syllabus Mapping

GS Paper II – International Relations (UN, Counter-Terrorism, India's Role in UNSC)

GS Paper III – Internal Security (Terrorism, Cross-Border Threats)

### 1. Context

- A UN Security Council (UNSC) Monitoring Team under the **1267 Sanctions Committee** confirmed that **The Resistance Front (TRF)** – a proxy of **Pakistan-based Lashkar-e-Taiba (LeT)** – was behind the **Pahalgam terror attack** in J&K.
- **Significance:**
  - Report adopted by consensus of all 15 UNSC members, including **Pakistan** (non-permanent member).
  - Reinforces **global recognition of cross-border terrorism** emanating from Pakistan.

### 2. About UNSC 1267 Sanctions Committee

1. **Origin:**
  - Named after **UNSC Resolution 1267 (1999)** targeting **Al-Qaida and Taliban**.
  - Later expanded to cover **ISIS (Da'esh)** and affiliated terror groups.
2. **Mandate & Functions:**
  - **Monitors sanctions** (asset freeze, travel ban, arms embargo) against **listed individuals and entities**.
  - **Coordinates global counter-terrorism efforts** by requiring member states to act against sanctioned groups.
3. **Current Scope:**
  - Focus on **ISIS, Al-Qaida, and affiliates like LeT, Jaish-e-Mohammed (JeM)**.
  - Maintains **Consolidated Sanctions List**.
4. **Chairmanship:**
  - **Denmark** chairs the 1267 Committee **till Dec 2025**.

### 3. Significance of 1267 Committee for India

- **Global Naming & Shaming:** Helps India **expose Pakistan-based terror groups** internationally.
- **Diplomatic Leverage:**
  - Cases like **TRF listing** strengthen India's stance on **cross-border terrorism**.
  - Consensus adoption **binds all UNSC members** to acknowledge the threat.
- **Legal Enforcement:** Facilitates **asset freeze, travel bans, and restricts arms access** for listed terrorists.

### 4. Challenges

- **Veto Politics:** P-5 nations (esp. China) sometimes **block listings** of Pakistan-based terrorists.
- **Implementation Gaps:** Many member states **lack capacity or political will** to enforce sanctions.
- **State Sponsorship of Terror:** Pakistan continues to **rebrand terror groups** (e.g., LeT → TRF) to bypass sanctions.

### 5. Way Forward for India

- Continue **active engagement in UNSC & FATF**.
- Build **coalitions with like-minded countries** to push listings and sanctions.
- Enhance **domestic intelligence & financial surveillance** to support global investigations.

### Mains Practice Question

Prelims: UNSC organs, 1267 Committee mandate, current chair.

Mains (GS II / III):

*"Discuss the role of the UN Security Council 1267 Committee in countering terrorism. How does it serve India's strategic interests in tackling cross-border terrorism?"*

## SECURITY & DEFENCE

### Union Ministry of Labour and Employment (MoLE) – Living Wage Discussion

#### ❖ Syllabus Mapping

GS Paper II – Governance (Social Justice, Welfare Schemes)

GS Paper III – Economic Development (Inclusive Growth, Labour Reforms)

#### 1. Context

- MoLE is discussing the **concept of a living wage** to enhance worker welfare and **boost female labour participation**.
- Presently, India mandates **minimum wages** under statutes, but **living wages** aim for fairer compensation aligned with **actual cost of living**.

#### 2. Minimum Wage vs Living Wage

Aspect	Minimum Wage	Living Wage
<b>Definition</b>	Statutory floor pay below which no worker can be paid	Wage sufficient to meet <b>basic and social needs</b>
<b>Legal Basis</b>	Minimum Wages Act, 1948 / Code on Wages, 2019	Not statutory yet; policy under discussion
<b>Purpose</b>	Prevent extreme exploitation	Ensure <b>decent standard of living</b>
<b>Coverage</b>	Specific sectors or state-notified categories	Universal/Global approach
<b>Impact on Economy</b>	Limited, ensures survival	Boosts <b>productivity, spending, GDP growth</b>

#### 3. Significance of Living Wages

- Economic Impact**
  - WEF Estimate*: Global living wage adoption could add **\$4.6 trillion/year** to GDP via higher productivity and consumption.
- Enhancing Female Labour Force Participation (FLFP)**
  - Women face higher **opportunity costs** due to childcare, health, and education responsibilities.
  - Living wages** can **offset these costs**, encouraging more women to work.
- Social and Labour Market Benefits**
  - Protects against **inflation and rising living costs**.
  - Attracts & retains talent; aligns with **ESG & social responsibility norms**.
  - Improves **worker well-being**, reducing absenteeism and turnover.

#### 4. Challenges in Implementation

- Fiscal burden** on MSMEs and low-margin industries.
- Regional disparity** in cost of living makes uniform living wages complex.
- Risk of **informalisation of labour** if employers evade higher wage mandates.

#### 5. Global and Policy Context

- ILO Recommendation No. 135**: Advocates for wages sufficient for a **decent standard of living**.
- Countries like **UK, New Zealand, and South Africa** have adopted living wage frameworks.
- India**: Code on Wages (2019) paves the way for **national floor wages**, but not yet **living wage**.

#### 6. Way Forward

- Data-Driven Policy**: Link living wage to **inflation, housing, food basket costs**.
- Phased Implementation**: Start with **formal sector and urban areas**.
- Incentives for MSMEs**: Tax credits or subsidies to offset initial costs.
- Integration with SDGs**: Supports **SDG 1 (No Poverty)** and **SDG 8 (Decent Work)**.

### Mains Practice Question

**Q. Distinguish between minimum wage and living wage. Discuss how implementing a living wage policy in India can enhance female labour force participation and inclusive growth. (GS II/III – 250 words)**

## Indian Army's IBG Modernisation: Agile & Tech-Driven Warfare

### ❖ Syllabus Mapping

- ✓ GS Paper II – International Relations & Security (India's security challenges, military doctrines)
- ✓ GS Paper III – Internal Security & Technology (Border security, defence modernization, role of technology in warfare)

### 1. Context

Amid collusive security threats from China and Pakistan, especially evident during **Operation Sindoar (2025)**, the **Indian Army** is restructuring its combat formations to implement the **Integrated Battle Group (IBG) Doctrine**.

- **Key Initiatives:**
  - Formation of 'Rudra' all-arms brigades
  - Creation of 'Bhairav' light commando battalions
  - Raising 'Shaktibaan' artillery regiments with 'Divyadrishti' surveillance and loitering munitions units
  - Equipping all infantry battalions with drone platoons

This transformation aims to enhance speed, mobility, and technological dominance for swift border responses.

### 2. Structural Reforms in Combat Capabilities

1. **Bhairav Light Commando Battalions**
  - Drawn from regular infantry
  - Trained for high-speed, high-mobility strikes
  - Equipped with lightweight weapons, modern drones, and surveillance gadgets
2. **Rudra All-Arms Brigades**
  - Converted from existing units into integrated formations
  - Combine infantry, mechanised infantry, tanks, artillery, UAVs, and special forces
  - Designed for independent, high-intensity border operations
3. **Shaktibaan Artillery Regiments & Divyadrishti Units**
  - Incorporate loitering munitions, precision artillery, and advanced surveillance
  - Provide lethal firepower and real-time targeting support
4. **Drone Platoons in Infantry Battalions**
  - Enhance situational awareness and tactical superiority in modern drone-centric warfare

### 3. Integrated Battle Groups (IBGs) – Concept

- **Definition:** Agile, brigade-sized, self-contained combat formations, designed for rapid deployment and swift offensive operations.
- **Size:** Approximately 5,000 troops each.
- **Customisation Factors:** Threat, Terrain, and Task.
- **Origin:** Evolved after Operation Parakram (2001-02) as part of Cold Start / Pro-Active Operations Doctrine.

### 4. IBG Operational Philosophy

1. **Pre-emption:**
  - Gaining the initiative before the adversary mobilizes.
2. **Dislocation:**
  - Striking at enemy vulnerabilities, forcing them into an unfavourable position.
3. **Disintegration:**
  - Disrupting enemy command-and-control systems, breaking operational cohesion.
4. **Time-Space-Force-Information Dominance:**
  - Controlling key battle spaces quickly with superior force and intelligence.

### 5. Significance of Modernisation

- **Faster Mobilisation:** IBGs allow swift deployment within hours instead of weeks.

- **Technology-Driven Warfare:**  
Use of UAVs, loitering munitions, and digital command systems ensures superiority.
- **Enhanced Border Security:**  
Especially critical for Western (Pakistan) and Northern (China) sectors.
- **Supports Cold Start Doctrine:**  
Enables limited, high-impact strikes without full-scale mobilization.

## 6. Way Forward

1. **Full IBG Operationalization**
  - Gradual conversion of select divisions into IBGs for both Western and Eastern commands.
2. **Jointness & Theaterisation**
  - Coordinate Army, Air Force, and Navy under integrated theatre commands.
3. **AI and Autonomous Systems**
  - Deploy AI-driven surveillance, autonomous drones, and battlefield analytics.
4. **Continuous Wargaming & Exercises**
  - Conduct joint exercises like Operation Sudarshan Shakti to validate IBG readiness.

### Mains Practice Question

1. Examine the significance of Integrated Battle Groups (IBGs) in the context of India's evolving border security challenges. (GS III)
2. Discuss how technology-driven modernization of the Indian Army enhances the effectiveness of the Cold Start Doctrine. (GS II & III)
3. "Integrated Battle Groups are the cornerstone of India's future land warfare strategy." Critically analyze. (GS III)

## Project 17A – Advanced Guided-Missile Frigates

### 📌 Syllabus Mapping

- ✓ GS Paper II – Security and Defense
- ✓ GS Paper III – Science & Technology (Indigenization of Technology)
- ✓ GS Paper III – Internal Security Challenges & Maritime Security

### 1. Context

- Indian Navy received 'Himgiri', the third Nilgiri-class (Project 17A) guided-missile frigate, in 2025.
- Role: Frigates primarily protect the fleet from sea-based threats, especially submarines, and enable blue-water operations.

### 2. About Project 17A

- Follow-on project: Shivalik-class frigates (Project 17)
- Total Ships: 7 Frigates
  - Built by Mazagon Dock Shipbuilders (Mumbai) and GRSE (Kolkata)
- Key Features:
  1. Stealth Technology: Reduced radar & infrared signature
  2. Modern Sensors & Weapons: Capable of multi-mission operations
  3. Blue-water Capability: Supports long-range operations in open seas

### 3. Weapons & Systems

- BrahMos Supersonic Cruise Missile – for anti-ship & land-attack roles
- Barak 8 Surface-to-Air Missile System – for air defense
- Advanced Anti-Submarine Warfare (ASW) suite
- Integrated Platform Management System for real-time monitoring
- Indigenous content: Over 75% equipment sourced from Indian industry

### 4. Significance for India

1. **Maritime Security:** Enhances India's blue-water naval capability
2. **Self-Reliance:** Promotes Atmanirbhar Bharat in Defense manufacturing
3. **Deterrence & Strategic Presence:** Strengthens India's presence in Indian Ocean Region (IOR) amid China's naval expansion
4. **Export Potential:** Supports Make in India defense diplomacy

### 5. Comparative Perspective

Class	Project	Role	Stealth	Key Weapons
Shivalik	17	Multi-role Frigate	Medium	BrahMos, Barak-1
Nilgiri (New)	17A	Advanced Stealth Frigate	High	BrahMos, Barak-8

### Mains Practice Question

**Prelims:** Identify Project 17A & weapon systems like BrahMos and Barak-8

**Mains (GS III):**

*"Discuss the significance of Project 17A in enhancing India's maritime security and defense indigenization efforts."*

## ECONOMY

### Digital Payment Index (DPI)

#### ❖ Syllabus Mapping

GS Paper III – Economy: Inclusive Growth, Banking, Digital Payments

GS Paper II – Governance: E-Governance & Digital India

#### 1. Context

- India has witnessed **65,000+** crore digital transactions worth **₹12,000 lakh crore** over the **last six financial years**.
- To **quantify and track digital payment adoption**, the **Reserve Bank of India (RBI)** developed the **Digital Payment Index (DPI)**.

