



RAMAN ACADEMY
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SR NO.	TOPIC NAME	PAGE NO.
1	Indian Polity	2
2	History, Art & Culture	13
3	Geography	19
4	Environment and Ecology	23
5	Economic Development	36
6	Science & Technology	46
7	Governance	62
8	Indian Society and Social Issues	67
9	International Relations	70

Indian Polity and Governance

National Investigation Agency (NIA)

Why in News?

In **2025**, the National Investigation Agency recorded a **conviction rate of over 92%** in terror-related cases, indicating a strengthened **counter-terrorism and internal security framework** in India.

Key Takeaways

- Federal counter-terror agency with **pan-India jurisdiction**
- Established under **NIA Act, 2008**
- Powers expanded by **NIA Amendment Act, 2019**
- Can investigate **extra-territorial offences**
- Operates through **NIA Special Courts**

About the National Investigation Agency

1. Status and Mandate

- India's **federal agency** for:
 - Terrorism
 - Insurgency
 - National security crimes with **inter-State or international dimensions**
- Created in the aftermath of the **26/11 Mumbai terror attacks**.

2. Legal Powers

- Empowered under the **NIA Act, 2008**.
- Key features:
 - Can **take over cases from States**
 - Investigate across State boundaries **without prior State consent**
 - Exercise **extra-territorial jurisdiction** for offences committed outside India
- Strengthened in 2019 to include:
 - Human trafficking
 - Counterfeit currency
 - Cyber-terrorism
 - Explosives and arms offences

3. Taking Up a Case (Section 6, NIA Act)

- Cases may be:
 - **Referred by States**, or
 - Taken up **suo motu by the Centre**

- For prosecution under **Unlawful Activities (Prevention) Act, 1967**, Central Government sanction is mandatory.

Continued Custody in Delhi Riots Cases and the Right to Liberty

Why in News?

A **January 5, 2026** order of the **Supreme Court of India** in the **Delhi Riots “larger conspiracy”** cases revived debate on **personal liberty, bail jurisprudence, and prolonged pre-trial detention**, especially under the **Unlawful Activities (Prevention) Act, 1967 (UAPA)**.

Core Issues

1.Right to Speedy Trial (Article 21)

- Prolonged detention (5+ years) without trial risks converting pre-trial custody into punishment.
- Speedy trial is an **integral facet of personal liberty**.

2.Bail Jurisprudence & Presumption of Innocence

- Bail denials based on **alleged roles or inferences** rather than tested evidence raise concerns.
- **“Bail is the rule, jail the exception”** diluted in special statutes.

3.UAPA's Broad Definitions

- Expansive interpretation of “terrorist act” may **criminalise protest**.
- High threshold for bail under UAPA amplifies **state power** over liberty.

The New Grammar of Indian Elections: Media, Misinformation and Manipulation

Why in News?

With elections due in **four States and one Union Territory** in the coming weeks, India’s electoral process is witnessing a major shift—from **WhatsApp-driven mobilisation (2019)** to a **hybrid digital ecosystem** dominated by social media, influencers, and AI tools. This transformation raises serious concerns about **fake news, deepfakes, and electoral integrity**.

Key Takeaways

- Indian elections now combine **traditional media + digital platforms**
- **Fake news** significantly influences voter perception
- **Influencers** have emerged as political intermediaries
- **Deepfakes and AI-generated content** pose new democratic risks
- Regulatory preparedness remains inadequate

Changing Media Landscape in Indian Elections

1.Hybrid Electoral Ecosystem

- 2026 elections reflect a mix of:
 - Television & print
 - Social media platforms (YouTube, WhatsApp, Instagram)
- Around **70% of Indians** now prefer online news sources.

2.Fake News & Electoral Manipulation

- No statutory definition of fake news in India.
- Broadly refers to **fabricated or misleading information** designed to advance political agendas.
- Algorithms amplify sensational content during elections.
- Data highlights:
 - Over **90 crore internet users**
 - **46% of fake news politically motivated**

Impact:

- Polarisation of society
- Erosion of **voter trust**
- Distortion of informed consent

3. Influencer Politics

- Political parties increasingly use:
 - Social media influencers
 - Micro-targeted messaging
- Studies show:
 - **86% of Gen Z** trusts influencers more than traditional celebrities
- Blurs line between:
 - Political communication
 - Paid political advertising

Delimitation After 2027: Redrawing Power in India

Why in News?

The **constitutionally mandated delimitation exercise** after the **2027 Census** is expected to significantly alter **political representation** in India. With sharp inter-State demographic differences, the process has triggered debates on **federal fairness, equality of vote, and democratic justice**.

Key Takeaways

- Delimitation ensures **equal suffrage** (one person–one vote).
- **Seat distribution frozen since 1976**, causing mismatch with current population data.
- Likely increase in representation of **high population growth (mostly northern) States**.
- Raises concerns for **southern States** that successfully implemented population control.

What is Delimitation?

- Redrawing **electoral constituency boundaries** based on population.
- Aimed at maintaining **equal representation** in legislatures.
- Conducted by a **Delimitation Commission**.

Constitutional & Historical Context

- The Constitution originally mandated delimitation **after every Census**.
- **42nd Constitutional Amendment (1976)**:
 - Froze Lok Sabha seat distribution till 2000.
 - Objective: avoid penalising States implementing **family planning**.
- Freeze later extended till **2026** by the **84th Amendment (2001)**.

Possible Solutions (Analytical)

- **Extend the freeze** further to allow demographic convergence.
- **Expand Lok Sabha strength** without reducing any State's current seats.
- Adopt a **weighted formula**:
 - Population
 - Human Development Indicators
 - Governance performance

Governor's Address and Constitutional Limits: Reasserting the Parliamentary Spirit

Why in News?

Recent **walkouts by Governors** during inaugural sessions of State Legislatures in **Opposition-ruled States** (Karnataka, Tamil Nadu, Kerala) have sparked debate over **Article 176(1)** and the **limits of gubernatorial discretion**. The issue may be taken to the **Supreme Court of India** for authoritative clarification.

Key Takeaways

- Governor's address is **constitutionally mandated**, not discretionary.
- Address reflects **State Cabinet policy**, not Governor's personal views.
- Raises concerns about **federalism, parliamentary democracy, and constitutional morality**.

Constitutional Position of the Governor

1. Article 176(1)

- Governor **shall address** the Legislative Assembly at the beginning of:
 - First session of the year
 - First session after general elections
- The address is prepared by the **Council of Ministers**.

2. Aid and Advice (Article 163)

- Governor must act on **aid and advice of the Council of Ministers**.
- Discretion exists only where **explicitly provided by the Constitution**.

Judicial Interpretation

Key Supreme Court Judgments

- **Shamsher Singh vs State of Punjab (1974)**
 - Governor is a **constitutional head**, not an executive authority.
 - Public criticism of Cabinet policy is unconstitutional.
- **Nabam Rebia vs Deputy Speaker (2016)**
 - Governor's discretionary powers are **limited and enumerated**.

- Addressing the House is an **executive act**, not discretionary.
- **Tamil Nadu Governor Case**
 - Discretion cannot undermine the authority of an **elected government**.

Reimagining Delimitation: Balancing Population, Federal Equity and Democratic Justice

Why in News?

Southern States—early investors in **health, education, and family planning**—now face potential **fiscal and political disadvantages**. With **population accounting for 50% of Finance Commission devolution** and **delimitation expected before the 2029 elections**, concerns have intensified that **Northern States** with higher population growth will gain disproportionate **Lok Sabha representation**.

Key Takeaways

- Delimitation risks **penalising demographic success**.
- **84th Constitutional Amendment** froze redistribution until post-2026 Census.
- Delayed Census (expected ~2028) heightens uncertainty.
- Need for **fair alternatives** to protect federal balance.

Constitutional & Historical Context

- **Delimitation** aims at **equal suffrage** (one person—one vote).
- Freeze rationale: **do not penalise States** that adopted population control.
- Looming reset threatens **political influence** of low-growth States.

The Federal–Ethical Dilemma

- **Democratic equality** vs **federal justice**
- Governance success (lower fertility, better outcomes) may reduce:
 - **Lok Sabha seats**
 - **Union tax share**
- Risks weakening **cooperative federalism**.

Proposed Solutions (Comparative & Analytical)

1. Expand Lok Sabha without Redistributing Seats

- Increase total seats; retain **2011 Census distribution**
- Avoids seat loss; improves representation ratios

2. Rajya Sabha Reforms (Balancing Chamber)

- Maintain/strengthen **equal State voice** (U.S. Senate analogy)

3. Strengthen State-Level Representation

- Expand **Vidhan Sabha** seats to correct ratios within States

4. Mixed Formula for Lok Sabha Allocation

- **60% population + 40% population-control performance**
- Inspired by **EU's degressive proportionality**

A **united Southern approach** around a mixed formula can protect equity.

UAPA's Ever-Widening Definition of Terrorism

Why in News?

The **Supreme Court of India** denied bail to Umar Khalid and Sharjeel Imam by adopting an **expansive interpretation of "terrorist act" under Section 15** of the **Unlawful Activities (Prevention) Act, 1967 (UAPA)**, including acts committed **"by any other means"** beyond conventional weapons.

Key Takeaways

- UAPA increasingly invoked beyond **mass-casualty violence**.
- Broad interpretation extends into **dissent, protest, and political mobilisation**.
- Strengthens **executive power** within a stringent procedural regime.
- Raises concerns for **civil liberties, bail jurisprudence, and proportionality**.

Evolution of the UAPA

1. Origins (1967)

- Enacted to curb **"unlawful activities"** threatening sovereignty and integrity.
- Rooted in **National Integration Council (NIC)** deliberations (1961).
- Led to the **Sixteenth Constitutional Amendment (1963)** permitting reasonable restrictions for national integrity.

2. Shift Towards Terrorism (Post-2004)

- After repeal of **POTA**, UAPA amended to include **terrorism**.
- **Chapter IV (2004)** introduced:
 - Definition of terrorist acts
 - Penal provisions

3. Post-26/11 Strengthening

- Expanded investigative powers and harsher procedures:
 - Longer custody
 - Stringent bail conditions
 - Burden shifts at the bail stage

What is a "Terrorist Act" under Section 15?

- Traditionally: use of **explosives, firearms, lethal weapons**.
- **Expanded clause:** acts done **"by any other means"**.

Result:

- Non-violent acts may be construed as terrorism
- Elastic interpretation at the investigation/bail stage

Key Amendments & Expansions

- **2012:** Economic security included as terrorism.
- **2019:** Government empowered to **designate individuals as terrorists** (presumption of innocence concerns).
- Corporate/institutional liability for terror acts unless ignorance proven.
- Enhanced powers for **National Investigation Agency** (property seizure, extra-territorial reach).
- Alignment with international counter-terror conventions.

Constitutional & Democratic Concerns

- **Article 21:** Prolonged pre-trial detention risks punishment without trial.
- **Article 19:** Chilling effect on speech, association, protest.
- **Rule of Law:** Vague standards + strict bail dilute judicial scrutiny.
- **Proportionality:** Non-violent acts treated on par with terror violence.

A Bill That Reimagines Higher Education Regulation

Why in News?

The **Viksit Bharat Shiksha Adhishthan Bill, 2025** has been introduced to reform higher-education regulation in line with **National Education Policy (NEP) 2020** and the vision of **Viksit Bharat 2047**, shifting focus from procedural compliance to **outcomes, quality, and social relevance**.

Key Takeaways

- Moves towards **"light but tight" regulation**.
- Seeks to replace fragmented oversight with a **unified apex body**.
- Emphasises **transparency, technology, and accountability**.
- Focus on **youth empowerment and meaningful learning outcomes**.

Why Reform Was Needed

- Rapid expansion of higher education without commensurate regulatory reform.
- Multiple regulators → **over-regulation, duplication, compliance burden**.
- Institutions diverted from:
 - Teaching quality
 - Research
 - Social relevance

Core Features of the Bill

1. Unified Regulatory Architecture

- Creation of a **single apex body** for higher education.
- Replaces fragmented, silo-based regulation with **coordinated standards**.