#### 2. About RBI Digital Payment Index (DPI)

Feature	Details
Introduced by	Reserve Bank of India (RBI)
Frequency	Published <b>semi-annually</b> (March & September)
Objective	Measure the <b>extent and penetration</b> of digital payments in India
Base Year	March 2018 = 100
Latest Trend	DPI shows <b>over 4x growth</b> in digital payment adoption since 2018

#### 3. Components of DPI

DPI is a **composite index** based on five key parameters:

wisdom leads to success

- Payment Enablers**
  - Bank accounts, Aadhaar penetration, mobile & internet connectivity, literacy & awareness.
- Payment Infrastructure**
  - Supply-Side:** ATMs, PoS terminals, QR codes, UPI acceptance points.
  - Demand-Side:** Volume of active digital payment users.
- Payment Performance**
  - Total transaction volume and value across UPI, IMPS, NEFT, RuPay, wallets, etc.
- Consumer Centricity**
  - Security, fraud management, grievance redressal, and customer experience.

#### 4. Significance of DPI

- Policy Tool:** Helps RBI & government track the success of **Digital India & fintech initiatives**.
- Financial Inclusion:** Reflects **penetration in rural and semi-urban areas**.
- Benchmarking Growth:** Enables **comparison across time and regions**.
- Boosts Confidence in Digital Ecosystem:** Encourages banks, fintechs, and NBFCs to expand services.

#### 5. Contemporary Relevance

- UPI** drives **>80% of retail digital transactions** in volume.
- Rural digital adoption** is rising due to **PM Jan Dhan Yojana, DBT, AePS, and QR-based payments**.
- Global Leadership:** India leads the world in real-time digital payments (~46% of global RT payments in 2023).

### 6. Challenges Ahead

- **Digital Divide:** Internet and smartphone penetration in rural areas remains uneven.
- **Cybersecurity Risks:** Rising instances of online frauds and phishing attacks.
- **Consumer Trust:** Need for strong grievance redressal and fraud detection mechanisms.

### 7. Way Forward

- Strengthen **cybersecurity frameworks** for UPI and digital banking.
- Promote **financial literacy** and awareness campaigns in tier-2 & tier-3 towns.
- Encourage **innovation in offline & low-bandwidth digital payment solutions**.

### Mains Practice Question

**Q. Examine the significance of the RBI's Digital Payment Index (DPI) in promoting financial inclusion and digital governance in India. Highlight the challenges in achieving a cashless economy.**

## Alternative Investment Funds (AIFs)

### 📌 Syllabus Mapping

✓ GS Paper III – Economy: Investment Models, Capital Market Regulation  
 ✓ GS Paper II – Governance: Role of Regulators in Financial Sector

### 1. Context

- **RBI (2025)** issued revised guidelines:
  - **Regulated Entities (REs)** like banks/NBFCs can invest only up to **20% of the corpus** of an individual **AIF scheme**.
  - Aimed to **mitigate concentration risk** and **protect financial stability**.

### 2. About Alternative Investment Funds (AIFs)

Aspect	Details
Definition	A <b>privately pooled investment vehicle</b> which collects funds from <b>sophisticated investors (Indian or foreign)</b> for investment as per a <b>defined policy</b> .
Regulator	<b>SEBI</b> under <b>SEBI (Alternative Investment Funds) Regulations, 2012</b>
Purpose	To invest in <b>non-traditional asset classes</b> like startups, private equity, hedge funds, and real estate.
Investor Base	Mainly <b>HNI (High Net-Worth Individuals)</b> , institutional investors, and foreign investors.

### 3. Categories of AIFs (SEBI, 2012)

Category	Key Focus	Examples
Category I	Invests in <b>start-ups, early-stage ventures, and socially/economically beneficial sectors</b>	<b>Venture Capital Funds, Angel Funds, SME Funds, Infrastructure Funds</b>
Category II	<b>Private funds</b> that <b>do not leverage</b> (except minimal for operations)	<b>Private Equity Funds, Debt Funds, Real Estate Funds</b>
Category III	Funds that <b>may use leverage and complex strategies</b> for higher returns	<b>Hedge Funds, Private Investment in Public Equity (PIPE) Funds</b>

### 4. Significance of AIFs

- **Boosts Entrepreneurship & Startups** – Key driver for **Make in India & Startup India**.
- **Channelizes Private & Foreign Capital** to **high-growth sectors** like tech, infrastructure, and SMEs.
- **Diversifies Capital Market** – Offers an alternative to traditional equity/debt investments.
- **Supports Job Creation** through funding early-stage ventures.

### 5. Regulatory & Risk Concerns

- **High-risk exposure** due to leveraged or illiquid investments.
- **Limited retail participation** (restricted to accredited/sophisticated investors).
- **Monitoring and Transparency** remain a challenge for SEBI & RBI.
- **Systemic Risk** if banks/NBFCs are overexposed to AIFs → reason behind **20% investment cap**.

### 6. Way Forward

- **Strengthen Disclosure Norms** for AIF performance and risk exposure.

- Promote Category I AIFs for startups and green sectors aligned with **SDGs & India@2047** vision.
- Use Tech Tools for risk monitoring (AI-enabled dashboards for SEBI & RBI).

### Mains Practice Question

**Q. "Alternative Investment Funds (AIFs) are crucial for deepening India's financial markets but require strong regulation to prevent systemic risks." Discuss.**

## Controller General of Patents, Designs & Trade Marks (CGPDTM)

### ❖ Syllabus Mapping

- ✓ GS Paper III – Economy: Intellectual Property Rights (IPR)
- ✓ GS Paper II – Governance: Regulatory Bodies & Industrial Policies
- ✓ GS Paper III – Science & Technology: Innovation & Startups

### 1. Context

- CGPDTM has released the Revised Guidelines for Examination of Computer Related Inventions (CRI), 2025.
- Aimed to clarify patentability criteria for AI, software, and emerging tech innovations in line with global IP best practices.

### 2. About CGPDTM

Aspect	Details
Ministry	Ministry of Commerce & Industry → DPIIT
HQ	Mumbai
Functions	<ul style="list-style-type: none"> <li>- Supervises implementation of Patents Act 1970, Designs Act 2000, Trade Marks Act 1999, and GI Act 1999</li> <li>- Advises Government on IPR matters</li> <li>- Administers Patent, Trademark, Design, and GI Registries</li> </ul>

### 3. Key Functions of CGPDTM

1. IPR Administration – Management of Patents, Designs, Trademarks, and Geographical Indications.
2. Advisory Role – Suggesting IPR policy reforms to Govt. & DPIIT.
3. Capacity Building – Conducting IP awareness & training programs for industry and academia.
4. Global Coordination – Represents India at WIPO, TRIPS negotiations, and other IPR forums.

### 4. Revised CRI Guidelines 2025

Aspect	Key Changes
Focus Areas	AI algorithms, Blockchain, Cloud Computing, IoT, Data Security
Patentability Test	Clarifies "technical effect & technical contribution" principle for software patents
Alignment	Follows TRIPS Agreement & global standards in US/EU/Japan
Exclusion Criteria	Pure mathematical/business methods or software without technical application remain non-patentable

### 5. Significance

- Encourages startups and IT companies to innovate in AI & Digital Tech.
- Strengthens India's IPR ecosystem, promoting Make in India & Digital India.
- Attracts FDI in R&D by providing clarity and predictability in patent examination.

### 6. Challenges & Way Forward

- Backlog of patent applications and shortage of trained examiners.
- Awareness gap among Indian innovators about software patenting norms.
- Need for faster digital IPR infrastructure like AI-assisted patent search tools.

### Mains Practice Question

**Q. "India's approach to Computer Related Inventions (CRI) must balance innovation with public interest." Critically examine in light of the 2025 CGPDTM Guidelines.**

### MoSPI to Reform Key Economic Indicators – 2025

#### 📌 Syllabus Mapping

- ✓ GS Paper III – Indian Economy and Issues
- ✓ GS Paper II – Governance (Data-driven Policy Making)

#### 1. Context

- Ministry of Statistics and Programme Implementation (MoSPI) announced major reforms in India's economic indicators to reflect structural shifts in the economy.
- Focus on updating base years, enhancing data sources, and adopting digital datasets (e.g., GST, UPI, e-Vahan).

#### 2. Key Proposed Reforms

Indicator	Current Base Year	Proposed Base Year	Key Changes
GDP	2011-12	2022-23	Include GST, e-Vahan, UPI data, better coverage of informal sector
IIP	2011-12	2022-23	Better reflection of industrial structure & manufacturing trends
CPI	2012	2024	Include digital data sources: airfare, OTT, fuel prices
HCES	Every 5 years	Every 3 years	Capture household consumption changes more frequently
ASSSE	New Survey	Annual	Map formal service sector similar to Annual Survey of Industries

#### 3. Need for Reforms

1. Capture Changes in Economic Structure
  - Rise of services & digital economy
  - Changing consumption patterns post-COVID & digital adoption
2. Use of Diverse Data Sources
  - GST returns → manufacturing output
  - UPI & e-Vahan → real-time economic activity
3. Accurate Real Growth Measurement
  - Base year revision ensures inflation-adjusted (real) growth
  - Avoids outdated sector weights & basket compositions

#### 4. Key Economic Indicators

1. Gross Domestic Product (GDP)
  - Definition: Monetary value of final goods & services produced in a period
  - Use: Economic growth, planning, fiscal management
2. Index of Industrial Production (IIP)
  - Compiled by: Central Statistical Organisation (CSO)
  - Sectors: Mining (14.2%), Manufacturing (77.6%), Electricity (8.2%)
3. Consumer Price Index (CPI)
  - Purpose: Measure inflation in household consumption basket
  - Types: CPI-Urban, CPI-Rural, CPI-Combined

#### 5. Significance

- Improved Policy Formulation – Data reflects current realities like e-commerce, fintech
- Boost to Credibility – Accurate statistics for investors, IMF, World Bank
- Better Poverty & Inflation Measurement – Timely household surveys

#### Mains Practice Question

- Prelims: Base years of GDP, IIP, CPI; Agencies compiling them
- Mains (GS III – Economy): "Discuss how the periodic revision of base years in economic indicators improves the reliability of India's macroeconomic data."

## Supply and Use Tables (SUTs)

### ❖ Syllabus Mapping

- ✓ GS Paper III – Indian Economy: National Accounts, Growth, Development, and Inclusive Measures
- ✓ GS Paper II – Government Policies and Programmes (MoSPI Initiatives)

### 1. Context

- Ministry of Statistics and Programme Implementation (MoSPI) released Supply and Use Tables (SUTs) for 2020–21 and 2021–22.
- Covers 140 products and 66 industries, based on National Accounts Statistics (NAS) 2024 and key surveys like Annual Survey of Industries (ASI).

### 2. What are Supply and Use Tables (SUTs)?

- Definition:** SUTs are **interlinked statistical matrices** that provide a **comprehensive picture of the supply and use of goods and services in the economy**.
- Components:**
  1. **Supply Table** → Captures **total supply** of goods & services, both **domestic production and imports**.
  2. **Use Table** → Records **utilization** of these products for **consumption, investment, exports, or intermediate use**.
- Structure:**
  - Presented in a **Product-by-Industry matrix** linking output and demand.
- Integration:**
  - SUTs **integrate all three GDP approaches:**
    1. **Production Method** (sectoral output – intermediate consumption)
    2. **Income Method** (factor incomes)
    3. **Expenditure Method** ( $C+I+G+NX$ )



### 3. Significance of SUTs

1. **Improved GDP Accuracy:**
  - Helps reconcile **discrepancies between production, income, and expenditure approaches**.
2. **Policy Formulation:**
  - Provides insights on **sectoral contributions, consumption patterns, and inter-industry linkages**.
3. **International Standards:**
  - Aligns India's national accounts with **UN System of National Accounts (SNA 2008)**.
4. **Economic Analysis:**
  - Essential for **input-output analysis, productivity studies, and impact assessment of policy changes**.