2. Outcome-Based Regulation

- Shift from input/procedure checks to:
 - Learning outcomes
 - Research quality
 - Social impact

3. Technology-Enabled Governance

- **Single-window digital system**
- Mandatory public disclosure of key institutional data
- **Faceless processes** to reduce discretion and delays

4. Transparency & Accountability

- Public dashboards
- Reduced inspector-raj
- Institutions accountable to **students and society**, not just regulators

Governance & Constitutional Dimensions

- **Education in Concurrent List** → Centre–State coordination essential.
- Avoid over-centralisation while ensuring national standards.
- Balancing:
 - Autonomy
 - Quality assurance
 - Equity and access

Judicial Removal – Tough Law with a Loophole

Why in News?

An impeachment motion against Justice G.R. Swaminathan of the Madras High Court, initiated by **107 Members of Parliament**, has revived debate on **judicial accountability versus judicial independence**, and exposed a **procedural loophole** in India's judicial removal framework.

Key Takeaways

- Judicial removal is governed by **Articles 124, 217, and 218** of the Constitution.
- The process is intentionally **rigorous** to protect judicial independence.
- The term "**misbehaviour**" is **undefined**, relying on judicial interpretation.
- **Discretion of the Speaker/Chairman at the admission stage** is a critical vulnerability.

Constitutional & Legal Framework

1. Constitutional Provisions

- **Article 124(4)**: Removal of Supreme Court judges
- **Article 217(1)(b)**: Removal of High Court judges
- **Article 218**: Applies Article 124 procedure to High Court judges
- Removal only on grounds of:
 - **Proved misbehaviour**, or
 - **Incapacity**

Removal requires:

- Special majority in **both Houses of Parliament**
- Presidential order after parliamentary approval

Meaning of "Misbehaviour"

- **Not defined** in the Constitution.
- Supreme Court interpretation:
 - **Judicial errors ≠ misbehaviour**
 - Misconduct must involve:
 - Wilful abuse of office
 - Corruption
 - Behaviour unbecoming of a judge

Protects judges from removal for **unpopular judgments**.

Procedural Safeguards

- Motion requires:
 - **100 Lok Sabha MPs**, or
 - **50 Rajya Sabha MPs**
- Inquiry by a **Judicial Committee** (Judges Inquiry Act, 1968)
- High threshold ensures:
 - Political consensus
 - Insulation from executive pressure

Corruption and Prior Sanction – Case of a Divided House

Why in News?

A split verdict in **CPIL v. Union of India** by Justice **B.V. Nagarathna** and Justice **K.V. Viswanathan** on the constitutionality of **Section 17A of the Prevention of Corruption Act, 1988** has reopened debates on **investigative autonomy versus protection of public servants**. The matter now awaits a larger Bench.

Key Takeaways

- Section 17A mandates **prior government sanction** for inquiry/investigation.
- One view sees it as **unconstitutional shielding of corruption**.
- The other views it as **necessary protection**, with safeguards.
- Outcome will shape India's **anti-corruption architecture**.

Background: Prevention of Corruption Act, 1988

- India's principal anti-corruption statute
- Rooted in **Santhanam Committee** recommendations
- Aimed at:
 - Strong investigative independence
 - Equality before law

What is Section 17A?

- Inserted in **2018**
- Requires **prior approval** of government before:
 - Inquiry
 - Investigation
- Applies to acts done by public servants in **official capacity**

Governance Implications

- Excessive protection → **erosion of accountability**
- No protection → **decision-making paralysis**
- Need for **filtered but independent scrutiny**

Indelible Ink and Electoral Integrity

Why in News?

During municipal corporation elections in Maharashtra, opposition parties questioned the **effectiveness of indelible ink**, alleging that the ink marks could be removed. Videos showing ink fading after application of marker pens triggered public debate.

Key Takeaways

- Indelible ink ensures **"one person, one vote."**
- It remains visible for several days and fades naturally as skin sheds.
- Concerns relate more to **misuse of markers**, not ink failure.

Background & Technical Details

Introduction

- Introduced in **1962**.
- First used during **India's third General Election**.
- Decision taken by the **Election Commission of India (ECI)**.

Manufacturer

- Produced exclusively by **Mysore Paints and Varnish Limited**.
- Karnataka government PSU.
- Exported to:
 - Afghanistan
 - Cambodia
 - Kenya
 - Mongolia
 - Nepal
 - Nigeria

Chemical Composition

- Key chemical: **Silver Nitrate**
- Developed by the **National Physical Laboratory**.
- Reacts with keratin in skin/nail → forms dark stain.
- Visibility:
 - On skin: several days
 - On nail: **up to 4 weeks**

Marker Pen Controversy

- Marker pens allowed in **local body elections since 2011**.

- Marker ink may cover or visually fade the indelible ink temporarily.
- Does **not negate** the chemical reaction of silver nitrate.

Draft IT (Digital Code) Rules, 2026 – Regulating Online Content

Why in News?

The Union Government has released the **Draft IT (Digital Code) Rules, 2026** to regulate **online obscenity** and introduce **mandatory age-based classification** for all digital content. The proposal reflects growing concerns over unregulated content on OTT platforms and social media in India's rapidly expanding digital ecosystem.

Key Takeaways

- Introduces **age-based classification** for digital content.
- Seeks to balance **freedom of expression** with **child protection and public morality**.
- Expands accountability of **online curated content providers**.
- Raises concerns over **creative freedom, vagueness, and over-regulation**.

Background & Legal Basis

Existing Framework

- **Information Technology Act, 2000**
- **IT (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021**

Rapid growth of OTT platforms and social media exposed regulatory gaps relating to:

- Obscenity
- Harmful content
- Child safety
- Misinformation

Legal Authority

- Draft Rules issued under **Section 87(1) of the IT Act, 2000**.
- Guided by Supreme Court jurisprudence on **reasonable restrictions under Article 19(2)** (morality, public order, decency).

Key Features of Draft IT (Digital Code) Rules, 2026

1. Definition of Obscene Content

- Content that is:
 - **Lascivious**
 - Appeals to **prurient interests**
- Aligns with existing judicial tests on obscenity.

2. Prohibited Content Categories

Includes content that:

- Attacks or insults religions
- Promotes violence
- Denigrates individuals or communities
- Portrays obscenity as **desirable or acceptable**

3. Mandatory Age-Based Classification

All digital content must be classified as:

- U (Suitable for all ages)
- 7+
- 13+
- 16+
- Adult (18+)

4. Parental Controls & Age Verification

- Mandatory parental controls for **13+ content**
- **Reliable age-verification mechanisms** for adult content
- Emphasis on **child online safety**

5. Enforcement & Accountability

- Introduces **civil consequences** for violations
- Direct responsibility on:
 - **Online Curated Content Providers**
- Shifts from advisory ethics to **regulatory compliance**



History, Art & Culture

Birth Anniversary of Mannathu Padmanabhan

Why in News?

The Prime Minister paid tribute to Mannathu Padmanabhan on his birth anniversary, remembering him as a towering social reformer who dedicated his life to dignity, equality, and nation-building.

About Mannathu Padmanabhan

- **Life span:** 2 January 1878 – 25 February 1970
- **Region:** Travancore (present-day Kerala)
- A prominent **social reformer and freedom fighter** who worked relentlessly against caste discrimination and social exclusion in Kerala.

Key Contributions

1. Institutionalized Social Reform

- Founded the **Nair Service Society (NSS)** in **1914**.
- NSS became a major platform for:
 - Social reform
 - Educational advancement
 - Community upliftment
- Helped ensure continuity of reformist ideals beyond individual leadership.

2. Influence of Gandhian Thought

- Deeply inspired by **Mahatma Gandhi**.
- Adopted **Satyagraha** as a moral and political instrument to achieve social justice.
- Emphasized non-violence, discipline, and ethical reform.

3. Champion of Anti-Untouchability Movements

- Played a leading role in **Savarnajatha Satyagraha**, demanding temple entry for marginalized communities.
- Actively associated with:
 - **Vaikom Satyagraha (1924)**
 - **Guruvayoor Satyagraha (1931)**
- These movements contributed significantly to the **Temple Entry Proclamation (1936)** in Travancore.

Transformational Legacy

- Revitalized an entire community through:

- Philosophy of action
- Unity and self-transformation
- His ideas remain deeply embedded in Kerala's **social, political, and cultural history**.
- Represents the broader **Kerala Model of social reform** combining spirituality, education, and activism.

Somnath Temple

Why in News?

Prime Minister **Narendra Modi** conveyed greetings on the commencement of **Somnath Swabhiman Parv**, highlighting the civilizational, cultural, and national significance of the Somnath Temple.

Key Takeaways

- Dedicated to **Lord Shiva**
- Located at **Prabhas Patan**, near Veraval, Gujarat
- **First among the twelve Jyotirlingas**
- Symbol of **cultural resilience and national resurgence**
- Reconstructed after Independence as a statement of civilizational continuity

About Somnath Temple

1. Religious Significance

- Dedicated to **Lord Shiva**, worshipped here as a **Jyotirlinga** (self-manifested form).
- Recognized as the **first Jyotirlinga** among the twelve sacred shrines across India.
- Mentioned in ancient scriptures such as:
 - Skanda Purana
 - Shiva Purana
 - Shrimad Bhagavata
 - Rig Veda

2. Geographical Significance

- Located at the **confluence of three rivers**:
 - Kapila
 - Hiran
 - Saraswati
- Rivers merge into the **Arabian Sea**, reflecting advanced ancient Indian geographical understanding.
- Situated on the **western coast of India**, giving it strategic and maritime importance.

3. Historical Timeline

- Antiquity traced back to **649 BCE** (traditional accounts suggest even earlier origins).
- The temple was built and rebuilt multiple times by different rulers over centuries.

Major Attacks & Reconstructions

- **1026 CE** – Destruction by Mahmud of Ghazni

- **1297 CE** – Further damage during Delhi Sultanate invasions
- **1394 CE** – Another major attack
- **1706 CE** – Destruction under Aurangzeb

Cultural & Civilizational Importance

- Somnath stands as a **symbol of India's resilience**, where faith, culture, and identity survived repeated invasions.
- Represents the **continuity of Indian civilization** despite political upheavals.
- An important case study for **heritage, memory, and nation-building** in modern India.

Iran's Pahlavi Dynasty and the 1979 Islamic Revolution

Why in News?

Recent protests in Iran over inflation and economic distress have escalated into violent unrest. Amid this turmoil, **Reza Pahlavi**, son of the last Shah **Mohammad Reza Pahlavi**, has emerged as a political voice from exile, reopening debates on Iran's monarchical past and the legacy of the **1979 Islamic Revolution**.

Key Takeaways

- Origins and nature of the **Pahlavi monarchy**
- Role of **foreign intervention** in Iran's political economy
- Causes and course of the **1979 Islamic Revolution**
- Post-revolution **theocratic–republican governance model**

Historical Background

1. Rise of the Pahlavi Dynasty

- Founded by **Reza Shah Pahlavi** in **1925** after overthrowing **Ahmad Shah Qajar**.
- Came to power through a **military coup**, amid British and Russian influence.
- Emphasized **centralization, modernization, and secular nationalism**, often through authoritarian means.

2. Foreign Influence & Economic Concessions

- Iran's sovereignty weakened by unequal treaties and concessions.
- **1872 British concession** granted extensive rights over railways, mines, and resources.
- Generated nationalist resentment against monarchy and foreign powers.

3. Mossadegh and Oil Nationalisation

- **Mohammad Mossadegh** (PM: 1951–53) nationalized Iran's oil industry.
- Challenged British and Western economic dominance.
- Became a symbol of **democratic nationalism**.

Display Plan for the Piprahwa (Piprawaha) Buddhist Relics

Why in News?