### 4. Key Highlights of 2020–21 and 2021–22 SUTs

- **Coverage:** 140 products × 66 industries.
- **Data Sources:**
  - National Accounts Statistics (NAS) 2024
  - Annual Survey of Industries (ASI)
  - Household surveys, trade data, and administrative records
- **Application:** Used for **GDP compilation, sectoral analysis, and evidence-based policy making**.

### Mains Practice Question

**Prelims:** Concept of SUTs, NAS, and GDP compilation methods.

**Mains (GS III – Economy):**

*"Explain the significance of Supply and Use Tables (SUTs) in improving the accuracy and reliability of India's GDP estimation."*

# AGRICULTURE

## Organic Certification in India: Framework, Significance, and Challenges

### ❖ Syllabus Mapping

- ✓ GS Paper II – Governance & Policies (Agriculture and allied policies, Institutional mechanisms)
- ✓ GS Paper III – Agriculture & Environment (Organic farming, Sustainable agriculture)
- ✓ GS Paper III – Economy (Agricultural exports, APEDA, trade facilitation)

### 1. Context

The Agricultural and Processed Food Products Export Development Authority (APEDA) recently **refuted allegations** regarding irregularities in **organic cotton certifications**, reiterating the **robustness of India's organic certification ecosystem**.

- India is among the **largest producers of organic cotton** globally, and credibility in certification is **crucial for exports and farmer income**.

### 2. Organic Certification Framework in India

India has a **dual certification system** for organic products, overseen by **APEDA** under the **Union Ministry of Commerce & Industry**:

#### a) National Programme for Organic Production (NPOP)

- Launched by: APEDA
- Key Components:
  - Accreditation of certification bodies
  - Standards for organic production & processing
  - Promotion and marketing of organic farming
- International Recognition:
  - European Commission & Switzerland recognize NPOP standards for unprocessed plant products as equivalent to their domestic standards.
  - Facilitates **export without additional certification**, boosting farmer income.

#### b) Participatory Guarantee System (PGS-India)

- Community-driven certification system under the **Ministry of Agriculture**.
- How it works:
  - Farmers **assess, inspect, and verify** each other's fields collectively.
  - Entire groups declare their farms **organic**, ensuring **peer accountability**.
- Benefits:
  - Cost-effective for small farmers
  - Encourages **community participation** in quality assurance

### 3. Significance of Organic Certification

- Consumer Confidence:** Ensures buyers about **authenticity of organic claims**.
- Boosts Export Potential:** Especially for **cotton, spices, tea, and pulses**.
- Environmental Sustainability:** Promotes **soil health, biodiversity, and low-chemical farming**.
- Farmer Income Security:** Certified products fetch **premium prices** in domestic and international markets.

### 4. Challenges & Concerns

- Allegations of Misuse:** Fake certifications can **damage India's credibility** in global markets.
- Cost & Complexity:** Small and marginal farmers face **barriers in accessing formal certification**.
- Monitoring Gaps:** Ensuring **uniform enforcement** across states remains challenging.
- Market Awareness:** Domestic consumers often **cannot differentiate** certified organic from conventional produce.

### 5. Way Forward

- Strengthen Monitoring:** Use **blockchain & QR codes** for **traceable certification**.
- Farmer Training:** Capacity-building programs on **organic standards and compliance**.
- International Alignment:** Expand equivalence agreements with **USA, Japan, and Gulf markets**.

- **Consumer Awareness:** Promote PGS and NPOP-certified labels in domestic markets.

### Mains Practice Questions

1. Discuss the role of APEDA and NPOP in strengthening India's organic farming ecosystem. (GS III)
2. "Participatory Guarantee System (PGS) can democratize organic certification in India." Examine. (GS II/III)
3. Evaluate the significance of credible organic certification for India's agricultural exports. (GS III)

## SOFI 2025: Global Food Security and Nutrition Status

### Syllabus Mapping

- GS Paper II – Governance, Welfare Schemes, and Social Justice (Food Security & Nutrition)
- GS Paper III – Economy & Agriculture (Food Prices, Food Security)
- GS Paper II – International Reports (Global Indices & UN Reports)

### 1. Context

- The **State of Food Security and Nutrition in the World (SOFI) 2025** report has been released by FAO, IFAD, UNICEF, WFP, and WHO.
- It is the annual global assessment for SDG 2 (Zero Hunger), monitoring progress on targets 2.1 (end hunger) and 2.2 (end all forms of malnutrition).
- The report highlights **mixed progress**: global hunger rates are improving overall, but regional disparities and nutrition challenges persist.

### 2. Key Global Findings

1. **Hunger Trends**
  - Global hunger fell to **8.2% in 2024** from 2022 levels.
  - Persistent rise in hunger in **Africa** and **Western Asia** despite overall global progress.
2. **Food Insecurity**
  - **Moderate or severe food insecurity** has been **declining since 2021**.
  - **2.60 billion people** globally cannot afford a healthy diet (down from **2.76 billion in 2019**).
3. **Food Prices and Inflation**
  - **Food prices rose sharply** in 2023–24 due to:
    - **COVID-19 pandemic aftershocks**
    - **Russia-Ukraine war** and global supply chain disruptions
  - Resulted in a **higher average cost of a healthy diet** worldwide.
4. **Nutrition Challenges**
  - **Anaemia among women (15–49 years)** continues to rise.
  - **Adult obesity** rose from **12.1% in 2012** to **15.8% in 2022** – indicating the **double burden of malnutrition**.

### 3. India-Specific Observations

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- **Improved Affordability:**
  - Excluding India, lower-middle-income countries show **worsening affordability**, implying **India fared better in making diets accessible**.
- **Digital Interventions in Kerala:**
  - **Mobile phone adoption** by fishermen and wholesalers reduced **price dispersion** and **food waste**, showing the role of **technology in market efficiency**.

### 4. Key Recommendations from SOFI 2025

1. **Time-bound Fiscal Measures**
  - **Temporary tax relief on essential food items**
  - Strengthening **social protection programs** to shield vulnerable groups
2. **Policy Coordination**
  - Align **fiscal and monetary policies** to **stabilize food markets** and control inflation
3. **Market Information Systems**
  - Develop **robust agricultural market intelligence** to mitigate price volatility and prevent speculative hoarding
4. **Nutrition and Health Interventions**
  - Integrated programs to **combat anaemia and obesity**
  - Promote **affordable and diverse diets** through local food systems

### 5. Significance of SOFI Report for India

- **Policy Guidance:** Helps in targeted nutrition programs like POSHAN Abhiyaan and PM Garib Kalyan Anna Yojana (PMGKAY).
- **Global Benchmarking:** Monitors India's progress in achieving SDG 2 commitments.
- **Agricultural Reforms:** Encourages better market mechanisms and price stability to address rural distress.

#### Mains Practice Question

1. Critically analyze the findings of the SOFI 2025 report with reference to India's food and nutrition security challenges. (GS II)
2. How do global conflicts and pandemics affect food security and affordability worldwide? Discuss with examples from SOFI 2025. (GS III)
3. "Technological interventions in agriculture can be a game-changer for ensuring affordable nutrition." Substantiate with recent examples. (GS III)

## SOCIETY, SOCIAL JUSTICE AND SOCIAL ISSUES

### Union Ministry of Labour and Employment (MoLE) – Living Wage Discussion

#### ❖ Syllabus Mapping

GS Paper II – Governance (Social Justice, Welfare Schemes)  
 GS Paper III – Economic Development (Inclusive Growth, Labour Reforms)

#### 1. Context

- MoLE is discussing the **concept of a living wage** to enhance worker welfare and **boost female labour participation**.
- Presently, India mandates **minimum wages** under statutes, but **living wages** aim for fairer compensation aligned with **actual cost of living**.

#### 2. Minimum Wage vs Living Wage

Aspect	Minimum Wage	Living Wage
<b>Definition</b>	Statutory floor pay below which no worker can be paid	Wage sufficient to meet <b>basic and social needs</b>
<b>Legal Basis</b>	Minimum Wages Act, 1948 / Code on Wages, 2019	Not statutory yet; policy under discussion
<b>Purpose</b>	Prevent extreme exploitation	Ensure <b>decent standard of living</b>
<b>Coverage</b>	Specific sectors or state-notified categories	Universal/Global approach
<b>Impact on Economy</b>	Limited, ensures survival	Boosts <b>productivity, spending, GDP growth</b>

#### 3. Significance of Living Wages

1. **Economic Impact**
  - o **WEF Estimate:** Global living wage adoption could add **\$4.6 trillion/year** to GDP via higher productivity and consumption.
2. **Enhancing Female Labour Force Participation (FLFP)**
  - o Women face higher **opportunity costs** due to childcare, health, and education responsibilities.
  - o **Living wages** can **offset these costs**, encouraging more women to work.
3. **Social and Labour Market Benefits**
  - o Protects against **inflation and rising living costs**.
  - o Attracts & retains talent; aligns with **ESG & social responsibility norms**.
  - o Improves **worker well-being**, reducing absenteeism and turnover.

#### 4. Challenges in Implementation

- **Fiscal burden** on MSMEs and low-margin industries.
- **Regional disparity** in cost of living makes uniform living wages complex.
- Risk of **informalisation of labour** if employers evade higher wage mandates.

## 5. Global and Policy Context

- **ILO Recommendation No. 135:** Advocates for wages sufficient for a **decent standard of living**.
- Countries like **UK, New Zealand, and South Africa** have adopted living wage frameworks.
- **India:** Code on Wages (2019) paves the way for **national floor wages**, but not yet **living wage**.

## 6. Way Forward

1. **Data-Driven Policy:** Link living wage to **inflation, housing, food basket costs**.
2. **Phased Implementation:** Start with **formal sector and urban areas**.
3. **Incentives for MSMEs:** Tax credits or subsidies to offset initial costs.
4. **Integration with SDGs:** Supports **SDG 1 (No Poverty)** and **SDG 8 (Decent Work)**.

### Mains Practice Question

**Q. Distinguish between minimum wage and living wage. Discuss how implementing a living wage policy in India can enhance female labour force participation and inclusive growth. (GS II/III – 250 words)**

## GEOGRAPHY AND DISASTER

### White Paper on Blue Economy: Roadmap to 2035

#### 📌 Syllabus Mapping

- ✓ GS Paper I – Geography (Resources, Oceanography)
- ✓ GS Paper II – Governance & Policy (Environment and Coastal Management)
- ✓ GS Paper III – Economy, Infrastructure, Environment, Security

#### 1. Context

- The Government of India released a **White Paper** titled **“Innovation and Sustainable Growth”** outlining the **Blue Economy Roadmap to 2035**.
- It **prioritizes feasible projects** and seeks to **build investor confidence**, positioning the blue economy as a **vital engine of national development** and a **core pillar of Viksit Bharat 2047**.

#### 2. What is Blue Economy?

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- **Definition:** Utilization of **ocean resources and coastal assets** for **economic growth, environmental sustainability, livelihood generation, and national security**.
- **Components:**
  1. **Marine resources** – fisheries, seaweed, offshore energy, seabed minerals
  2. **Maritime infrastructure** – ports, shipping, coastal tourism, marine biotechnology
  3. **Coastal economy** – mangroves, eco-tourism, and disaster resilience
- **India's Potential:**
  - **Coastline:** 11,098 km
  - **Exclusive Economic Zone (EEZ):** 2.4 million sq. km
  - **Maritime States & UTs:** 9 States + 4 UTs

#### 3. Significance of Blue Economy for India

1. **Economic Growth:**
  - Boosts GDP through fisheries, port logistics, tourism, and renewable ocean energy.
2. **Employment & Livelihoods:**
  - Supports 4 million+ coastal and fishing community livelihoods; promotes **women-led enterprises** (e.g., **Odisha seaweed farming**).
3. **Strategic Importance:**
  - Enhances **maritime security, trade routes**, and aligns with **SAGAR vision** (Security and Growth for All in the Region).
4. **Environmental Sustainability:**
  - Promotes **eco-tourism, mangrove conservation, and clean ports** in line with **SDG-14: Life Below Water**.