Ancient Buddhist relics associated with the historical Buddha, dispersed for over a century, were partially reunified and transferred to the Government of India. A public exhibition was inaugurated in Delhi by **Narendra Modi**, raising important questions on **heritage stewardship, museum ethics, and cultural representation**.

Key Takeaways

- Religious and cultural significance of **Buddhist relics**
- Challenges of **colonial museum practices**
- Need for **participatory and educational heritage models**
- India's role in **global Buddhist pilgrimage networks**

Background: Buddhist Relics

- After the Buddha's **Mahaparinirvana**, relics were:
 - Divided among followers
 - Enshrined in **stupas** with offerings
- Value lay in **spiritual sanctification**, not material worth.

Historical & Cultural Context

1. Relics and Sacred Geography

- Stupas acted as **centres of devotion and memory**.
- Enabled spread of Buddhism through **sacred landscapes**.

2. Sanchi as a Model

- **Sanchi Stupa** (Ashokan period):
 - Circumambulatory path
 - Narrative gateways (Toranas)
 - Visual storytelling of Buddha's life
- Demonstrates **immersive heritage design**.

3. Regional Adaptations

- In regions without relics:
 - Rock-cut caves
 - Symbolic representations (empty throne, Bodhi tree)

- Architecture substituted physical relics.

Contemporary Challenges in Display

- Glass-case display repeats **colonial museum logic**.
- Risks:
 - De-contextualization
 - Loss of spiritual meaning

Bhadrakali Temple Inscription, Prabhas Patan

Why in News?

The **Bhadrakali Temple inscription** has emerged as important **epigraphic evidence** supporting the historical continuity and religious legacy of **Prabhas Patan** and the **Somnath Temple** in Gujarat.

Key Takeaways

- Located at **Bhadrakali Temple, Prabhas Patan (Gujarat)**
- Dated to **1169 CE**
- Written in:
 - **Valabhi Samvat 850**
 - **Vikram Samvat 1255**
- Mentions Shaiva–Pashupata tradition
- Confirms patronage by **Solanki rulers**

About the Inscription

1. Location & Date

- Carved on the **wall of Bhadrakali Temple, Prabhas Patan**.
- Chronology: **1169 CE**, an important phase of **early medieval Gujarat**.

2. Political & Religious Context

- Honors **Param Pashupata Acharya Shriman Bhavabrihaspati** (Spiritual preceptor of **Kumarapala**, ruler of Anhilwad Patan).
- Reflects strong **Shaiva–Pashupata lineage**, influential in western India.

3. Mytho-Historical Narrative of Somnath

The inscription records the **construction of Somnath Temple in all four Yugas**, blending mythology with historical memory:

Yuga	Builder	Material
Satya Yuga	Chandra (Soma)	Gold
Treta Yuga	Ravana	Silver
Dvapara Yuga	Shri Krishna	Wood

Kali Yuga	Bhimdev (renovated Kumarapala)	Solanki by	Stone
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Thiruvalluvar Day

Why in News?

On **Thiruvalluvar Day**, Prime Minister **Narendra Modi** paid homage to **Thiruvalluvar**, highlighting the enduring relevance of the Tirukkural and encouraging its reading.

Key Takeaways

- Thiruvalluvar: **Tamil poet-philosopher of the Sangam age**
- Lived around **2000 years ago**
- Associated with **Mylapore (present-day Chennai)**
- Author of the **Tirukkural**
- Revered as a saint across South India

About Thiruvalluvar

1. Historical & Cultural Context

- Lived during a period of **religious pluralism**:
 - Hinduism
 - Jainism
 - Buddhism
- Scholars debate his religious affiliation:
 - Some associate him with **Jain ethical thought**
 - Others with **Hindu dharmic philosophy**

2. Philosophy of the Tirukkural

- Demonstrated that **householder life** can lead to moral and spiritual excellence.
- Rejected the idea that **renunciation alone leads to salvation**.
- Emphasized:
 - Virtue (Aram)
 - Wealth (Porul)
 - Love (Inbam)

Ethics rooted in **universal human values**, not sectarian theology.

3. Religious & Social Significance

- In some traditions, revered as an **incarnation of Brahma**.
- His work transcends:
 - Religion
 - Region
 - Time

- Considered a **moral guide for governance and society**.

Contemporary Relevance

- Tirukkural cited in:
 - Ethics
 - Public life
 - Education
- Promotes:
 - Moral governance
 - Social harmony
 - Individual responsibility



Geography

Zaskar River

Why in News?

The iconic **Chadar Trek** on the frozen **Zaskar River** in **Ladakh** has been **postponed** due to inadequate ice formation, raising concerns over **changing winter conditions in the Himalayas**.

Key Takeaways

- Zaskar River is a **left-bank tributary** of the **Indus River**.
- Flows **entirely within Ladakh**.
- Famous for the **Zaskar Gorge**.
- Enables the unique **winter Chadar Trek**.

Geographical Profile

Location & Drainage

- Drains the **Zaskar Valley** in the **north-western Himalayas**.
- Joins the Indus near **Nimmu** at ~3,100 m elevation.

Origin & Course

- Formed by **two major headwater systems**:
 1. **Doda River** – originates near **Pensi La Pass**
 2. River system formed by:
 - **Kargyag River** (near **Shingo La**)
 - **Tsarap River** (near **Baralacha La**)
- Flows **north-westward** through deep gorges.

Geomorphological Significance

- Valley exhibits classic **glacial landforms**:
 - **U-shaped valleys**
 - Hanging valleys
- The **Zaskar Gorge** is one of the deepest and most dramatic gorges in the Himalayas.

Seasonal Importance

- **Winter**:
 - River freezes → **Chadar Trek**
 - Indicates sustained sub-zero temperatures
- **Summer**:
 - River rafting (notably **Chilling–Nimmu stretch**)

- Tourism and adventure sports
- Reduced ice formation signals **climate variability in high-altitude regions**.

Sagar Island (Gangasagar / Sagardwip)

Why in News?

The Chief Minister of West Bengal laid the foundation stone for a **5-km bridge over the Muriganga River**, improving connectivity between **Sagar Island** and the mainland.

Key Takeaways

- Located in the **Ganges Delta**.
- Part of **South 24 Parganas district**, West Bengal.
- Situated near the **Hooghly River**, a major distributary of the Ganges.
- Major **Hindu pilgrimage centre** (Gangasagar Mela).

Geographical Setting

Location

- About **100 km south of Kolkata**.
- Lies at the **mouth of the Hooghly River** near the Bay of Bengal.
- Also known as:
 - **Gangasagar**
 - **Sagardwip**

Environmental Challenges

1. Coastal Erosion & Sea-Level Rise

- Continuous land loss due to:
 - Tidal action
 - Cyclones
 - Rising sea levels
- Threatens:
 - Settlements
 - Infrastructure
 - Heritage sites

2. Salinity Ingress

- Affects agriculture and freshwater availability.

Environmental Protection Measures

- As per **National Green Tribunal (NGT)** directions:
 - **Casuarina shelter belt plantations**
 - **Mangrove conservation**
- Aim to:
 - Reduce erosion
 - Stabilise shoreline
 - Act as bio-shields

India's Small Towns and the Changing Urbanisation Pattern

Why in News?

Recent urban studies show that **India's urban growth is now being driven more by small towns than megacities**, indicating a **structural shift in the country's urbanisation trajectory**.

Key Takeaways

- Urban growth is **decentring from megacities** to small and medium towns.
- Small towns are emerging as **key nodes of migration and economic activity**.
- This trend reflects changes in **India's economic geography and development model**.

Changing Pattern of Urbanisation in India

1. From Megacities to Small Towns

- Earlier focus: **Delhi, Mumbai, Kolkata, Chennai**.
- Present reality:
 - Nearly **8,500 towns** have populations **below 1 lakh**.
 - Majority of new “urban population” is being absorbed by **small towns**.
- Indicates **diffuse and dispersed urbanisation** rather than metropolitan concentration.

2. Economic Geography Behind the Shift

- Over-accumulation of capital, land scarcity, and high costs in megacities.
- Economic activities moving to:
 - Peri-urban areas
 - Census towns
 - Small municipalities
- Small towns offer:
 - Cheaper land
 - Informal labour
 - Lower entry barriers for enterprises

Reflects a shift in India's **capitalist development pattern**.

3. Nature of Small-Town Urbanisation

- Often driven by:
 - Informal employment
 - Rural-to-urban spillover

- Leads to **urbanisation of rural poverty**, not necessarily prosperity.
- Weak industrial base and limited service-sector growth.

Gandak River (Narayani / Gandaki)

Why in News?

The **Gandak River** has drawn attention for its **ecological significance**, especially as a key habitat for **gharial** populations, and for its distinctive **geomorphology** and **transboundary river management** across Nepal and India.

Key Takeaways

- Major **left-bank tributary** of the **Ganges**.
- Known as **Narayani** (central Nepal) and **Gandaki** (upper reaches).
- Total length **~700 km; 300+ km** in India.
- Creates the **Kali Gandaki Gorge**, among the **deepest gorges** globally.
- Biodiversity-rich basin with protected areas in **Nepal and India**.

Geographical Profile

Origin & Course

- **Source:** Near **Dhaulagiri** (Tibetan Plateau), **~7,620 m**.
- Flows south through **Nepal**, carving the **Kali Gandaki Gorge** between Dhaulagiri and Annapurna ranges.
- Enters India at **Valmikinagar** (West Champaran, Bihar).
- Traverses the **Upper Gangetic Plain** before joining the Ganges.

Tributary System

Major tributaries include:

- Daraudi
- Seti
- Madi
- Marsyandi
- Budhi Gandaki

These contribute to high seasonal discharge and sediment load.

Geomorphology & Hydrology

Kali Gandaki Gorge

- A classic example of **antecedent drainage** and **river incision**.
- Cuts across major Himalayan ranges → exceptional vertical relief.

Sediment Load & Channel Shifting

- Steep gradients + fragile geology → **heavy silt transport**.
- Frequent **course shifts** in Bihar plains.
- Earned the epithet “**Sorrow of Bihar**” due to floods and bank erosion.

Glacial & Cryospheric Inputs

- Upper basin hosts ~**1,710 glaciers** and **300+ high-altitude lakes**.
- Glacial melt sustains lean-season flows but raises **GLOF risks** under warming.

Ecology & Conservation

Biodiversity Significance

- Important habitat for **gharial (fish-eating crocodile)**.
- Supports riparian forests, wetlands, and floodplain ecosystems.



Environment and Ecology

Environmental Protection Fund Rules

Why in News?

The Union government has notified **comprehensive rules for the utilisation of the Environmental (Protection) Fund**, created from **penalties collected under major environmental laws**. The move operationalises a key reform under the **Jan Vishwas Act, 2023**, which **decriminalises minor environmental offences** while retaining **financial deterrence**.

Key Takeaways

- Penalties from environmental violations will be **reinvested in environmental restoration**
- Legal basis: **Jan Vishwas Act, 2023**
- **75% of funds → State governments**
- **25% of funds → National-level environmental projects**
- Strong accountability via **Comptroller and Auditor General of India (CAG)** audits

Background & Rationale

Why an Environmental (Protection) Fund?

- Earlier: penalties merged into general revenues → **weak corrective linkage**
- Now: **"Polluter pays → environment repairs"** logic institutionalised
- Aligns enforcement with **restoration and sustainability outcomes**

Objectives of the Fund

- Pollution prevention and control
- Remediation of contaminated sites
- Promotion of **clean and green technologies**
- Capacity-building of pollution control authorities
- Support for environmental research and innovation

Permitted Areas of Utilisation

The rules specify **11 broad categories**, including:

- Pollution abatement projects
- Restoration of degraded ecosystems
- Waste management and recycling infrastructure
- Clean technology R&D

- Environmental monitoring and compliance systems

Valley of Flowers National Park

Why in News?