### 4. Sector-Specific Challenges

- **Fragmented Governance:** Overlapping mandates between ministries and states.
- **Environmental Risks:** Overfishing, coral bleaching, and coastal pollution.
- **Investment Gaps:** Limited private participation and high project costs.
- **Technology Deficit:** Need for R&D in **marine biotechnology** and **ocean energy**.
- **Climate Change Impact:** Rising sea levels and cyclones threaten coastal infrastructure.

### 5. Key Recommendations in the White Paper

1. **Institutional Strengthening:**
  - Improve inter-ministerial coordination and data sharing to streamline planning.
2. **Financial Innovation:**
  - Attract private and global investments using:
    - Blue Bonds
    - Blended Finance
    - Sovereign Guarantees
    - Public-Private Partnerships (PPPs)
3. **Scale Successful State Models:**
  - **Odisha:** Women-led **seaweed farming** for sustainable livelihoods
  - **Kochi:** Smart ports and green shipping
  - **Andaman Islands:** Marine **eco-tourism** and **biodiversity conservation**
4. **Roadmap to 2035:**
  - Focus on **high-impact feasible projects**, with **phased implementation** to boost investor confidence.

### Mains Practice Question

#### Prelims:

- **Definition of Blue Economy**
- **India's EEZ and coastline length**
- **Initiatives like SAGAR, Deep Ocean Mission, Pradhan Mantri Matsya Sampada Yojana**

#### Mains (GS III):

*"Discuss the significance of the Blue Economy in India's sustainable growth and national security. Examine the challenges and suggest a roadmap for its effective realization."*

## Uttarakhand to Assess Nainital's Tourist Carrying Capacity for Sustainable Tourism

#### ❖ Syllabus Mapping

Wisdom leads to success

- ✓ **GS Paper I – Geography** (Environmental geography, Human-environment interaction)
- ✓ **GS Paper III – Environment, Ecology, and Sustainable Development** (Carrying capacity, Environmental Impact Assessment)
- ✓ **GS Paper II – Governance** (Policy measures for environmental sustainability, Role of NGT)

### 1. Context

Uttarakhand has initiated a survey to assess the Tourist Carrying Capacity (TCC) of Nainital district, a popular Himalayan tourist hub.

- **Objective:** Formulate a **long-term sustainable tourism strategy** to protect **fragile hill ecosystems** from:
  - **Overcrowding & unregulated tourism**
  - **Vehicular congestion and pollution**
  - **Overpopulation and resource stress**
- **Background:**
  - In September 2024, the **National Green Tribunal (NGT)** directed Uttarakhand to **classify Nainital district** based on:
    1. **Carrying capacity**
    2. **Environmental sensitivity**

This step aligns with **precautionary principles of environmental management** for fragile Himalayan regions.

## 2. What is Carrying Capacity?

**Definition:** Carrying Capacity is the **maximum population or activity level** an area can sustain **without degrading its environment or resource base**.

**Determinants:**

- **Biotic Factors:** Vegetation cover, wildlife, hydrology
- **Abiotic Factors:** Terrain, soil stability, climate, water availability

## 3. Approaches to Assess Carrying Capacity

1. **Planetary Boundaries Approach**
  - Focuses on **ecological thresholds** beyond which **irreversible damage** occurs
  - Relevant to **climate change, land degradation, pollution, and water stress**
2. **Biocapacity Overshoot Approach**
  - Measures **human demand vs nature's regenerative capacity**
  - Example: **Earth Overshoot Day**, where humanity consumes the year's natural resources within a few months

## 4. Significance of Tourist Carrying Capacity Assessment

1. **Environmental Sustainability**
  - Prevents **landslides, deforestation, and water scarcity** in hill towns like **Nainital and Bhimtal**
2. **Regulated Urban Development**
  - Guides **urban planning, traffic management, and waste disposal systems**
3. **Disaster Risk Reduction**
  - Reduces **human-induced disasters** in ecologically fragile **Himalayan ecosystems**
4. **Tourism Management**
  - Helps in **seasonal visitor limits, smart ticketing, and eco-tourism models**
5. **Policy Alignment**
  - Supports **Sustainable Development Goals (SDG-11: Sustainable Cities & SDG-15: Life on Land)**

## 5. Challenges and Way Forward

**Challenges:**

- Lack of **accurate data** on seasonal tourist flows
- Weak **coordination between local bodies and state agencies**
- Economic dependence on **high-volume tourism**

**Way Forward:**

1. **Data-Driven Tourism Planning**
  - Use **GIS, drones, and satellite monitoring** for real-time visitor mapping
2. **Eco-Tourism Promotion**
  - Encourage **low-impact tourism models and homestay culture**
3. **Carrying Capacity-Based Zoning**
  - Classify areas as **high, medium, or low capacity** to restrict construction and traffic
4. **Community Participation**
  - Engage **local residents in conservation and tourism management**

## 6. Case Study Reference

- **Shimla & Manali** have faced **acute water crises** due to **tourist inflow exceeding carrying capacity**
- **Bhutan** follows a "**High Value, Low Volume**" **tourism policy**, a model India can adapt for fragile hill regions

### Mains Practice Question

1. **Explain** the concept of carrying capacity and its significance in sustainable urban and tourism planning in Himalayan regions. (GS III)
2. **Critically analyze** the role of carrying capacity assessment in balancing environmental conservation and economic development. (GS I & III)
3. **Discuss** how the precautionary principle can guide hill state governments in regulating tourism and urban expansion. (GS II & III)

### Human-Made Dams Have Shifted Earth's Poles

#### 📌 Syllabus Mapping

- ✓ GS Paper I – Geography (Earth's rotation, physical geography)
- ✓ GS Paper III – Science & Technology / Environment (Anthropogenic impact on planetary systems)

#### 1. Context

- A 2025 study revealed that **human-made dams** have **shifted Earth's rotational axis** by over 1 meter since 1835, driving **True Polar Wander (TPW)**.
- This is a **rare example of anthropogenic activity** altering the planet's geophysical properties.

#### 2. What is True Polar Wander (TPW)?

- **Definition:** TPW (planetary reorientation) is the **rotation of Earth's solid layers (crust + mantle)** relative to its **liquid outer core** to maintain **rotational balance**.
- **Key Drivers:**
  1. **Natural** – Glacial melting, Ice sheet retreat, Tectonic shifts, Ocean mass redistribution.
  2. **Anthropogenic (New)** – Dams and artificial reservoirs.

#### 3. How Human-Made Dams Cause TPW?

1. **Water Redistribution**
  - o Reservoirs **trap huge volumes of water** that otherwise stay in oceans.
  - o Shifts Earth's **mass inland**, leading to **rotational axis displacement**.
2. **Uneven Shift**
  - o The **magnitude and direction** of TPW vary depending on **location & size of dams**.

#### 4. Key Effects of Shifting Poles

Effect	Explanation
Navigation Challenges	Affects <b>satellites, GPS, and space telescopes</b> relying on stable axes.
Longer Days	Slight increase in <b>length of day (LOD)</b> due to rotational drag.
Accelerating Changes	Human activities now <b>complement natural TPW drivers</b> .

#### 5. Significance & Concerns

- Demonstrates **human influence on planetary mechanics** (Anthropocene evidence).
- Raises **long-term implications for geodesy, space navigation, and climate modeling**.
- Supports **sustainable water and infrastructure planning** to limit large-scale geophysical impacts.

#### 6. Way Forward

1. **Global Monitoring** of mass redistribution using **satellite gravimetry (e.g., GRACE mission)**.
2. **Impact Assessment** before constructing **mega-dams** in seismically sensitive or polar-shift-prone areas.
3. **Integrate Geophysical Studies** with **climate & hydrology policies** under SDG-13 (Climate Action).

#### Mains Practice Question

**Q. Discuss how large-scale anthropogenic activities, such as dam construction, are influencing Earth's geophysical processes like True Polar Wander (TPW). What are the implications for navigation and climate systems? (GS I/III – 250 words)**

### Earthquake in Russia's Far East Triggers Pacific Tsunami

#### 📌 Syllabus Mapping

- ✓ GS Paper I – Geography: Earthquakes, Tsunamis & Natural Hazards
- ✓ GS Paper III – Disaster Management & NDMA Guidelines
- ✓ GS Paper II – International Cooperation in Disaster Relief

#### 1. Event Overview

- **Magnitude:** 8.8

- **Epicentre:** Russia's Kamchatka Peninsula, part of the **Pacific Ring of Fire**.
- **Impact:** Triggered **tsunami waves** near **Kuril Islands**; coastal areas placed on **high alert**.

## 2. About Tsunami

Feature	Details
<b>Definition</b>	A series of extremely long ocean waves caused by <b>sudden displacement of water</b> .
<b>Causes</b>	Submarine <b>earthquakes, volcanic eruptions, landslides, glacier calving, meteorite impacts, or underwater explosions</b> .
<b>Historical Example</b>	2004 Indian Ocean Tsunami (Sumatra earthquake)

### Tsunamis & the Ring of Fire

- **Pacific Ring of Fire:** A horseshoe-shaped belt of **tectonic plate boundaries** and **active volcanoes**.
- 80% of the world's tsunamis occur here.

## 3. Characteristics of Tsunami Waves

- **Wavelength:**
  - ~200 km in deep ocean → < 20 km near shore due to **shoaling**.
- **Wave Height (Amplitude):**
  - Negligible in open seas → **increases near shallow coastlines**.
- **Speed:**
  - Depends on **ocean depth** (can reach 700-800 km/h in deep waters).
- **Impact:**
  - Sudden **coastal flooding, destruction of lives, property, ecosystems**.

## 4. Consequences of Tsunami

1. **Socio-Economic**
  - Mass casualties, displacement, infrastructure loss.
  - Loss of fishing and tourism-based livelihoods.
2. **Environmental**
  - Destruction of **mangroves, coral reefs, estuaries**.
  - **Soil and groundwater salinization**.
3. **Psychological & Administrative**
  - Trauma, disruption of essential services, and governance challenges.

## 5. NDMA Guidelines for Tsunami Management

1. **Institutional Setup**
  - **Multi-tiered system:** NDMA → SDMAs → DDMAs for coordinated response.
2. **Preparedness & Mitigation**
  - **Early Warning Systems:** INCOIS in India for tsunami alerts.
  - **Hazard Mapping & Vulnerability Assessment**.
  - **Land-use planning & natural buffers** (bio-shields, mangroves).
3. **Response & Recovery**
  - Evacuation drills, public awareness, and community-based preparedness.
4. **Protection of Critical Infrastructure**
  - Coastal power plants, ports, and communication hubs.

## 6. Contemporary Relevance for India

- India is part of **Indian Ocean Tsunami Warning System (IOTWS)**.
- Lessons from **2004 Tsunami** helped develop **early warning & coastal disaster resilience**.

### Mains Practice Question

**Q. Discuss the causes and impacts of tsunamis with reference to the Ring of Fire. Evaluate India's preparedness measures in the context of NDMA guidelines.**

### India Facing Growing Threats of Glacial Lake Outburst Floods (GLOFs)

#### 📌 Syllabus Mapping

- ✓ GS Paper I – Physical Geography: Glaciers & Natural Hazards
- ✓ GS Paper III – Disaster Management & Mitigation
- ✓ GS Paper II – India & Neighbourhood Relations (Trans-boundary Disaster Management)

### 1. What are GLOFs?

- **Definition:**  
*Sudden release of water from a glacial lake formed due to glacier melt, often leading to flash floods downstream.*
- **Examples:**
  - *South Lhonak GLOF (Sikkim, 2023)*
  - *Nepal's Lende River GLOF (2025)*
- **Types of Glacial Lakes in IHR:**
  1. **Supraglacial Lakes** – On glacier surface; prone to summer melting.
  2. **Moraine-Dammed Lakes** – At glacier toes; held by debris or ice-core, highly unstable.
- **Scale in India:**
  - *28,000 glacial lakes across 11 Himalayan river basins.*
  - *7,500 lakes above 4,500 m*, making monitoring logistically difficult.

### 2. Factors Increasing GLOF Susceptibility in IHR

1. **Triggering Events:**
  - **2/3rd due to** ice avalanches or landslides into lakes.
  - **Others due to** excessive meltwater pressure on weak moraine dams (e.g., *Chorabari GLOF, Kedarnath 2013*) or earthquakes.
2. **Climate Change:**
  - Rising global temperatures → accelerated glacial melt.
  - 2023 & 2024 were **hottest years in recorded history**.
3. **Topographical & Monitoring Challenges:**
  - Remote locations above 4,500 m, short summer survey window.
  - Dynamic nature of glacial lakes, often forming or expanding rapidly.

### 3. India's Mitigation Strategy

Institution/Initiative	Key Measures
NDMA (via CoDRR)	Shift from post-disaster response to proactive risk reduction
National GLOF Risk Mitigation Project (NGRMP)	Implemented in <b>Arunachal Pradesh, Himachal Pradesh, Sikkim, Uttarakhand</b>
Central Water Commission (CWC)	Monitoring <b>902 glacial lakes</b> via satellite imagery
Use of Technology	<b>Synthetic Aperture Radar (SAR)</b> for lake-size change detection, even during clouded monsoons

### 4. Way Forward

- **Trans-boundary Early Warning Systems**
  - Cooperation with *Nepal, Bhutan, China* for real-time data sharing.
- **Technological Integration**
  - AI & Remote Sensing for **predictive GLOF models**.
  - Drone-based surveys for inaccessible lakes.
- **Structural Measures**
  - Construct **controlled drainage channels, spillways, and check dams**.
- **Community Preparedness**
  - Village-level evacuation maps and regular mock drills.

### 5. Contemporary Relevance

- **Increasing GLOF Events:**
  - 2013 Kedarnath disaster (Chorabari lake).
  - 2021 Chamoli flood (partially GLOF-induced).
  - 2023 Sikkim Lhonak GLOF.
- **Global Context:**
  - Melting glaciers in **Himalayas, Andes, and Alps** are emerging as a major 21st-century hazard.
  - UNDRR and ICIMOD emphasize **regional GLOF risk cooperation**.

### Mains Practice Question

**Q. Glacial Lake Outburst Floods (GLOFs) are an emerging climate-induced disaster in the Himalayas. Examine the factors contributing to their rise and discuss India's mitigation strategy.**

## HISTORY, ART & CULTURE

### Ratadiya Ri Dheri – Harappan Settlement in Rajasthan

#### ❖ Syllabus Mapping

- ✓ GS Paper I – Ancient History: Indus Valley Civilization (IVC)
- ✓ GS Paper I – Indian Culture: Archaeological Discoveries

#### 1. Context

- Ratadiya Ri Dheri, a 4,500-year-old Harappan site, has been discovered in Jaisalmer, Rajasthan,
- Marks the first mature urban Indus Valley settlement in Rajasthan's arid desert zone.
- It bridges the archaeological gap between IVC sites in Northern Rajasthan and Gujarat.

#### 2. Key Facts about Ratadiya Ri Dheri

Feature	Details
Time Period	Mature Harappan Phase (2600 – 1900 BCE)
Location	Jaisalmer District, Rajasthan
Significance	First IVC urban settlement in the Thar Desert region
Discovery	Revealed through recent archaeological excavations & surveys
Function	Likely a trade and habitation site, bridging Harappan interaction zones

#### 3. Significance of Discovery

1. Archaeological Gap Filler:
  - Connects northern Rajasthan sites (Kalibangan, Sothi) with southern IVC sites in Gujarat (Dholavira, Lothal).
2. Desert Urbanization Evidence:
  - Proves Harappans adapted to arid ecology, using water management strategies.
3. Trade & Cultural Linkages:
  - Likely part of Harappan trade networks, facilitating interaction between Indus core cities and Gujarat's coastal centers.

#### 4. Other Major Harappan Sites in Rajasthan

Site	Key Features
Kalibangan	Known for fire altars, ploughed fields, planned city layout; discovered by Luigi Pio Tessitori
Sothi	Early Harappan site, precursor to Kalibangan
Baror	Cemetery site, associated with Late Harappan phase
Karanpura	Trade and craft activity center

#### 5. Broader Historical Importance

- Highlights Harappan urban expansion into semi-arid and desert regions.
- Supports studies on climate adaptation and water management in ancient civilizations.
- Enhances the archaeological mapping of IVC migration and settlement patterns.

### Mains Practice Question

#### Prelims:

- Location of Ratadiya Ri Dheri, Kalibangan & Dholavira.
- Key features of Mature Harappan Phase.
- **Mains:** "Examine the significance of recent Harappan discoveries in Rajasthan for understanding the expansion of the Indus Valley Civilization."

### FIDE Women's World Cup 2025 – India's Historic Victory

#### 📌 Syllabus Mapping

- ✓ GS Paper I – Art & Culture (Sports and Personalities)
- ✓ GS Paper II – International Events and Achievements

#### 1. Context

- Divya Deshmukh won the **FIDE Women's World Cup 2025**, defeating **Humpy Koneru** in Batumi, Georgia.
- She becomes **India's third Women's World Cup winner** and is now **eligible to become India's 4th Woman Grandmaster (WGM)**.

#### 2. Key Facts

Aspect	Details
<b>Winner</b>	Divya Deshmukh (India)
<b>Runner-Up</b>	Humpy Koneru (India)
<b>Venue</b>	Batum, Georgia
<b>Edition</b>	2025
<b>Significance</b>	Divya becomes eligible for <b>Woman Grandmaster title</b>
<b>Previous Indian Grandmasters</b>	Humpy Koneru, Harika Dronavalli, Vaishali Rameshbabu

#### 3. About FIDE Women's World Cup

- **Organizer:** FIDE (International Chess Federation).
- **Nature:** Knockout chess tournament for women, **different from the World Chess Championship**.
- **Importance:**
  - Provides **qualification path** to the Women's Candidates Tournament.
  - Enhances **global rankings** and visibility for players.

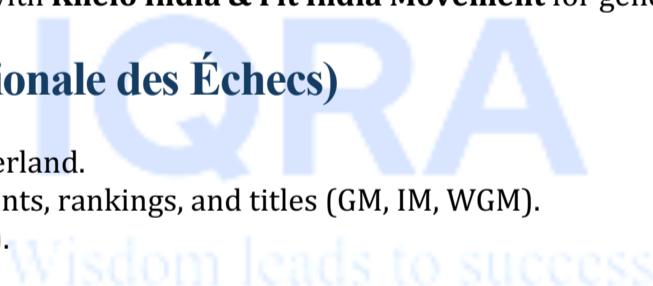


#### 4. Significance for India

1. **Historic Achievement:** Two Indians in the final shows India's **growing dominance in women's chess**.
2. **Boost to Chess Culture:** Encourages **grassroots participation** and international recognition.
3. **Women Empowerment in Sports:** Aligns with **Khelo India & Fit India Movement** for gender inclusivity.

#### 5. About FIDE (Fédération Internationale des Échecs)

- **Founded:** 1924, Paris; HQ: Lausanne, Switzerland.
- **Role:** Governs international chess tournaments, rankings, and titles (GM, IM, WGM).
- **Motto:** *Gens Una Sumus* (We are one people).



#### Mains Practice Question

**Q. India is increasingly excelling in women's chess at the global level. Discuss the factors contributing to this rise and its significance for sports diplomacy. (GS Paper I – 150 words)**

### Zonal Cultural Centres (ZCCs)

#### 📌 Syllabus Mapping

- ✓ GS Paper I – Indian Culture: Art, Architecture, and Heritage
- ✓ GS Paper II – Governance and Policies in Culture Promotion

#### 1. Context

- The **Government of India** recently reviewed the status and activities of **7 Zonal Cultural Centres (ZCCs)** under the **Ministry of Culture**.
- ZCCs are crucial for **preserving folk, tribal, and endangered art forms** and **promoting India's cultural diversity**.

#### 2. About Zonal Cultural Centres (ZCCs)

Aspect	Details
<b>Status</b>	<b>Autonomous bodies</b> under the Ministry of Culture
<b>Objective</b>	To <b>preserve, innovate, and promote</b> folk, tribal, and vanishing art forms

Activities	Organizing festivals, workshops, cultural events, and artist residencies	
Target Group	Folk and tribal artists, youth, and students	
Special Focus	Youth engagement & showcasing regional diversity	

### 3. Headquarters of ZCCs

ZCC Name	Headquarters	State/Region
North Zone Cultural Centre (NZCC)	Patiala	Punjab
South Central Zone Cultural Centre (SCZCC)	Nagpur	Maharashtra
West Zone Cultural Centre (WZCC)	Udaipur	Rajasthan
North Central Zone Cultural Centre (NCZCC)	Prayagraj	Uttar Pradesh
Eastern Zonal Cultural Centre (EZCC)	Kolkata	West Bengal
North East Zone Cultural Centre (NEZCC)	Dimapur	Nagaland
South Zone Cultural Centre (SZCC)	Thanjavur	Tamil Nadu

### 4. Significance of ZCCs

- Cultural Preservation**
  - Safeguards **folk, tribal, and endangered art forms** like Baul, Bihu, Kalbelia, and Sattriya.
- Promotion of Diversity**
  - Showcases India's unity in diversity at national and international levels.
- Youth Engagement**
  - Workshops and scholarships attract **young talent** to cultural practices.
- Support for Artists**
  - Provides **platforms, exposure, and livelihood opportunities** for rural and tribal artists.

### 5. Challenges & Way Forward

- Challenges:** Limited funding, low outreach in remote regions, digital adaptation lag.
- Way Forward:**
  - Enhanced **digital archiving and virtual festivals**.
  - Collaboration with schools/universities** for youth participation.
  - Greater **integration with tourism and cultural diplomacy**.

### Mains Practice Question

**Q. Evaluate the role of Zonal Cultural Centres in preserving India's intangible cultural heritage. Suggest measures to enhance their effectiveness in the digital era.**

## Piprahwa Relics – Return of Lord Buddha's Sacred Relics

### ❖ Syllabus Mapping

**GS Paper I – Indian Art & Culture: Buddhism, Heritage Conservation**  
 **GS Paper II – International Relations (Cultural Diplomacy & Soft Power)**

### 1. Context

- India received back the sacred Piprahwa Relics of Lord Buddha in 2025.
- These relics hold **immense religious, cultural, and historical significance** and are linked to **ancient Kapilavastu**.

### 2. About Piprahwa Relics

Aspect	Details
Discovery	1898 by <b>William Claxton Peppé</b> , a British civil engineer
Location	<b>Piprahwa, Siddharthnagar, Uttar Pradesh</b> (ancient <b>Kapilavastu</b> )
Significance	Contain <b>mortal remains (body relics)</b> of Lord Buddha
Key Features	Bone fragments, soapstone & crystal caskets, sandstone coffer, gold ornaments
Dating	Enshrined around <b>3rd century BCE</b> , likely during <b>Mauryan era</b>
Inscription	<b>Brahmi script</b> confirms deposition by the <b>Sakya clan</b>
Current Status	Classified as ' <b>AA</b> ' antiquities under Indian law – <b>cannot be removed or sold</b>

### 3. Historical & Cultural Significance

- Buddhist Heritage:**
  - Confirms the **Sakya clan's** role in preserving Buddha's relics.
  - Connects to **Kapilavastu**, the childhood home of Prince Siddhartha (Buddha).
- Archaeological Value:**

- Earliest evidence of **relic worship** and **stupa tradition**.
- Supports accounts from **Mahaparinibbana Sutta** about Buddha's relic distribution.