The Uttarakhand government sought assistance from the **Indian Air Force (IAF)** to control a **forest fire** in the **Valley of Flowers National Park**, highlighting the ecological sensitivity of this high-altitude ecosystem.

Location & Legal Status

- **Location:** Chamoli district, Uttarakhand (Western Himalayas)
- **Declared National Park:** 1982
- **UNESCO World Heritage Site:** 2005
- Part of the **Nanda Devi Biosphere Reserve**
- River flowing through park: **Pushpawati River**

Discovery & Global Recognition

- Discovered in **1931** by British mountaineer **Frank S. Smythe**
- Popularised globally through his book “Valley of Flowers” (1938)

Ecological Significance

- **Altitude:** ~3,000–5,000 metres
- Represents a **pristine alpine ecosystem**
- Naturally protected by **glacial barriers**
- Lies in a **transition zone** between:
 - Zaskar Range
 - Greater Himalayas

Cultural Significance

- Linked with the **Bhotia tribe**
- Practice **transhumance**:
 - Seasonal migration between:
 - High-altitude **Bugyals** (summer pastures)
 - Lower-altitude winter settlements
- Traditional practices form part of the park’s **cultural landscape**

Environmental Concerns

- Increasing **forest fire incidents**
- Climate change–induced:
 - Drier alpine conditions
 - Higher fire vulnerability
- Difficult terrain limits ground firefighting → need for aerial support

Karuna Abhiyan 2026

Why in News?

The Chief Minister of Gujarat, **Bhupendra Patel**, reviewed rescue and treatment operations at the Wildlife Care Centre, Bodakdev (Ahmedabad), under **Karuna Abhiyan**—a statewide initiative to rescue birds injured by **kite strings (manja)** during the **Uttarayan** festival.

Key Takeaways

- **Karuna Abhiyan:** Launched in **2017**
- **Objective:** Rescue, treat, rehabilitate, and release birds/animals injured during festivals
- **Uniqueness:** India’s **first state-driven** wildlife rescue campaign of this kind
- **Peak relevance:** Uttarayan (kite-flying) season

Institutional Framework

- **Implementing agencies:**
 - Forest Department
 - Animal Husbandry Department
 - Urban Local Bodies
 - Voluntary organisations & NGOs

Special Features (Operational Strengths)

- **Dedicated Water Birds Unit** (specialised avian care)
- **24×7 WhatsApp helpline:** Send “Hi” to **8320002000** (district-wise treatment centres)
- **Emergency helpline: 1926**
- **Animal Husbandry helpline: 1962**

Environmental Significance

- Addresses **festival-linked wildlife injuries** (manja cuts)
- Promotes **compassionate conservation**
- Strengthens **state-citizen-NGO** coordination
- Builds awareness on **eco-friendly practices** (safe kite strings)

Galaxy Frogs

Why in News?

A recent study reports that **seven rare Galaxy Frogs** are missing and presumed dead due to **unethical wildlife photography** and rising **photo-tourism** pressures in the **Western Ghats**.

Species Profile

- **Scientific name:** Melanobatrachus indicus
- **Common name:** Galaxy Frog
- **Endemism:** Southern **Western Ghats** (Kerala & Tamil Nadu)
- **Flagship species:** Mathikettan Shola National Park, Idukki (Kerala)

Distinctive Features

- Shiny **black skin** with **blue speckles** and **orange markings**
- Size: **2–3.5 cm**
- **Non-vocal**, cold-blooded
- Partial **cutaneous respiration** → highly sensitive to heat/drying

Habitat & Ecology

- Lives **under decaying logs**
- Requires **cool, moist evergreen forests**
- Extremely **habitat-specific** → low population density

Conservation Status & Threats

- **IUCN status:** **Vulnerable**
- Key threats:
 - Habitat disturbance
 - Flash photography & handling
 - Photo-tourism pressure
- High sensitivity due to skin-based respiration

Miyawaki Method

Why in News?

Rapid urbanisation has intensified **heat islands, flooding, and drought risks**, renewing interest in the **Miyawaki method** for **urban afforestation and ecological restoration**.

What is the Miyawaki Method?

- Developed by **Akira Miyawaki** (1970s)
- Creates **dense, native forests** in small urban spaces
- Often called “**pot plantation**” due to close spacing

Core Principles

- **Native species only**
- **High-density planting**
- **Soil enrichment** before planting
- Short initial care (2–3 years), then **self-sustaining**

Ecological Mechanics

- Competition for sunlight → **vertical growth**
- Rapid canopy formation
- Mimics **primordial forests**
- Improves:
 - Soil structure
 - Micro-climate
 - Urban biodiversity

Benefits

- Faster green cover (10–30 years’ growth in ~3 years)
- Reduces:
 - Urban heat
 - Air & noise pollution
- Restores degraded/industrial lands
- Low long-term maintenance

Limitations / Cautions

- Requires careful **species selection**
- High initial planting cost
- Not a substitute for large natural forests

Weeds: The Silent Threat Undermining Mustard Yields

Why in News?

India's mustard crop is increasingly threatened by **Orobanche aegyptiaca**, a parasitic weed causing yield collapse and pushing farmers away from mustard cultivation.

Importance of Mustard in India

- Largest **indigenous edible oil source**
- Area: ~9 million hectares
- Annual contribution: **>4 million tonnes**
- Strategic crop for **reducing edible oil imports**

Orobanche aegyptiaca: The Weed Problem

Biological Characteristics

- Root-parasitic weed (no chlorophyll)
- Attaches to mustard roots → siphons water & nutrients
- Produces **thousands of seeds**
- Seed viability: **up to 20 years**

Field-Level Impact

- Yield decline:
 - From **9–12 quintals/acre** → **~6 quintals/acre** (Haryana example)
- Symptoms: wilting, yellowing, stunted growth
- Appearing **earlier in crop cycle** and in fertile soils

Why Control is Difficult

- Conventional herbicides largely ineffective
- Underground parasitism → late detection
- Long seed dormancy creates legacy infestation

Economic & Policy Implications

- Farmers abandoning mustard → crop diversification under distress
- Rising edible oil imports:
 - ~\$15.9 billion (2023–24)
 - ~\$18.3 billion (2024–25)
- Threatens **Atmanirbhar edible oil strategy**

Emerging Solutions

- **Herbicide-tolerant mustard hybrids** (e.g., imazapyr-tolerant)

- Research on **GM mustard resistant to glyphosate**
- Integrated weed management:
 - Crop rotation
 - Trap crops
 - Resistant varieties

Policy Dilemma

- Scientific vs ideological debate on GM crops
- Trade-off between:
 - Farmer income
 - Import dependence
 - Biosafety concerns

Supreme Court’s ‘Green Governance’: Protection vs Uncertainty

Why in News?

The Supreme Court’s expanding role in environmental governance has raised concerns about **regulatory uncertainty**, despite strong environmental intent.

Evolution of Judicial Role

- Shift from **judicial review** → **managerial governance**
- Court increasingly issues:
 - Policy-like directions
 - Uniform standards
 - Time-bound administrative mandates

Key Issues Identified

1. Judicial Overreach

- Blanket directives (e.g., uniform ESZs, vehicle bans)
- Frequent modifications → policy instability

2. Expertise Dilemma

- Inconsistent reliance on expert committees
- Rapid reversals reduce credibility of evidence-based policy

3. Chilling Effect

- Early judicial intervention discourages:
 - Public participation
 - Administrative experimentation

4. Rule of Law Concerns

- Lack of predictability weakens:
 - Investor confidence
 - Regulatory accountability
 - Federal balance

Thanthai Periyar Wildlife Sanctuary

Why in News?

The initial phase of the **All-India Tiger Estimation-2026 (AITE-26)** has commenced in the **Thanthai Periyar Wildlife Sanctuary**, located in the **Erode Forest Division of Tamil Nadu**.

About Thanthai Periyar Wildlife Sanctuary

Aspect	Details
Location	Bargur Hills, Erode district, Tamil Nadu
Physiographic significance	Convergence zone of Eastern & Western Ghats
Status	Declared Tamil Nadu’s 18th Wildlife Sanctuary (30 Jan 2024)
Area	~ 80,114.80 hectares (~801 sq km)
River system	Catchment of Palar River
Landscape	Hills, valleys, forests, grasslands

Ecological & Conservation Significance

1. Tiger Corridor Importance

- Acts as a **critical tiger corridor** connecting:
 - **Sathyamangalam Tiger Reserve (Tamil Nadu)**
 - **Male Mahadeshwara Hills Tiger Reserve (Karnataka)**
- Ensures **genetic flow and dispersal** of large carnivores

2. Elephant Landscape

- Forms part of the **Nilgiris Elephant Reserve**
- Supports seasonal movement of elephants and large herbivores

3. Biodiversity

- Key species:
 - Tiger
 - Leopard
 - Sloth bear
 - Large herbivores
 - Rich avifaunal diversity
- Mosaic habitats enhance ecological resilience

The Gadgil Report and the Western Ghats Backlash

Why in News?

The passing of **Prof. Madhav Gadgil**, former Chairperson of the **Western Ghats Ecology Expert Panel (WGEEP)**, has revived debate on ecological governance of the Western Ghats amid recurring landslides, floods, and habitat degradation.

Western Ghats: Why They Matter

- One of the **world's 8 "hottest" biodiversity hotspots**
- Source of major peninsular rivers
- Regulates:
 - Monsoon patterns
 - Groundwater recharge
 - Climate stability
- Supports livelihoods of millions

Backlash & Rejection

State Opposition

- **Kerala, Maharashtra, Karnataka** raised concerns over:
 - Livelihood loss
 - Impact on agriculture & plantations
 - Federal overreach

Political Economy Issues

- Perceived as:
 - Anti-development
 - Insensitive to local socio-economic realities

Kasturirangan Committee (2013) – Diluted Approach

Aspect	Gadgil	Kasturirangan
ESA Coverage	1.29 lakh sq km	56,825 sq km
Approach	Bottom-up, people-centric	Top-down, satellite-based
Focus	Ecological primacy	Development-environment balance

- Repeated **landslides & floods** validate ecological fragility
- Fragmented implementation has worsened disasters
- Climate change amplifies risks Gadgil warned against
- Highlights failure of **preventive environmental governance**

Why Gadgil Report Remains Relevant Today

Olive Ridley Sea Turtles

Why in News?

Ahead of the **sea turtle nesting season**, the **Forest Department** has intensified conservation efforts along the **Mangaluru coastline**, including the establishment of **hatcheries** to protect Olive Ridley turtle eggs.

About Olive Ridley Sea Turtles

- **Scientific name:** *Lepidochelys olivacea*
- **Distinctive feature:** Olive-green coloured carapace (shell)
- **Size:** Smallest among all sea turtle species
- **Behavioural hallmark:** **Arribada** – mass nesting phenomenon

Distribution

Global

- **Warm waters of:**
 - Indian Ocean
 - Pacific Ocean
 - Atlantic Ocean

India

- **Major mass nesting sites (Odisha coast):**
 - Gahirmatha
 - Rushikulya
 - Devi River mouth
- **Solitary nesting sites:**
 - Tamil Nadu
 - Andhra Pradesh
 - Andaman & Nicobar Islands
 - Karnataka coast (including Mangaluru)

Ecological & Biological Features

- **Habitat:** Open oceans; migrate thousands of kilometres between feeding and nesting grounds
- **Diet:** Omnivorous (crabs, jellyfish, algae, shrimp)
- **Rookery:**
 - **Gahirmatha Marine Sanctuary** – world's largest sea turtle rookery

Conservation Status

Framework	Status
IUCN Red List	Vulnerable

Wildlife Protection Act, 1972	Schedule I
CITES	Appendix I

Threats

- Egg predation and habitat disturbance
- Coastal development and artificial lighting
- Fishing nets (bycatch)
- Climate change affecting sand temperature (sex ratio imbalance)

India's Progress on Climate Targets: Achievements and Structural Gaps

Why in News?

Recent assessments have highlighted a **disconnect between India's declining emissions intensity and its rising absolute emissions**, raising concerns over the effectiveness of current climate strategies.

India's Climate Commitments (Paris Agreement)

- Reduce **emissions intensity of GDP** by **33–35%** from 2005 levels by 2030
- Achieve **40% non-fossil fuel power capacity by 2030** (enhanced to **50%**)
- Install **175 GW renewable energy** capacity
- Create **2.5–3 billion tonnes CO₂-equivalent forest carbon sink**

Key Achievements

1. Emissions Intensity Reduction

- Reduced by **~36% by 2020** (from 2005 levels)
- Driven by:
 - Renewable energy expansion
 - Shift towards services sector
 - Energy efficiency programmes (PAT, UJALA LEDs)

2. Renewable Capacity Expansion

- Rapid growth in:
 - Solar
 - Wind
 - Hydro
 - Nuclear
- Non-fossil capacity nearing national targets

CAQM Report on Delhi Winter Air Pollution

Why in News

A recent synthesis report by the **Commission for Air Quality Management** has identified **secondary particulate matter** as the largest contributor to **Delhi's winter air pollution**.

Key Findings

Source	Contribution
Secondary particulate matter	27%
Transport emissions	23%
Biomass burning (crop + waste)	20%
Road & construction dust	15%
Industrial emissions	9%

Understanding the Core Issue Why Winter Pollution is Severe

- Low wind speeds
- Temperature inversion
- Shallow mixing layer
 - ➔ Pollutants get trapped near the surface, causing persistent smog.

Secondary Particulate Matter (PM_{2.5})

- **Not directly emitted**
- Formed through chemical reactions involving:
 - Sulphur Dioxide (SO₂)
 - Nitrogen Oxides (NO_x)
 - Ammonia (NH₃)
- Contributes **25–60% of PM_{2.5}** during winter.
- **High health risk** due to deep lung penetration.

Role of Ammonia

- Major source: **Agricultural activities**
- Reacts with acids formed from SO₂ and NO_x
- Produces ammonium salts → increases PM_{2.5}
- Highlights **rural–urban pollution linkage**

Bhitarkanika National Park

Why in News

The latest forest department census reports a **rise in migratory bird numbers** in **Bhitarkanika National Park**.

Key Facts

- **Location:** Kendrapara district, Odisha
- **Area:** ~672 sq. km
- **Ecosystem:** Mangrove swamps
- **Wildlife Sanctuary:** 1975
- **Ramsar Site:** August 2002
- **Mangrove Rank:** 2nd largest in India (after Sundarbans)

Why Bhitarkanika is Important

- Acts as a **coastal bio-shield**
- High carbon sequestration
- Supports marine and avian biodiversity
- Ramsar status highlights **wetland conservation priority**

Himalayan Development at the Cost of Ecological Collapse

Why in News

In 2025, India recorded **over 4,000 climate-related deaths**, with **Himachal Pradesh and Uttarakhand** facing severe disasters such as cloudbursts, landslides, avalanches, and flash floods. Despite this, large infrastructure projects like the **Char Dham Road Project** continue in high-risk Himalayan zones.

Key Observations

- Himalayas warming **~50% faster** than global average
- Climate change acts as a **risk multiplier**
- Development activities:
 - Deforestation
 - Hill slope cutting
 - Road widening
 ➔ Increase disaster vulnerability

Ecological Role of Devdar (Deodar) Forests

- Stabilize slopes
- Reduce landslides & avalanches
- Regulate water flow in **Ganga headwaters**
- Maintain microclimate
- Possess antimicrobial properties supporting soil ecology

Pygmy Hog

Why in News

India's **Pygmy hog** is facing a **rapid population decline** due to the degradation and loss of **tall grassland ecosystems**, highlighting concerns over grassland conservation.

Key Facts

- **Smallest and rarest wild pig species** in the world
- **Endemic to India**
- Only mammal known to **build a roofed nest**
- Acts as an **indicator species** for grassland ecosystem health

Habitat & Distribution

- Prefers:
 - Undisturbed **tall grasslands**
 - Early-succession riverine vegetation
- Vegetation structure:
 - Dense tall grasses
 - Herbs, shrubs, young trees
- **Current distribution (restricted):**
 - Manas National Park
 - Orang National Park
- Largely confined to **Assam**

Ecological Role

- Foraging by digging soil using snout
- Diet includes:
 - Roots, tubers, fruits
 - Termites, earthworms, eggs
- Ecological benefits:
 - Improves **soil aeration**
 - Enhances **soil fertility**
 - Aids **seed dispersal**
 - Supports **grassland regeneration**

Conservation Status

- **IUCN Red List:** Critically Endangered
- **Wildlife Protection Act, 1972:** Schedule I
- Wild population: **Extremely small and fragmented**

Achanakmar Tiger Reserve

Why in News

A young male tiger was recently found dead in **Achanakmar Tiger Reserve**, reportedly due to **territorial conflict**, drawing attention to tiger population dynamics.

Key Facts

- Located in **Chhattisgarh**
- One of the **three tiger reserves** in the state
- Part of the **Achanakmar–Amarkantak Biosphere Reserve**
- Critical **tiger corridor** between:
 - Kanha Tiger Reserve
 - Bandhavgarh Tiger Reserve

Physical & Ecological Features

River

- **Maniyari River** flows through the reserve
- Acts as ecological lifeline

Vegetation

- Tropical moist deciduous forest
- Major species:
 - Sal, Teak, Haldu
 - Bamboo
 - Bija, Saja, Tinsa
- Over **600 medicinal plant species**

Human Dimension

- Tribal communities:
 - **Baiga** (Particularly Vulnerable Tribal Group)
 - Gond
 - Yadav

Why Article 6 is a Powerful Tool for India

Why in News

The operationalisation of **Article 6 of the Paris Agreement**—especially after progress at **COP29**—has opened pathways for **market-based international climate cooperation**, offering strategic advantages to India.

What is Article 6? (Conceptual Clarity)

Article 6 provides **voluntary cooperation mechanisms** allowing countries to meet their climate targets (NDCs) more efficiently.

Key Provisions of Article 6

Article 6.2 – ITMOs

- Allows trading of **Internationally Transferred Mitigation Outcomes (ITMOs)**
- Enables **bilateral / plurilateral carbon trading**
- Countries retain sovereignty over projects

Article 6.4 – Paris Agreement Crediting Mechanism

- Successor to the **Clean Development Mechanism (CDM)**
- Centralised UN-supervised mechanism
- Focus on:
 - Environmental integrity
 - Transparency
 - Avoidance of double counting

Why Article 6 Matters for India

- India entered Article 6 via **Joint Crediting Mechanism with Japan**
- Aligns climate action with:
 - Industrial modernisation
 - Technology transfer
 - Climate finance inflows
- Supports **development without emission penalties**

India's Preparedness

- Identified **13 eligible technologies**, including:
 - Renewable energy
 - Green hydrogen & sustainable fuels
 - Industrial efficiency technologies
- Enhances **industrial competitiveness** under global decarbonisation

Carbon Credits: A New Income Stream for Rice Farmers

Why in News

With over **86% of Indian farmers being small or marginal**, climate-friendly practices such as **Alternate Wetting and Drying (AWD)** in rice cultivation are being promoted, with **carbon credits** emerging as a new income opportunity.

Background: Rice Cultivation & Emissions

- Traditional flooded paddy creates **anaerobic conditions**
- Leads to high **methane (CH₄) emissions**
- Methane has **28× global warming potential** of CO₂ (100-year scale)

Alternate Wetting and Drying (AWD)

What is AWD?

- Periodic drying and reflooding of rice fields
- Breaks anaerobic conditions
- Reduces methane-producing microbes

AWD Schedule

- First 20 days: Flooded
- Then: Two drying cycles (~6 days each)
- Reflooding after drainage

Carbon Credit Potential

- Value: **\$15–25 per tonne CO₂e**
- Income:
 - ~\$37.5 per hectare
 - ~₹3,367 per hectare per crop
- Scalable due to India being:
 - Largest rice producer
 - Major rice exporter

Transforming a Waste-Ridden Urban India

Why in News

At **COP30** in Belém (Brazil), waste management and circular economy were highlighted as **key climate mitigation tools**, with direct relevance for India’s rapidly urbanising cities.

Urban Waste Crisis in India

- Urbanisation inevitable, but **quality matters**
- Projected waste generation:
 - **165 million tonnes by 2030**
 - **436 million tonnes by 2050**
- Public health + climate risks rising

Circular Economy: The Way Forward

Core Idea

- Shift from:
 - “Collect–Dump–Burn”
 - “Reduce–Reuse–Recycle–Recover”

Relevance to India

- Aligns with **Mission LiFE**
- Turns waste into:
 - Resources
 - Energy
 - Jobs

Waste Composition & Solutions

- **>50% organic waste**
 - Composting
 - Bio-methanation
- Plastic waste:
 - Needs source segregation
 - Recycling market development

Systemic Barriers

- Poor segregation at source
- Inefficient collection logistics
- Weak demand for recycled products

Role of Citizens

- Behaviour change is critical
- Initiatives like **Cities Coalition for Circularity**
- Citizen participation = success multiplier

Bannerghatta National Park

Why in News

The **Central Empowered Committee** has recommended restoring the **Ecologically Sensitive Zone (ESZ)** around **Bannerghatta National Park** to its **2016 notified extent**, citing concerns over biodiversity loss and ecological imbalance.

Key Facts

- **Location:** Anekal Range, near Bengaluru, Karnataka
- **Year of Declaration:** 1974
- **Area:** ~260.51 sq. km
- **Special Feature:** India’s **first butterfly enclosure** (2006)
- **River/Stream:** Suvarnamukhi stream flows through the park

Ecological Significance

Connectivity Role

- Serves as a **critical elephant corridor**
- Links:
 - Biligirirangana Hills
 - Sathyamangalam forests
 Ensures genetic exchange and wildlife movement

Vegetation Types

- Dry deciduous scrub forests
- Southern tropical dry deciduous forests
- Southern tropical moist mixed forests

Guidelines on Religious Structures in Wildlife Sanctuaries

Why in News

The **Standing Committee of the National Board for Wildlife** has drafted guidelines to regulate **diversion of forest land within wildlife sanctuaries** for construction or expansion of religious structures.

Background

- Triggered by a controversial proposal in **Balaram Ambaji Wildlife Sanctuary (Gujarat)**
- Raised concerns regarding:
 - Legal precedents
 - Encroachments
 - Ecological degradation

Legal Framework

- Governed by:
 - **Wildlife Protection Act, 1972**
- Sanctuaries and national parks are meant for **habitat protection**, not permanent construction

Key Provisions of the Guidelines

- **Post-1980 constructions** in forest areas generally treated as **encroachments**
- **Expansion of religious structures prohibited**
- Exceptions allowed only for:
 - Ecological management
 - Essential services
- Mandatory **ecological assessment** before approval
- SCNWL to scrutinize all such proposals

Rationale Behind the Guidelines

- Prevent fragmentation of habitats
- Avoid legitimisation of illegal constructions
- Maintain sanctity of protected areas
- Balance:
 - Cultural/religious practices
 - Conservation imperatives

India's Biggest Climate Gap Could Be Language

Why in News

Experts have highlighted that **ineffective climate communication**, especially due to **language and jargon**, is emerging as a major barrier in climate governance and public preparedness.

Core Argument

- Scientific knowledge loses impact when:
 - It remains jargon-heavy
 - It fails to connect with lived experiences
- Communication is as crucial as:
 - Technology
 - Policy
 - Finance

Key Concepts Explained

Loss and Damage

- Refers to climate impacts **beyond adaptation limits**
- Includes:
 - Loss of lives & livelihoods
 - Cultural identity
 - Biodiversity
- Often reduced locally to **only quantifiable damage**, ignoring ethical dimensions

Why Communication Failure Matters

- Complex climate reports ≠ effective decision-making
- Poor translation of science → weak policy response
- Delays transformative action

What Effective Climate Communication Requires

- Localization of scientific concepts
- Use of local languages & contexts
- Co-creation with communities
- Integration into governance and planning

Economic Development

EU's Carbon Border Adjustment Mechanism (CBAM)

Implications for India's Steel and Aluminium Exports

Why in News?