3. **Soft Power & Diplomacy:**

- Relics have traveled internationally for **Buddhist cultural exhibitions**.
- Strengthens India's position as the **cradle of Buddhism**.

## 4. Protection and Legal Framework

- **Antiquities and Art Treasures Act, 1972:**
  - Categorizes Piprahwa relics as 'AA' antiquities.
  - Restricts **export, removal, and commercial transactions**.
- **ASI Custody:**
  - Maintained and displayed under the supervision of the **Archaeological Survey of India**.

### Mains Practice Question

**Prelims:** Location of Piprahwa, discovery year, Sakya clan inscription.

**Mains (GS I - Culture):** "Discuss the significance of Piprahwa Relics in understanding the cultural and religious history of early Buddhism in India."

# ENVIRONMENT & ECOLOGY

## Acoustic Monitoring Technique

❖ Syllabus Mapping

✓ GS Paper III – Environment & Biodiversity

✓ GS Paper III – Science & Technology in Ecology and Conservation

### 1. Context

- Kaziranga National Park, Assam conducted India's first grassland bird census using **Acoustic Monitoring Technique**.
- Focus species: **10 rare/near-threatened birds**, including:
  - Bengal Florican (Critically Endangered)
  - Black-breasted Parrotbill (Vulnerable)
- Appreciated by **Prime Minister** for innovation in wildlife monitoring.

### 2. Why Acoustic Monitoring?

- Traditional methods like **visual spotting** are **ineffective for**:
  - Small, **camouflaged birds**
  - **Shy species** in **dense grasslands**
- Acoustic monitoring **captures unique calls** of birds, offering a **non-invasive** method.

### 3. How It Works

1. **Data Collection**
  - **Acoustic recorders** placed on **tall trees near grasslands**
  - Timing: **Breeding season (March–May)** when birds are more vocal
2. **Data Analysis**
  - **Spectrograms**: Visual representation of frequencies over time
  - **BirdNET (AI Tool)**: Identifies species by their calls with high accuracy

### 4. Advantages of Acoustic Monitoring

- **Non-invasive**: Minimal disturbance to birds and habitat
- **Continuous Monitoring**: Works day and night
- **Covers Large Areas**: More effective than human survey teams
- **Permanent Data Record**: Calls can be archived and verified later
- **Climate & Habitat Studies**: Tracks migration, breeding patterns, and ecosystem health

### 5. Significance for India

- Supports **conservation of threatened species** under **Wildlife Protection Act, 1972**.
- Helps **identify biodiversity hotspots** for **Eco-Sensitive Zone** planning.
- Strengthens India's **CBD & SDG 15** commitments (Life on Land).
- Can be scaled to **wetlands, forests, and Himalayan ecosystems**.

### Mains Practice Question

**Q. Discuss the significance of Acoustic Monitoring Technique in wildlife conservation and how it can strengthen India's biodiversity management.**

## Status of Small Cats in Tiger Landscapes of India

### 📌 Syllabus Mapping

- ✓ GS Paper III – Environment & Biodiversity
- ✓ GS Paper III – Conservation Efforts & Protected Areas
- ✓ GS Paper I – Geography (Species Distribution)

### 1. Context & Objective

- This **first-of-its-kind report** assesses **occupancy, distribution, and dynamics** of **10 small cat species** in India's **tiger landscapes**.
- Small cats are critical indicators of **ecosystem health** and **biodiversity conservation** beyond flagship species like tigers.

### 2. Key Findings of the Report

- Jungle Cat** → *Most widespread* small cat species in India.
- Rusty-Spotted Cat** → *World's smallest wildcat*; second-most widespread in India.
- Total Small Cat Species in India: 10**
  - Jungle cat
  - Rusty-spotted cat
  - Leopard cat
  - Fishing cat
  - Asiatic golden cat
  - Marbled cat
  - Desert cat
  - Caracal
  - Eurasian lynx
  - Pallas's cat



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### 3. Small Cats vs Big Cats

Feature	Small Cats (Felinae)	Big Cats (Pantherinae)
Hyoid Bone	Rigid → <i>Can purr</i>	Flexible → <i>Can roar</i>
Ecological Role	Rodent & bird control	Apex predators
Distribution	Almost all terrestrial biomes	Select ecosystems (forests, savannas)

### 4. Major Small Cats in India (As per Infographic)

Species	Habitat	Characteristics	Conservation Status
Asiatic Golden Cat	NE India (Assam, Sikkim, Meghalaya, Mizoram, Nagaland, Arunachal, WB)	Solitary, territorial	IUCN: Near Threatened; WPA: Schedule I
Caracal	Rajasthan, Gujarat, Madhya Pradesh (arid/semi-arid)	<i>Siya Gosh</i> , nocturnal, black-tufted ears	IUCN: Least Concern; WPA: Schedule I
Fishing Cat	Wetlands (Sundarbans, Himalayan foothills, NE India)	Webbed feet, swims well, nocturnal	IUCN: Vulnerable; WPA: Schedule I
Eurasian Lynx	Ladakh (rocky plateaus)	Solitary, nocturnal	IUCN: Least Concern; WPA: Schedule I

### 5. Conservation Significance

- Small cats act as **mesopredators**, balancing rodent populations and maintaining food web stability.
- Their protection aids **ecosystem services**, wetland conservation, and **human-wildlife coexistence**.
- Supports India's commitment to **Global Biodiversity Framework (GBF) 2030**.

### 6. Challenges for Small Cats

- **Habitat loss & fragmentation** (urbanization, agriculture)
- **Wetland degradation** (especially for fishing cats)
- **Human-wildlife conflict & retaliatory killing**
- **Data deficiency** – Less research compared to tigers & leopards

### 7. Way Forward

1. **Strengthen Landscape-Level Planning** – Integrate small cat corridors in tiger reserves.
2. **Promote Citizen Science & Acoustic/Camera Trap Monitoring**.
3. **Community Involvement** – Reduce conflicts and incentivize coexistence.
4. **Include Small Cats in Eco-Tourism Narratives** – Beyond tiger-centric tourism.

### Mains Practice Question

**Q. Discuss the ecological significance of small wild cats in India and the challenges they face in tiger landscapes. Suggest measures to ensure their long-term conservation.**

## Kaziranga Tiger Reserve (KTR)

### 📌 Syllabus Mapping

**GS Paper III – Environment & Ecology: Protected Areas, Biodiversity, Conservation**  
 **GS Paper I – Geography: Flora, Fauna & Natural Vegetation**

### 1. Context

- Kaziranga Tiger Reserve (KTR) has recorded the **3rd highest tiger density** in India (after Bandipur & Corbett).
- Highlights **successful wildlife conservation and tiger recovery** in India under **Project Tiger** and **NTCA monitoring**.

### 2. About Kaziranga Tiger Reserve

Feature	Details
<b>State</b>	Assam
<b>Declared National Park</b>	1974
<b>Tiger Reserve</b>	2006 (under Project Tiger)
<b>UNESCO World Heritage Site</b>	1985
<b>Biodiversity Hotspot</b>	Eastern Himalayan
<b>IBA Status</b>	Recognized as <b>Important Bird Area (IBA)</b> by BirdLife International

### 3. Geography & Location

- Lies between Brahmaputra River (north) and Karbi (Mikir) Hills (south).
- Floodplains and wetlands make it **ideal tiger and rhino habitat**.
- Characterized by **tropical semi-evergreen forests, grasslands, and wetlands**.

### 4. Flora & Fauna

#### Fauna (Flagship Species)

- **Greater One-Horned Rhinoceros** (70% of global population)
- **Tigers** (high density; ~18 tigers per 100 sq. km in core zones)
- **Elephants, Wild Water Buffalo, Swamp Deer (Barasingha)**

#### Birds (Migratory & Resident)

- **Lesser White-fronted Goose**
- **Ferruginous Duck**
- **Baer's Pochard Duck** (Critically Endangered)
- **Lesser & Greater Adjutant Storks**
- Migration route: **Central Asian Flyway**

### 5. Conservation Significance

- **Tiger Density** – One of the **highest in India**, crucial for Project Tiger success.
- **Rhino Conservation** – Global stronghold for **Rhinoceros unicornis**.
- **Wetland Ecosystem Services** – Supports **flood control, fisheries, and carbon storage**.
- **IBA Status** – Protects migratory birds along the **Central Asian Flyway**.

### 6. Challenges

- **Annual Floods** – Brahmaputra floods cause wildlife migration and mortality.
- **Poaching** – Rhino horn poaching remains a threat.
- **Human-Wildlife Conflict** – Seasonal animal movement towards Karbi hills.
- **Encroachment & Tourism Pressure** – Stress on core ecological zones.

### 7. Government Initiatives

1. **Project Tiger (2006)** – Intensive monitoring with **camera traps & NTCA protocols**.
2. **Rhino Vision 2020** – Boosted population of one-horned rhinos.
3. **Eco-Sensitive Zone (ESZ)** notification to regulate development.
4. **Kaziranga National Park Expansion** – Added highlands to provide refuge during floods.

### Mains Practice Question

**Q. Discuss the ecological significance of Kaziranga Tiger Reserve and the challenges faced in balancing conservation and human activities.**

## India's Resolution on 'Wise Use of Wetlands' – Ramsar CoP15, 2025

### 📌 Syllabus Mapping

- ✓ GS Paper II – International Relations, Environmental Conventions
- ✓ GS Paper III – Environment, Conservation, and Biodiversity

### 1. Context

- At Ramsar CoP15 (Zimbabwe, 2025),
  - India's resolution on "Promoting Sustainable Lifestyles for Wetlands" was **adopted by 172 countries**.
  - Aligns with **Mission LiFE (Lifestyle for Environment)**, India's global movement promoting eco-conscious living, launched at **COP26 (Glasgow, 2021)**.

### 2. About 'Wise Use of Wetlands'

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- **Core Principle of Ramsar Convention**
  - "Maintain ecological character of wetlands using ecosystem-based approaches within sustainable development."
- **Objectives:**
  1. **Conservation** of wetlands
  2. **Sustainable utilization** of wetland services
  3. **Community participation** and long-term ecological balance
- **Implementation by Contracting Parties:**
  - National wetland policies & plans
  - Legislative protection
  - Integrated management actions
  - Public education and awareness

### 3. India's Approach to Wise Use

1. **Policy & Plans**
  - **National Plan for Conservation of Aquatic Ecosystems (NPCA)**
  - **Integrated Management Plans (IMPs)** for each major wetland
2. **Framework & Campaigns**
  - **Wetland Wise Use – Implementation Framework (2024)**
  - **Mission Sahbhagita & Save Wetlands Campaign:**
    - 2 million volunteers
    - 1.7 lakh wetlands mapped
3. **Community-Centric Conservation**

- Linking Mission LiFE with citizen-led wetland stewardship

### 4. About Ramsar Convention

Feature	Details
Adopted	1971, Ramsar (Iran); in force 1975
Purpose	Intergovernmental treaty for wetland conservation & wise use
Ramsar Sites Globally	2,500+
India's Ramsar Sites (2025)	91 (Highest in Asia)
Designation Criteria	Wetland must meet <b>at least 1 of 9 criteria</b> (biodiversity, waterbird habitat, threatened species, etc.)

### 5. Significance of India's Resolution

- **Global Environmental Leadership:**
  - Showcases India as a promoter of **nature-positive lifestyles** and **community stewardship**
- **Alignment with SDGs:**
  - *SDG 6 (Water), SDG 13 (Climate Action), SDG 15 (Life on Land)*
- **Strengthens Mission LiFE:**
  - Encourages **behavioral change** and **local actions** with **global impact**

### Mains Practice Question

- **Prelims:** Ramsar Convention, Mission LiFE, Number of Ramsar Sites in India
- **Mains (GS III – Environment):** *"Discuss the significance of the 'Wise Use of Wetlands' principle in balancing ecological conservation with sustainable development in India."*

## BIOTECHNOLOGY & HEALTH

### Darwin Tree of Life (DTOL)

#### 📌 Syllabus Mapping

✓ GS Paper III – Science & Technology (Biotechnology, Genomics)  
 ✓ GS Paper III – Environment & Biodiversity

### 1. Context

- The **first phase** of the Darwin Tree of Life (DTOL) project is **almost complete**.
- It is a **landmark biodiversity genomics project** in the UK & Ireland.