From **1 January 2026**, the **European Union (EU)** will operationalise the **Carbon Border Adjustment Mechanism (CBAM)** for carbon-intensive imports such as **steel and aluminium**.

Although the purchase of CBAM certificates will begin in **2027**, the **price and competitiveness impact will be felt from 2026**, posing immediate challenges for Indian exporters.

Key Facts / Core Content

What is CBAM?

- CBAM is the EU's policy tool to **extend its domestic carbon pricing regime to imports**.
- Objective: **Prevent carbon leakage**, i.e., relocation of production to countries with lax climate regulations.
- Covered sectors (Phase-I):
 - Steel
 - Aluminium
 - Cement
 - Fertilisers
 - Electricity
 - Hydrogen

How CBAM Works

- Import taxation is linked to **plant-level carbon emissions**.
- Based on the **EU Emissions Trading System (EU-ETS)** carbon price
→ **~€80 per tonne of CO₂**
- Emission coverage:
 - **Scope 1**: Direct emissions
 - **Scope 2**: Indirect emissions from electricity
 - Excludes mining and transportation emissions

Who Bears the Cost?

- **EU importers** must buy CBAM certificates.

- However, costs are **passed on to exporters** via:

- Lower negotiated prices
- Reduced margins

Impact on Indian Steel & Aluminium Exports

- Expected **16–22% fall in realised prices** for Indian exports.
- Example:
 - **BF–BOF steel production** emits **~2.4 tonnes CO₂ per tonne**
 - CBAM cost **≈ €192 per tonne**
- Consequences:
 - Reduced export competitiveness
 - Higher compliance and verification costs
 - Pressure on MSME exporters lacking emission-tracking systems

India's Minerals Diplomacy and the Energy Transition

Why in News?

India's clean energy transition—covering **renewables, electric mobility, battery storage, and green hydrogen**—is critically dependent on **imported minerals and rare earth elements**.

With **China tightening export controls** and rising geopolitical risks, **minerals diplomacy** has emerged as a strategic priority for India's **energy and economic security**.

Key Concepts

What is Minerals Diplomacy?

- Strategic effort to **secure reliable access to critical minerals** through:
 - Bilateral partnerships
 - Multilateral frameworks
 - Overseas investments
- Comparable to **oil diplomacy of the 20th century**

India's Two-Pronged Strategy

1. External Dimension

- Diversifying mineral supply sources
- Partnerships with:
 - Australia
 - Canada
 - Namibia
 - Zambia
 - Latin American countries

2. Internal Dimension

- Strengthening domestic:
 - Mining
 - Processing
 - Refining
 - Recycling capabilities

Importance of Critical Minerals

- Essential for:
 - Solar panels
 - Wind turbines
 - EV batteries
 - Grid storage
 - Green hydrogen
- Critical minerals today = **Strategic oil of the energy transition era**

Key Challenges

- **Overdependence on China**
 - Dominates rare-earth processing and refining
- **Resource-only partnerships**
 - Limited focus on value addition and technology transfer
- **Weak institutional mechanisms**
 - Poor implementation of MoUs
- **Geopolitical uncertainty**
 - Sanctions on Russia, volatile US trade policies
- **Weak midstream capacity**
 - Lack of refining, separation, and recycling infrastructure

Household Finances in India – The Hidden Fault Line (Ahead of Union Budget 2026)

Why in News?

Ahead of the **Union Budget 2026**, headline macroeconomic indicators suggest stability and resilience. However, analysis of data from the **Reserve Bank of India**—notably the Financial Stability Report and Annual Report 2024–25—reveals a structural shift: **Indian households are saving less and borrowing more**, absorbing economic risks earlier borne by the State.

Key Facts / Core Content

- **Household debt: 41.3% of GDP (March 2025)**
→ Lower than China or Malaysia, but on a **rising trajectory**
- **Private consumption: ~60% of GDP**
- **Consumption stability** despite uneven income growth → indicates **credit-led smoothing**
- **Financial liabilities rising**, while **net financial savings show volatility**

Analytical Insights

1. Aggregates Mask Underlying Stress

- Household debt rose from **~36% (2021)** to **41.3% (2025)**
- No immediate debt crisis, but:
 - Aggregate ratios **do not reveal repayment capacity**
 - Composition and purpose of borrowing matter

2. Uneven Incomes, Stable Consumption

- RBI Annual Report (2024–25):
 - Real income growth uneven, especially outside formal employment
- Borrowing increasingly used to **maintain consumption**, not to invest

3. Credit as Cushion, Not Capital

- Shift from **asset-creating loans** to **consumption smoothing**
- Raises vulnerability of households to:
 - Income shocks
 - Interest rate tightening

4. Stock vs Flow Problem

- **Gross household financial assets: 106.6% of GDP**
- **Financial liabilities: 41.3% of GDP**

- Households remain **net financial wealth holders**
- But **net financial savings (flow)** are volatile → weakening shock absorber

5. Macro Risk in Plain Sight

- Debt-financed consumption is fragile
- Any shock (income slowdown, tighter credit):
 - Could trigger **sharp consumption contraction**
 - Affect overall GDP growth

Challenges Before Budget 2026–27

- Rising leverage among **lower-income and informal households**
- Reduced **fiscal cushioning** at Union and State levels
- Dependence on consumption-led growth without income support

India's FTAs – Rising Trade Deficit Amid Structural Shift Towards Sunrise Exports

Why in News?

India is accelerating **Free Trade Agreement (FTA)** negotiations to diversify exports and hedge against potential US tariffs. However, a recent **NITI Aayog** report (Trade Watch Quarterly) highlights a paradox: **trade deficits with FTA partners are widening**, even as **sunrise sectors like electronics expand rapidly**.

Key Facts / Core Content

- **FTA trade deficit** rose by **59.2% (April–June YoY)**
- Deficit with FTA partners: **\$26.6 billion**
- Imports: **+10%**
- Exports: **–9%**
- Electronics exports: **+47% YoY**
- Exports to **ASEAN**: **–16.9%**
- **Top 7 import sources = 43% of total imports**

Analytical Insights

1. Rising Trade Deficit with FTA Partners

- Despite preferential access, imports have surged faster than exports
- Indicates **asymmetric utilisation of FTAs**

2. Structural Shift in Export Basket

- Decline in traditional exports:
 - Petroleum
 - Low-value manufacturing
- Surge in electronics exports:
 - Deeper integration into **global value chains**
 - Positive long-term signal

3. ASEAN Challenge

- Sharp fall in exports to ASEAN:
 - Reflects competitiveness issues
 - Rules-of-origin and non-tariff barriers persist

Rethinking India's Skilling Outcomes

Why in News?

Over the last decade, India has built a large skilling ecosystem led by **Pradhan Mantri Kaushal Vikas Yojana (PMKVY)**, training nearly **1.40 crore candidates (2015–2025)**.

However, evidence from the **Periodic Labour Force Survey (PLFS)** shows **limited and inconsistent wage gains**, especially in the **informal sector**, raising concerns about the **economic value and aspirational appeal** of skilling.

Key Facts / Core Content

- Only **4.1% of India's workforce** has formal vocational training (up from ~2% a decade ago)
- India's **Gross Enrolment Ratio (GER): 28%**
 - Target: **50% by 2035 (NEP 2020)**
- Skilling has not emerged as a **preferred career pathway**
- Employers show **limited trust in public skilling certifications**

Analytical Insights

1. Weak Integration with Education Pathways

- Skilling largely exists as a **parallel track**, not embedded in higher education
- NEP 2020 vision requires:
 - Integration of skilling into **degree programmes**
 - Credit-based mobility between academic and vocational streams

2. Global Comparison Gap

- OECD countries:
 - ~**44%** of upper-secondary students choose vocational education
 - Up to **70%** in some European nations
- In India, vocational education remains **second-choice**, not mainstream

3. Poor Labour Market Outcomes

- PLFS data:
 - Minimal wage premium from vocational training
- Borrowing relevance from industry:
 - Skills used mainly for **entry-level roles**
 - Limited upward mobility

RBI's 'State of the Economy'

Growth Resilience and Emerging Global Risks

Why in News?

The **Reserve Bank of India (RBI)** published its State of the Economy article (December 2025), assessing India's macroeconomic conditions using high-frequency indicators.

The article highlights **growth resilience and strong domestic demand**, while cautioning against **elevated global geopolitical and geo-economic risks**.

(Note: The views expressed are those of the authors, not official RBI policy.)

Key Facts / Core Content

- **GDP Growth (2025–26): 7.4%** (NSO First Advance Estimates)
- **Domestic demand** remains the key growth driver
- **Private consumption** and retail activity show strong momentum
- **Rural consumption** improving

Analytical Insights

1. Robust Demand Conditions

- High-frequency indicators show:
 - Strong retail sales
 - Sustained commercial activity
- Indicates **broad-based recovery**, not limited to urban centres

2. Inflation Dynamics

- **CPI inflation** rose to **1.3% (December)**
- Reasons:
 - Easing of food deflation
 - Mild uptick in core inflation
- Suggests inflation remains **benign but watchful**

3. Global Geopolitical Risks

- Major risk factors:
 - US intervention in Venezuela
 - Middle East conflicts
 - Uncertainty over Russia–Ukraine peace
- Implications:
 - Trade disruptions
 - Commodity price volatility
 - Policy uncertainty

Startup India @10

From Policy Initiative to a National Innovation Revolution

Why in News?

On **16 January 2025 (National Startup Day)**, the **Prime Minister of India** addressed the startup ecosystem to mark **10 years of the Startup India initiative**, launched on **16 January 2016**. The address highlighted India's rapid startup growth, changing risk appetite, and ambitions in **deep tech and indigenous AI**.

Key Facts / Core Content

- India is the **3rd largest startup ecosystem globally**
- **~44,000 startups** registered in 2025, compared to **<500 in 2014**
- Startup India aims to:
 - Promote innovation
 - Encourage job creators over job seekers
 - Build a robust startup ecosystem

Startup India Scheme – Core Pillars

- **Simplification & Handholding**
 - Single-window clearance
 - Ease of compliance
- **Funding Support**
 - Fund of Funds for Startups (FFS)
- **Incubation & Industry–Academia Partnerships**
 - Innovation hubs
 - Research commercialization

Budget 2026–27 and the Imperative of Sustaining India's Growth Momentum

Why in News?

Budget 2026–27 assumes critical importance as India navigates **global trade fragmentation, protectionism, and geopolitical uncertainty**. Despite global headwinds in 2025, India has shown resilience driven by **domestic demand and structural reforms**. The challenge now is to convert this resilience into **sustained, high-quality growth** while maintaining fiscal discipline.

Key Priorities Highlighted

- Sustain growth momentum amid global uncertainty
- Balance **fiscal prudence** with **growth imperatives**
- Stimulate **private investment**
- Enhance **export competitiveness**

Analytical Insights

1. Global Trade Uncertainty

- Rising tariffs and protectionist measures
- Slowing global demand
- Necessitates calibrated export support and diversification

2. Investment and Credit Constraints

- Overdependence on **bank credit**
- Underdeveloped **corporate bond market**
- Limits long-term infrastructure and industrial financing

3. Strategic Vulnerabilities

- **Dependence on imported:**
 - Critical minerals
 - Advanced technologies
- Impacts strategic autonomy and supply-chain resilience

Policy Imperatives for Budget 2026–27

- **Prioritise productive capital expenditure**
 - Infrastructure
 - Manufacturing
- **Enhance export competitiveness**
 - Trade facilitation
 - Market diversification
- **Unlock private investment**
 - Policy certainty

- Ease of doing business
- **Maintain fiscal discipline**
 - Debt sustainability
 - Efficient public spending

India's Demand Puzzle: Consumption Without Wage Growth

Why in News?