### 2. About DTOL Project

Feature	Details
Aim	To sequence genomes of <b>70,000 eukaryotic species</b> in Britain & Ireland
Type of Species	Eukaryotic organisms – organisms with <b>nucleus &amp; membrane-bound organelles</b>
Parent Project	Earth BioGenome Project (EBP)
Global Collaboration	Part of a <b>network of researchers &amp; institutions</b> globally

### 3. About Earth BioGenome Project (EBP)

- **Objective:** Sequence, catalog, and characterize **all eukaryotic species** on Earth in **10 years**.
- **Significance:**
  - Preserve **biodiversity**
  - Aid in **conservation and ecological restoration**
  - Enable **biotechnological and medical breakthroughs**

### 4. Significance of DTOL

1. **Biodiversity Conservation**
  - Creates a **genomic library** for conservation planning.
2. **Scientific Research**
  - Helps understand **evolutionary relationships** among species.
3. **Climate & Ecology**

- Supports studies on **species adaptation** to environmental change.
- 4. **Economic & Medical Potential**
  - Insights for **biotechnology, agriculture, and drug discovery**.

### Mains Practice Question

#### Prelims:

- DTOL → UK & Ireland project; sequencing **70,000 eukaryotic species**
- Linked with **Earth BioGenome Project**
- **Mains (GS III):** "Discuss the role of genomic sequencing projects in biodiversity conservation and climate adaptation."

## Deep Brain Stimulation (DBS): Advancing Neurotherapeutics

#### 📌 Syllabus Mapping

- ✓ **GS Paper II – Health & Human Resource Development** (Medical technologies, healthcare interventions)
- ✓ **GS Paper III – Science & Technology** (Biotechnology & medical innovations)
- ✓ **GS Paper IV – Ethics in Medicine** (Ethical implications of invasive medical procedures)

### 1. Context

**Deep Brain Stimulation (DBS)** is a **neurosurgical therapy** where doctors implant electrodes in **specific brain regions** to correct abnormal neural activity.

- **Significance:** DBS represents a **cutting-edge treatment** for **neurological and movement disorders** such as **Parkinson's disease, dystonia, epilepsy, and obsessive-compulsive disorder (OCD)**.
- **Relevance to India:** Growing neurodegenerative disorders in an aging population make DBS an important **public health innovation**.

### 2. What is Deep Brain Stimulation?

#### 1. Definition

- A **medical procedure** where **electrodes are surgically implanted** into the brain to **regulate abnormal electrical signals**.
- Connected to a **neurostimulator (pacemaker-like device)** placed under the **chest skin** that delivers **controlled electrical impulses**.

#### 2. Mechanism of Action

- Many neurological disorders result from **erratic communication between neurons**.
- **DBS delivers precise electrical pulses** to:
  - **Interrupt abnormal signals**
  - **Restore balanced neural activity**
  - **Alleviate motor and cognitive symptoms**

#### 3. Common Applications

- **Movement Disorders:**
  - Parkinson's Disease (reduces tremors & rigidity)
  - Dystonia (muscle contractions)
  - Essential Tremor
- **Neurological & Psychiatric Conditions:**
  - Epilepsy (reduces seizure frequency)
  - Obsessive-Compulsive Disorder (OCD)
  - Depression (experimental)

### 3. Advantages of DBS

- **Symptom Management:** Provides **long-term relief** where medication response declines.
- **Reversible & Adjustable:** Unlike lesioning surgeries, DBS is **programmable** and **reversible**.
- **Improves Quality of Life:** Enables better **mobility, independence, and daily functioning**.

### 4. Challenges and Ethical Dimensions

#### 1. Medical & Technical Challenges

- **High cost** and limited access in low-income regions
- Requires **precise neurosurgical expertise**
- **Battery maintenance** and device replacement every 3-5 years

#### 2. Risks

- Surgical complications: infection, bleeding
- Rare cognitive or mood side effects

### 3. Ethical Concerns

- **Invasiveness** and long-term dependency
- Equity issues in **accessibility and affordability**
- Informed consent critical for **experimental psychiatric uses**

## 5. Way Forward for India

- **Strengthen Neuro-care Facilities:** More specialized centers for DBS in major hospitals
- **Government Schemes & Insurance:** Include DBS under **Ayushman Bharat** or state insurance schemes
- **R&D Support:** Promote **Make in India neurostimulators** to reduce costs
- **Public Awareness:** Early screening for Parkinson's & neurological disorders

### Mains Practice Question

1. **What is Deep Brain Stimulation (DBS), and how does it work?** Discuss its applications and limitations in treating neurological disorders. (GS III)
2. **Neurological innovations like DBS offer hope but also raise ethical challenges.** Comment. (GS IV)
3. **Evaluate the scope and challenges of adopting DBS in India's public healthcare system.** (GS II)

## Uttarakhand to Assess Nainital's Tourist Carrying Capacity

### 📌 Syllabus Mapping

- ✓ GS Paper II – Governance & International Health (WHO, global health cooperation)
- ✓ GS Paper III – Environment, Science & Technology (Diseases, One Health, Climate impact on health)
- ✓ GS Paper III – Disaster Management (Biological hazards, pandemic preparedness)

## 1. Context

A landmark study has **mapped global hotspots of zoonotic diseases**—diseases transmitted between animals and humans—prioritized by the **World Health Organization (WHO)**, excluding COVID-19.

- **Zoonotic diseases (Zoonoses):**  
Caused by **viruses, bacteria, fungi, or parasites** that **spread between animals and humans**.
  - Examples: **Ebola, Nipah, Avian Influenza, Rabies, Zika**
- **Significance:**
  - Over **70% of emerging infectious diseases** in humans are zoonotic in origin.
  - These pose **global health security challenges** and require **One Health** approaches.

## 2. Key Findings of the Study

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1. **Global Risk Mapping**
  - **9.3%** of Earth's land surface is at **high (6.3%) or very high (3%)** risk of zoonotic outbreaks.
  - **Regional Hotspots:**
    - **Latin America & Oceania:** 18.6% (highest risk)
    - **Asia:** 6.9%
    - **Africa:** 5.2%
2. **Population Exposure**
  - **3%** of the global population lives in **high or very high-risk** zones
  - **20%** resides in **medium-risk** areas
3. **Drivers of Outbreak Risk**
  - **Anthropogenic (human-driven) factors** are primary determinants:
  1. **Climate Factors**
    - **Risk increases with rising temperatures** and **moderate rainfall**
    - **Water scarcity** forces animals to congregate, increasing **human-animal interaction**
  2. **Environmental & Land-Use Changes**
    - **High livestock density** near settlements → higher spillover risk
    - **Deforestation and urban expansion** → more human-wildlife encounters
  3. **Population Pressure**
    - **Rapid urbanization in unplanned cities** with **weak health infrastructure**
    - Population density is the **strongest individual risk factor**

## 3. Policy Recommendations and Global Preparedness

1. **Climate-Sensitive Health Planning**

- Integrate **climate adaptation measures** into disease surveillance systems
- 2. **Sustainable Land-Use Practices**
  - Regulate **deforestation, urban sprawl, and livestock clustering**
- 3. **Health System Strengthening**
  - Improve **zoonosis surveillance, diagnostics, and rapid response capacity**
  - Invest in **primary healthcare** in high-risk zones
- 4. **Data and Technology Integration**
  - **Machine learning & GIS tools** for predicting outbreak hotspots
- 5. **One Health Approach**
  - Cross-sector collaboration among **health, agriculture, wildlife, and climate authorities**
  - Global partnerships for **vaccine research and early warning systems**

## 4. Broader Implications

- **National Security:** Pandemics are considered **non-traditional security threats**.
- **Economic Impact:** Outbreaks can cause **trade disruptions** and **GDP losses**.
- **International Cooperation:** Aligns with WHO's **International Health Regulations (IHR)** and **SDG-3: Good Health & Well-being**.

**Example:** The **Nipah outbreaks in Kerala** highlight how **land-use changes and fruit bat habitats** contribute to zoonotic risk.

### Mains Practice Question

1. **Discuss** the role of anthropogenic factors in the emergence of zoonotic diseases and suggest a One Health-based strategy for India. (GS III)
2. **Analyze** the global implications of zoonotic hotspots for health security and international cooperation. (GS II & III)
3. “**Climate change and urbanization are silent drivers of future pandemics.**” Examine in light of recent studies. (GS III)

## Flagellin: A New Gut-Brain Communication Pathway

### ❖ Syllabus Mapping

✓ GS Paper II – Health & Human Physiology (Science & Tech in Health)  
 ✓ GS Paper III – Biotechnology, Science & Tech Developments

## 1. Context

- A Duke University study reveals a **new sensory mechanism** in the **gut**, highlighting how the **microbiome** communicates with the **brain** through the **vagus nerve**, potentially influencing **appetite and mental health**.

## 2. About Flagellin

Aspect	Details
<b>Definition</b>	Ancient protein released from <b>bacterial flagella</b> , which are tail-like structures enabling bacterial movement.
<b>Location</b>	Produced by <b>gut bacteria</b> in the human microbiome.
<b>Receptor</b>	Detected by <b>TLR5 (Toll-Like Receptor 5)</b> present on <b>neuropod cells</b> in the gut lining.
<b>Signal Pathway</b>	Neuropod cells → <b>Vagus nerve</b> → Brain
<b>Function</b>	Regulates <b>appetite</b> , potentially impacting <b>digestion, immunity, and mental health</b> .

## 3. Mechanism of Action

1. **Gut Microbiome releases flagellin**
2. **Neuropod cells detect flagellin via TLR5 receptors**
3. **Signal sent to brain through vagus nerve**
4. **Influences feeding behavior and emotional state**

## 4. Implications of the Discovery

- **Health & Nutrition:**
  - Offers new ways to **control appetite** and **combat obesity**.
- **Mental Health:**
  - Links gut signals to **depression and anxiety** regulation.
- **Microbiome Therapy:**
  - Opens avenues for **probiotics and precision medicine** targeting **gut-brain axis**.

### Mains Practice Question

**Prelims:** TLR5 receptor, vagus nerve, gut microbiome functions.

**Mains (GS III)** "The gut microbiome acts as a second brain. Discuss in light of recent discoveries like the role of flagellin in appetite regulation."

# SCIENCE & TECHNOLOGY

## Accelerometers: Functioning, Applications, and Significance

### ❖ Syllabus Mapping

- ✓ **GS Paper III – Science & Technology** (Applications of sensors, IT, and electronic devices)
- ✓ **GS Paper III – Disaster Management** (Technological solutions for disaster early warning)

### 1. Context

Google's **Android Earthquake Alert System** has successfully detected **over 18,000 earthquakes** worldwide by **using smartphone accelerometer data**.

- This demonstrates the **potential of crowd-sourced sensor networks in disaster preparedness and real-time alerts**.

### 2. About Accelerometers

**Definition:** An **accelerometer** is a **sensor device** that **measures acceleration** — the rate of change of velocity of an object — and can detect the **intensity, direction, and frequency of movement**.