With **Union Budget 2026–27** approaching, the policy focus is shifting away from further consumer-centric tax relief towards **investment and supply-side growth drivers**. This makes it essential to assess whether recent **income tax and GST support** has produced **durable consumption growth**, especially in the absence of strong wage expansion.

Key Facts / Core Content

- Multiple **tax and GST revisions (2025–26)** aimed at boosting household spending
- Headline **retail inflation fell to a record low (~0.25% in October)**
- Sharp rise in **consumer durable demand**, especially vehicles
- Household balance sheets under stress:
 - Rising debt
 - Declining net financial assets

Core Economic Concern

- **Inflation-led consumption ≠ income-led consumption**
- Rising debt raises risks of:
 - Abrupt demand slowdown
 - Financial instability
- Limited fiscal space restricts scope for:
 - Further tax cuts
 - Large consumption subsidies

Economic Survey 2025–26 (Preface) Towards an Entrepreneurial State in an Uncertain World

Why in News?

The **Economic Survey 2025–26**, presented in Parliament by the **Union Minister for Finance and Corporate Affairs**, marks a conceptual shift in India's economic thinking. The **Preface** argues for transforming India into an **“entrepreneurial state”**—one that actively manages risk and uncertainty—amid global instability and post-pandemic realignments.

Key Facts / Core Content

- Survey expanded to **17 chapters**
- Chapters reorganised by **national priorities**, not traditional macro structure
- India's real GDP growth (2025–26): **>7%**
- Introduces the idea of the **“Paradox of 2025”**:
 - Strong domestic growth
 - Weak and unstable global economy

Analytical Insights

1. Reimagining the Economic Survey

- Inclusion of thematic essays on:
 - Artificial Intelligence evolution
 - Quality of life in Indian cities
 - State capacity and governance
- Reflects:
 - Multi-dimensional view of development

2. Entrepreneurial State – Core Idea

- Shift from:
 - Risk-averse, rule-bound governance
- To:
 - Risk-structuring, adaptive policymaking
- Emphasises:
 - Learning by experimentation
 - Avoiding policy paralysis

3. Managing Global Uncertainty

- Global headwinds:
 - Geopolitical tensions
 - Economic nationalism
 - Fragmented trade
- Survey argues:

- Alignment between state, private sector, and citizens can convert risks into opportunities

Strategic Significance

- Encourages:
 - Policy innovation
 - State capacity building
- Recognises uncertainty as:
 - A permanent feature, not a temporary shock
- Calls for:
 - Patience
 - Institutional learning
 - Strategic governance

Green Steel Can Shape India's Climate Goals Trajectory

Why in News?

India faces the dual challenge of **scaling economic growth** while **meeting climate commitments**. Pressure to strengthen its **Nationally Determined Contribution (NDC)** under the Paris framework makes **deep decarbonisation of the steel sector** unavoidable, given steel's centrality to infrastructure and its large emissions footprint.

Key Facts / Core Content

- India's steel production:
 - Current: **~125 million tonnes**
 - Required by mid-century: **>400 million tonnes**
- Steel sector emissions:
 - **~12% of national CO₂ emissions**
- Dominant technology:
 - Coal-based **BF-BOF** route
- Global trend:
 - Tightening emissions norms
 - Carbon-linked trade measures (e.g., EU border charges)

Analytical Insights

1. Steel as an Engine of Growth

- Backbone for:
 - Infrastructure
 - Urbanisation
 - Manufacturing
- Steel decarbonisation is **systemically linked** to India's development path.

2. Climate Lock-in Risk

- Continued reliance on coal-based plants risks:
 - Locking emissions for decades
 - Undermining future NDC ambitions
- Delayed action raises **transition costs** later.

3. Global Competitive Pressures

- EU and China advancing:
 - Emissions caps
 - Green standards
- Carbon-intensive steel risks:
 - Border taxes
 - Loss of export competitiveness

India's Manufacturing Revival in a Reconfigured Global Economy

Why in News?

Amid **geopolitical uncertainty** and **global supply-chain reconfiguration**, India's manufacturing sector is witnessing renewed momentum. This revival is crucial as India seeks to build a **resilient industrial base** aligned with shifting global production networks.

Key Facts / Core Content

- Policy focus:
 - Lowering entry barriers
 - Infrastructure-led competitiveness
- Manufacturing strategy:
 - Shift from **capacity creation** to **capability building**
- MSMEs:
 - Central to employment and output
 - Constrained by credit and scale

Analytical Insights

1. From Capacity to Capability

- Sustainable manufacturing growth requires:
 - Strong ecosystems
 - Skilled labour
 - Technology adoption
- Enhances investor confidence and resilience.

2. Strategic Industrialisation

- Focus areas:
 - Technology-intensive sectors
 - Scaling traditional manufacturing
- Objective:
 - Improve India's bargaining power in global value chains.

3. Sectoral Success Stories

- **Electronics** and **pharmaceuticals**:
 - Rapid growth
 - Export orientation
 - Demonstrate feasibility of tech-led manufacturing.

Budget 2026–27: Three Big Macro Challenges Ahead

Why in News?

The **Union Budget 2026–27**, to be presented by **Nirmala Sitharaman**, will outline the government's growth assumptions, expenditure priorities, revenue projections, and borrowing needs (fiscal deficit). However, the Budget is **not a clean slate**—it is shaped by **past fiscal realities, committed expenditures, and current-year economic trends**, which sharply constrain policy choices.

Key Facts / Core Content

- Budget decisions depend heavily on:
 - Current-year growth
 - Tax performance
 - Investment trends
- A large portion of expenditure is **pre-committed**
- Macroeconomic signals point to **three structural challenges** for Budget 2026–27

Structural Constraint: Why Budgets Have Limited Flexibility

- **Committed expenditures**:
 - Salaries
 - Pensions
 - Interest payments
 - Subsidies
- **Tax rates**:
 - Cannot be altered frequently without economic disruption
- **Fiscal spillovers**:
 - Shocks in one year carry forward into the next
- Hence, Budget choices are shaped more by **constraints than discretion**

Policy Imperatives for Budget 2026–27

- Focus on **reviving private investment**:
 - Policy certainty
 - Stable regulatory environment
- Prioritise **productive capital expenditure**
- Improve tax administration rather than rate hikes
- Strengthen investor confidence—domestic and foreign

- Balance:
 - Growth support
 - Fiscal discipline
 - Debt sustainability



RAMAN ACADEMY

"inspiring excellence"

Science & Technology

Havana Syndrome (Anomalous Health Incidents – AHIs)

Why in News?

A renewed debate has emerged in the United States after reports (CNN) revealed that the **U.S. Department of Defense** tested a **covertly acquired device capable of emitting pulsed radio-frequency energy**. This has revived global concerns surrounding **Havana Syndrome**, a mysterious health condition affecting diplomats and security personnel.

Key Facts / Core Content

- First reported in **2016** among **U.S. diplomats in Havana, Cuba**
- Officially referred to as **Anomalous Health Incidents (AHIs)**
- Reported symptoms:
 - Severe headaches
 - Dizziness and nausea
 - Cognitive impairment
 - Memory loss
 - Sensation of head trauma
- Cases reported across:
 - Europe
 - Asia
 - Latin America
- Affected groups:
 - Diplomats
 - Intelligence officers
 - Military personnel

Technical Context

- Devices operating in **2.4–2.5 GHz RF band** include:
 - Bluetooth devices
 - Wi-Fi routers
 - Microwave ovens
 - Cordless phones
- Raises concerns about:
 - Electromagnetic exposure
 - Weaponisation of RF technologies

- Potential emergence of **directed-energy weapons**
- Challenges existing arms control frameworks
- Raises diplomatic, ethical, and international law concerns
- Implications for:
 - Diplomatic security
 - Intelligence operations
 - Military health protocols

Strategic and Security Implications

Frontiers of Marine and Space Biotechnology

Why in News?

Rapid advances in **marine and space biotechnology** are enabling exploration of **extreme environments** such as deep oceans and outer space. These frontiers promise breakthroughs in **biological knowledge, materials science, food systems, and advanced manufacturing**, with significant implications for India.

Key Facts / Core Content

Marine Biotechnology

- Uses:
 - Marine microorganisms
 - Algae
 - Seaweed
 - Marine fauna
- Outputs:
 - Bioactive compounds
 - Bioplastics
 - Pharmaceuticals
 - Biofuels

Space Biotechnology

- Studies biological responses to:
 - Microgravity
 - Space radiation
- Applications:
 - Long-duration space missions
 - Human health
 - Space-based food systems

Importance for India

1. Marine Biotechnology Potential

- Coastline: **~11,000 km**
- Exclusive Economic Zone: **>2 million sq km**
- Current marine biomass (seaweed):
 - **~70,000 tonnes annually**
- Heavy dependence on imports for:
 - Agar
 - Carrageenan
- Indicates **large untapped potential**

2. Space Biotechnology Relevance

- Critical for:
 - Human spaceflight missions
 - Life-support systems
 - Bio-regenerative ecosystems

- Research led by **Indian Space Research Organisation**
- Limited private sector participation so far

Institutional and Policy Landscape

- **Blue Economy agenda**
- **Deep Ocean Mission**
- **BioE3 Policy**
- Research institutions:
 - **ICAR–Central Marine Fisheries Research Institute**
- Private sector initiatives:
 - Sea6 Energy
 - ClimateCrew

Key Challenges

- Fragmented research ecosystem
- Low investment in marine biomanufacturing
- Limited scale-up from lab to industry
- Weak coordination between:
 - Academia
 - Industry
 - Government
- Slow private sector entry in space biotechnology

Gujarat's BSL-4 Facility: India's State-Backed Lab for Deadliest Pathogens

Why in News?

The Union Home Minister Amit Shah laid the foundation stone for India's first state-funded Bio-Safety Level-4 (BSL-4) containment facility in Gandhinagar, Gujarat, terming it a national "health shield". The project marks a major leap in health security, biodefence, and advanced biotechnology research.

Key Facts / Core Content

- **Location:** Gandhinagar, Gujarat
- **Nature:** India's first state-funded BSL-4 lab
- **Area:** ~11,000 sq m
- **Cost:** ~₹362 crore
- **Implementing mission:** Gujarat State Biotechnology Mission
- **Operating institution:** Gujarat Biotechnology Research Centre (GBRC)

What is a BSL-4 Facility?

- **Highest level** of biological containment
- Handles **highly infectious and lethal pathogens**
- Typically **no approved vaccines or treatments**
- Requires:
 - Maximum isolation
 - Specialized air filtration (HEPA)
 - Full-body positive-pressure suits
 - Strict access controls

Research & Operational Capabilities

- Research on **deadly human and zoonotic pathogens**
- Development of:
 - **Diagnostics**
 - **Vaccines**
 - **Therapeutics**
- **ABSL-4 (Animal BSL-4) component:**
 - Animal disease research
 - Vaccine testing and production
 - Eliminates need to send samples to distant national labs
- Builds on GBRC's experience in **SARS-CoV-2 genome sequencing** during COVID-19

Molecular Clouds Understanding the Cradles of Star Formation

Why in News?

Astronomers have studied the **L328 molecular cloud**, located about **700 light years from Earth**, to map **magnetic fields** across different scales—critical for understanding **star formation mechanisms**.

Key Concepts & Facts

What is a Molecular Cloud?