#### Principle of Working:

- **Based on Newton's Second Law of Motion ( $F = m \times a$ )**
- Measures **two types of acceleration**:
  1. **Static acceleration** – caused by **gravity**, helps determine orientation
  2. **Dynamic acceleration** – caused by **movement or vibrations**, like a car crash or tremor

### 3. Key Applications of Accelerometers

1. **Consumer Electronics:**
  - **Smartphones & Tablets:** Auto-rotation of screens, step counting, gaming motion control
  - **Laptops & Cameras:** Protect hard drives during sudden falls and stabilize images
2. **Vehicles & Transportation:**
  - **Airbags Deployment:** Detect sudden deceleration to trigger airbags
  - **Crash and Tilt Detection:** For automotive safety and advanced driver assistance systems
3. **Aerospace & Drones:**
  - **Orientation & Navigation:** Maintain balance and flight stability in drones and aircraft
4. **Disaster Management:**
  - **Earthquake Detection Systems:** Detect seismic waves early, enabling quick alerts
  - Example: Google's **Earthquake Alert System** leverages **billions of smartphone accelerometers** as a distributed seismic network

### 4. Significance in Public Safety and Technology

- **Crowdsourced Seismic Networks:** Using accelerometers in mobile phones enables **cost-effective earthquake monitoring** in regions with limited infrastructure.
- **Integration with AI & IoT:** Data from accelerometers can be integrated into **smart cities, disaster management, and health monitoring systems**.
- **Early Warning Systems:** Earthquake alerts can save lives by providing **few seconds of lead time** for evacuation or emergency responses.

### 5. Challenges and Way Forward

- **False Positives:** Distinguishing between genuine seismic waves and human movement remains a challenge.
- **Data Privacy Concerns:** Location and movement data collection must comply with **privacy norms**.
- **Improved Accuracy:** Integration with **gyroscopes, GPS, and AI algorithms** can enhance precision.

### Mains Practice Question

1. Explain the principle of an accelerometer and discuss its role in disaster management with examples. (GS III)
2. "Crowdsourced sensor data can transform public safety mechanisms in India." Discuss in the context of Google's Earthquake Alert System. (GS III)
3. Evaluate the technological and ethical challenges of using accelerometer data for real-time monitoring and public safety. (GS III)

## Heavy Water: Strategic Importance in India's Nuclear Program

### ❖ Syllabus Mapping

- ✓ GS Paper III – Science & Technology (Nuclear Technology, Applications)
- ✓ GS Paper III – Energy Security & Strategic Sectors (Nuclear Self-Reliance)
- ✓ GS Paper II – International Relations (Nuclear treaties & non-proliferation context)

### 1. Context

- TEMA India Ltd. has commissioned India's first private test facility for upgrading depleted Heavy Water, marking a **milestone in India's nuclear self-reliance and indigenization efforts**.
- This step **reduces dependency** on imports and aligns with **Atmanirbhar Bharat** in the nuclear sector.

### 2. What is Heavy Water?

- **Chemical Formula:** D<sub>2</sub>O (Deuterium Oxide)
- **Composition:** Hydrogen atoms are replaced by **Deuterium (²H)**, the heavier stable isotope of Hydrogen.
- **Physical Property:** Slightly denser than regular water (H<sub>2</sub>O).

### 3. Applications of Heavy Water

1. **In Nuclear Reactors**
  - **Moderator:** Slows down **fast neutrons** to sustain chain reactions in **Pressurized Heavy Water Reactors (PHWRs)**.
  - **Coolant:** Transfers heat from the reactor core efficiently without capturing neutrons.
  - **Significance for India:**
    - Most Indian PHWRs (like **Kakrapar & Narora**) rely on Heavy Water for operation.
    - Enables use of **natural uranium** without enrichment, a key aspect of India's **three-stage nuclear program**.
2. **Scientific Research and Industry**
  - **NMR Spectroscopy:** Serves as a solvent for studying molecular structures.
  - **Neutrino Detection:** Used in experiments like the **Sudbury Neutrino Observatory (Canada)** to detect weak neutrino interactions.
  - **Isotope Separation and Pharma Research:** Useful in tracer studies and developing radiopharmaceuticals.

### 4. Strategic Significance for India

- **Self-Reliance in Nuclear Fuel Cycle:** Heavy Water production and upgradation facilities ensure **energy security** for nuclear power generation.
- **Export Potential:** India, via **Heavy Water Board (HWB)**, is among the few global exporters of Heavy Water.
- **Private Sector Entry:** TEMA's facility reflects **public-private collaboration** in sensitive nuclear sectors.

### 5. Challenges and Way Forward

- **High Production Cost:** Electrolysis and ammonia-hydrogen exchange methods are energy-intensive.
- **Depletion Management:** Efficient **recycling and upgradation of depleted Heavy Water** is vital for cost-effective operations.
- **Strategic Oversight:** Private participation requires **robust security and regulatory compliance** under **Atomic Energy Regulatory Board (AERB)**.

### Mains Practice Question

1. Explain the significance of Heavy Water in India's three-stage nuclear power program. (GS III)
2. Discuss how private participation in Heavy Water production contributes to India's nuclear self-reliance and energy security. (GS III)
3. Evaluate the dual-use nature of Heavy Water technology and the need for strong regulatory mechanisms in India. (GS III)

### N-nitrosodimethylamine (NDMA)

#### ❖ Syllabus Mapping

- ✓ GS Paper III – Science and Technology, Health, Environment & Pollution
- ✓ GS Paper II – Public Health and Regulatory Frameworks

### 1. Context

- Central Drugs Standard Control Organization (CDSCO) has requested testing of NDMA levels in Ranitidine, an antacid used to reduce stomach acid.
- Concerns arose after reports of NDMA contamination, which is linked to cancer risk.

### 2. What is NDMA?

- Chemical Nature:
  - Formula:  $C_2H_6N_2O$
  - Appearance: Yellow, odorless liquid at room temperature.
- Formation:
  - Unintentional by-product in:
    - Industrial manufacturing (pesticides, rubber, leather)
    - Certain pharmaceutical processes
  - Naturally found in air, water, soil, and some foods (cured meats, beer).
- Carcinogenic Risk:
  - Classified as a probable human carcinogen (IARC Group 2A).
  - Even trace amounts over long-term exposure can cause liver damage and cancer.

### 3. Historical Use

- Earlier: Component in rocket fuel and some industrial processes.
- Discontinued: Due to environmental contamination concerns.
- Other Uses:
  - Additive in cosmetics, lubricants, plastics, and softeners.

### 4. Public Health Concerns

1. Pharmaceutical Contamination
  - NDMA detected in Ranitidine, Valsartan (BP drug) in past recalls.
  - Formation can occur during storage under high temperatures.
2. Environmental Exposure
  - Present in chlorinated drinking water and industrial effluents.
3. Regulatory Response
  - FDA & CDSCO require regular testing in high-risk medicines.
  - WHO suggests extremely low permissible limits in drugs.

### 5. Significance for India

- Ensuring drug safety and public health confidence.
- Strengthening pharmaceutical regulatory systems to prevent international recalls.
- Relevant for India's pharma export reputation as the "Pharmacy of the World".

### Mains Practice Question

**Q. What is N-nitrosodimethylamine (NDMA), and why has it raised global health and regulatory concerns? Discuss measures to prevent its contamination in pharmaceuticals.**

### NASA-ISRO Synthetic Aperture Radar (NISAR) Satellite

#### ❖ Syllabus Mapping

- ✓ GS Paper III – Science & Technology (Space Technology)
- ✓ GS Paper II – International Relations (Indo-US Collaboration)

### 1. Context

- NISAR Satellite was successfully launched from Satish Dhawan Space Centre, Sriharikota on GSLV-F16 into Sun-Synchronous Polar Orbit (SSO).
- Marks India's first dual-frequency radar imaging Earth Observation mission and a major Indo-US space collaboration milestone.

### 2. Key Features of NISAR

Feature	Details
Type	Earth Observation Satellite (EOS)
Launch Vehicle	ISRO's <b>GSLV-F16</b> (first GSLV to SSO)
Weight	2,392 kg
Orbit	Sun-Synchronous Polar Orbit (SSO)
Revisit Period	12 days ( <i>Orbits Earth every 97 minutes</i> )
Mission Life	5 years
SAR Bands	<b>L-band (NASA) &amp; S-band (ISRO)</b>
Data Policy	Open data, freely available to global scientific community

### 3. Synthetic Aperture Radar (SAR) Technology

- **Function:** Sends radar pulses to Earth and records reflected energy to create **high-resolution images**.
- **Advantages:**
  - All-weather, day-night imaging capability
  - Can penetrate clouds, vegetation, and ice
- **Technique:** SweepSAR – enables **high-resolution and wide-swath imaging** of diverse terrain.

### 4. Significance of NISAR

1. **Scientific & Environmental Monitoring**
  - Tracks **glacial melting, forest cover, soil moisture**, earthquakes, and landslides.
  - Aids in **climate change studies and disaster management**.
2. **Strategic and Socio-economic Impact**
  - Helps **agriculture monitoring, urban planning, and water resource management**.
  - Contributes to **national disaster early warning systems**.
3. **Indo-US Space Diplomacy**
  - Joint mission reflects **science diplomacy** under the **U.S.-India Civil Space Cooperation** initiative.
  - Strengthens **India's space collaboration** with NASA.

### 5. About Sun-Synchronous Polar Orbit (SSO)

- **Sun-Synchronous Orbit:**
  - Satellite passes over the **same part of Earth at the same local solar time**, providing consistent lighting for imaging.
- **Polar Orbit:**
  - Satellites travel **pole-to-pole**, at altitudes **200-1000 km**, useful for **Earth observation & climate monitoring**.

### Mains Practice Question

- **Prelims:** SAR technology, NISAR features, Sun-Synchronous Orbit characteristics
- **Mains:** "Discuss the significance of NISAR for India's environmental monitoring and space diplomacy."

## Starlink Receives License to Launch Satellite Internet in India

### ❖ Syllabus Mapping

- ✓ **GS Paper II – Governance, Policies & Regulatory Frameworks**
- ✓ **GS Paper III – Science & Technology, Infrastructure, Security**

### 1. Context

- **Starlink**, a **SpaceX project**, has received the **license to launch satellite internet services in India**.
- It operates through a **Low Earth Orbit (LEO) satellite constellation** to provide **global broadband coverage**.

## 2. About Satellite Internet Services

- **Definition:** Satellite internet (or satellite broadband) is a **wireless internet connection** delivered via **communication satellites** orbiting the Earth.
- **How It Works (Diagrammatic Overview):**
  1. User terminals (dishes) connect to LEO satellites.
  2. Satellites relay signals to **ground stations**.
  3. Data is routed through the **internet backbone** and sent back to the user.

## 3. Significance for India

1. **Bridging the Digital Divide**
  - Provides **connectivity to remote and rural areas**, where fiber or mobile networks are limited.
  - Example: North-East India, Andaman & Nicobar Islands, Ladakh.
2. **Disaster Management**
  - Supports **emergency communication** in disaster-hit or inaccessible areas (e.g., **Siachen, Uttarakhand floods**).
3. **Boost to Emerging Technologies**
  - Enables **IoT, telemedicine, e-learning, smart agriculture**, and remote surveillance.
4. **Military & Strategic Use**
  - Indian Army already uses satellite connectivity for **border and high-altitude regions** (e.g., **Siachen Glacier**).

## 4. Challenges

- **High Cost for End-Users:** Hardware and subscription remain **costly**, limiting rural uptake.
- **Infrastructure Barriers:** High cost of terminals and limited satellite capacity.
- **Latency & Bandwidth Issues:** LEO satellites reduce latency but require **dense constellations** for stable coverage.
- **Regulatory & Security Concerns:** Data security, spectrum allocation, and national security risks.
- **Demand-Supply Imbalance:** Urban areas already have **cheaper terrestrial broadband options**.

## 5. Way Forward

1. **Complementary Use**
  - Focus on **rural, remote, and disaster-prone areas** rather than urban markets.
2. **Hybrid Connectivity Models**
  - Combine **satellite and terrestrial networks** for efficiency.
3. **Ensure Affordability**
  - Local manufacturing of user terminals, **partnerships with Indian telecom companies**, and **customized rural pricing**.
4. **Robust Regulation**
  - Strengthen **data security** and **spectrum management** under DoT & TRAI.

### Mains Practice Question

- *"Discuss the significance and challenges of satellite internet services in bridging the digital divide in India. Suggest measures for effective adoption."*