- Interstellar cloud of **gas and dust**
- Dominated by **molecular hydrogen (H₂)**
- Primary sites for **star and planetary system formation**

Physical Characteristics

- **Temperature:** < **40 K** (colder than liquid nitrogen)
- **Density:** ~10² to 10⁴ particles/cm³
- **Size:**
 - Few light years to ~**600 light years**
 - Massive ones termed **Giant Molecular Clouds (GMCs)**

Observation & Identification

- Dust blocks visible light → appear as **Dark Nebulae**
- Observed using:
 - **Radio telescopes**
 - **Infrared telescopes**
- Central regions often obscured from direct optical observation

Star Formation Mechanism

- Governed by interaction of:
 - **Gravity**
 - **Magnetic fields**
 - **Turbulence**
- Process:
 - Cloud contraction
 - Fragmentation
 - Protostar formation
- After star birth:
 - Stellar winds disperse remaining gas and dust

Scientific Importance

- Provide **raw material** for stars and planets
- Help explain:
 - Initial mass of stars
 - Star formation rates
 - Structure of galaxies
- Studies like L328 improve understanding of **magneto-hydrodynamics** in space

Antibiotic Pipeline Running Dry Antimicrobial Resistance (AMR) as a Silent Pandemic

Why in News?

India faces a mounting **antimicrobial resistance (AMR)** crisis driven by excessive and inappropriate antibiotic use. In **2021**, **~2.67 lakh deaths** were linked to AMR, and reports suggest **~83% of the population carries drug-resistant bacteria**. With **few new antibiotics** entering the global pipeline, routine infections are becoming harder to treat—threatening the foundations of modern medicine.

Key Facts / Core Content

- AMR affects **both hospitals and communities**
- High antibiotic consumption accelerates resistance
- **Antibiotic pipeline is critically thin**—few drugs from **new classes**
- Behavioural misuse is a major driver
- Stewardship and awareness are central to solutions

Analytical Insights

1. AMR: A Silent, Systemic Crisis

- Drug-resistant infections increasingly acquired **during treatment for unrelated illnesses**
- Burden extends beyond ICUs to **primary care and communities**

2. Behavioural Drivers of Overuse

- Antibiotics taken for **viral illnesses** (cough/cold)
- Easy access via pharmacies; pressure on clinicians
- Inadequate diagnostics → empirical prescribing

3. Drying Antibiotic Pipeline

- Recent approvals largely **variants of existing classes**
- Misuse shortens the effective life of available drugs
- Low private R&D incentives due to:
 - High failure risk
 - Low returns (short treatment courses)

Military Quantum Mission Policy Framework

Why in News?

The **Chief of Defence Staff, Anil Chauhan**, unveiled the **Military Quantum Mission Policy Framework**, outlining a roadmap to integrate **quantum technologies** across the **Army, Navy, and Air Force** to secure **future battlefield superiority**.

Key Facts / Core Content

- Strategic **vision and roadmap** document
- Enables **systematic adoption** of quantum tech across services
- Aligns defence needs with **National Quantum Mission**
- Emphasises **tri-services jointness** and **civil-military fusion**

Four Pillars of the Framework

1. Quantum Communication

- Ultra-secure links (quantum key distribution)
- Resistance to interception

2. Quantum Computing

- Faster optimisation and simulation
- Enhanced decision-making and cryptanalysis (defensive)

3. Quantum Sensing & Metrology

- Superior navigation (GPS-denied environments)
- High-precision detection (submarines, stealth targets)

4. Quantum Materials & Devices

- Advanced sensors
- Resilient hardware for harsh environments

Strategic Features

Tri-Services Jointness

- Unified adoption across **Army–Navy–Air Force**
- Avoids siloed capability build-up

Civil–Military Fusion

- Partnerships with:
 - Academia
 - Startups
 - Industry

- Government labs

- Dedicated governance and coordination mechanisms

Battlefield Orientation

- Secure communications
- Superior sensing and navigation
- Faster OODA loops
- Resilience against **cyber and electronic warfare**

Battling the Fog: How Trains and Flights Manage Winter Disruptions

Why in News?

Every winter, **dense fog over northern India** causes large-scale **delays and cancellations** in **rail and air transport**. Reduced visibility directly affects safety and capacity, forcing operators to slow down or suspend services during peak fog periods.

Key Facts / Core Content

- Fog-related disruptions peak between **10 December and 10 February**
- Northern India (especially around Delhi) is most affected
- Both **Indian Railways** and airlines rely on **technology-driven safety protocols**

Scientific Basis: Why Fog Persists in North India

Radiation Fog

- Forms on **clear winter nights**
- Rapid cooling of the ground → condensation of near-surface moisture
- Common in plains with calm winds

Role of Air Pollution

- Pollutants act as **condensation nuclei**
- Results in **smog-like dense fog**
- Visibility remains poor even after sunrise

How Aviation Manages Fog Conditions

Low Visibility Procedures (LVP)

- Activated when visibility drops below safe thresholds
- Airport operations follow strict spacing and sequencing norms

Instrument Landing System (ILS) CAT IIIB

- Enables aircraft to land with:
 - **Runway Visual Range (RVR) as low as ~50 metres**
- Critical for fog-prone airports

Infrastructure & Operational Constraints

- Only select airports (e.g., Delhi) are **CAT IIIB compliant**
- Reduced runway capacity under LVP
- Slower taxiing due to poor ground visibility

Airline Preparedness

- CAT IIIB-trained pilots
- Certified aircraft stationed at fog-prone hubs

- AI-based real-time weather and traffic planning

Flight Diversions

- Alternate airports identified in advance
- Decisions based on:
 - Weather updates
 - Engineering support availability

How Indian Railways Manages Fog Operations

Fog Safety Devices (FSDs)

- GPS-based handheld devices
- Alert drivers about:
 - Signals
 - Level crossings
 - Speed restrictions

Modified Signalling Systems

- Automatic signalling limits train movement
- Prevents rear-end collisions during low visibility

Kavach System

- **Automatic Train Protection (ATP)** system
- Displays signals inside locomotive cab
- Applies brakes automatically if danger is detected
- Significantly improves safety during foggy conditions

(Implemented by **Indian Railways**)

Dust Experiment (DEX)

Why in News?

The **Indian Space Research Organisation (ISRO)** has successfully deployed India's first **indigenously developed cosmic dust detector**, the **Dust EXperiment (DEX)**, confirming that **interplanetary dust particles (IDPs)** strike Earth's atmosphere roughly once every 1,000 seconds.

Key Facts / Core Content

- **DEX**: India's first instrument to detect high-speed cosmic dust
- Developed by:
 - **Physical Research Laboratory (Ahmedabad)**
- Launched on:
 - **1 January 2024**
- Mission:
 - **PSLV-C58 / XPoSat**
- Platform:
 - **PSLV Orbital Experimental Module (POEM)**

Technical Features of DEX

- Weight: **~3 kg**
- Power consumption: **~4.5 watts**
- Operating altitude: **~350 km**
- Detection principle:
 - **Hypervelocity impact detection**
- Designed to capture:
 - High-transient signals from fast-moving dust particles

Strategic Importance

- Strengthens India's:
 - Space situational awareness
 - Deep-space research capability
- Reduces dependence on foreign instruments
- Enhances scientific self-reliance

ISRO's Next Phase: Building Industrial-Scale Capability

Why in News?

India's space programme has reached a **critical inflection point**. After a decade of operational success, the challenge now is to **sustain high-frequency, complex missions at industrial scale**, especially as mission ambitions expand to **human spaceflight and advanced lunar exploration**.

Key Facts / Core Content

- India transitioned from experimental launches to **high reliability operations**
- Proven launch vehicles:
 - **Indian Space Research Organisation (ISRO)**
 - **PSLV**
 - **GSLV LVM-3**
- Next phase demands:
 - Higher launch cadence
 - Faster project turnarounds
 - Scalable manufacturing

Analytical Insights

1. Rising Mission Complexity

- Upcoming missions:
 - Human spaceflight
 - Advanced lunar and deep-space exploration
- Implications:
 - Tighter timelines
 - Greater systems integration
 - Higher tolerance thresholds for safety and reliability

2. Capacity & Throughput Constraints

- Legacy project-style execution is **not sufficient** for:
 - Serial production
 - Parallel missions
- Need to move from **mission execution** to **system production**

3. Governance Gaps in a Liberalised Sector

- Absence of a **comprehensive national space law**
- Regulatory ambiguities burden ISRO with:
 - Operator roles
 - Regulator-like oversight
- Slows private participation and clarity in licensing

Kaladi: A Traditional Dairy Product

Why in News?

The **Union Minister of State for Science & Technology** announced plans to **scale up “Kaladi”**, a traditional dairy product from **Udhampur district, Jammu & Kashmir**, for wider food applications and markets.

Key Facts / Core Content

- **Kaladi:**
 - Traditional cheese of **Dogra cuisine**
- **GI Tag:**
 - Recognised for unique regional characteristics
- Key constraint:
 - **Short shelf life**, especially without refrigeration

Traditional Preparation Process

1. Raw full-fat milk churned in an **iron pot**
2. Coagulation using **whey water / sour milk (mathar)**
3. Stretching and cooling in the same pot
4. Solidification in a bowl
5. **Sun-drying** to reduce moisture

Scientific & Institutional Support

- Collaboration with:
 - **CSIR–Central Food Technology Research Institute**
 - **CSIR–Indian Institute of Integrative Medicine**
- Focus areas:
 - Nutrient profiling
 - Characterisation
 - Shelf-life extension

Economic & Cultural Significance

- Market expansion:
 - National and international
- Benefits:
 - Higher farmer incomes
 - Value addition
 - Global promotion of Dogra cuisine
- Preserves:
 - Culinary heritage
 - Indigenous food knowledge

Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD)

Why in News?

Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD) is gaining recognition as a major and growing public-health concern in India, underscoring the need for early detection, lifestyle interventions, and targeted therapies.

Key Facts / Core Content

- MASLD is a **“silent” chronic liver disease**—often asymptomatic in early stages
- **Most common liver disease globally**
- Spectrum ranges from:
 - Simple hepatic steatosis (fatty liver)
 - To **Metabolic Dysfunction-Associated Steatohepatitis (MASH)** with inflammation and fibrosis
- Effective management hinges on **lifestyle modification**, with **medications** for advanced disease

Conceptual Clarity

What is MASLD?

- A chronic condition marked by **excess fat accumulation in the liver** unrelated to alcohol intake
- Leads to liver inflammation, fibrosis, cirrhosis, and increased cardiometabolic risk

Nomenclature Shift

- Earlier called **Non-Alcoholic Fatty Liver Disease (NAFLD)**
- Renamed to **MASLD** to:
 - Emphasise **metabolic roots**
 - Reduce stigma
 - Align diagnosis with obesity, diabetes, dyslipidaemia

Pathophysiology (Why it Develops)

- **Insulin resistance** → impaired fat and glucose handling
- Increased hepatic fat deposition
- Contributors:
 - Obesity
 - Type-2 diabetes
 - High cholesterol

- **Genetic predisposition** (e.g., PNPLA3 variants)

Clinical Features

- Often asymptomatic initially
- When present:
 - Fatigue
 - Right upper abdominal discomfort
 - In advanced stages: mental confusion (hepatic encephalopathy)

Treatment & Management

Lifestyle (First Line)

- Calorie-balanced diet
- Regular physical activity
- Sustained **weight loss**

Pharmacotherapy (Advanced Disease)

- **Resmetirom** – conditionally approved for MASH
- **Semaglutide** – metabolic benefits, weight loss
- **Saroglitazar** – approved in India for MASLD

Kerala Declares *Bacillus subtilis* as ‘State Microbe’

Why in News?

Kerala has become the **first Indian state** to declare a **State Microbe**, naming ***Bacillus subtilis***, alongside the inauguration of the **Centre of Excellence in Microbiome (CoEM)**—India’s first integrated microbiome translational research platform.

Key Facts / Core Content

- **State:** Kerala
- **State Microbe:** *Bacillus subtilis*
- **Institutional support:**
 - Kerala State Council for Science, Technology and Environment
 - Kerala Development and Innovation Strategic Council

About *Bacillus subtilis*

- A **beneficial, non-pathogenic bacterium**
- Naturally found in:
 - Soil
 - Human gut
 - Fermented foods
- Known for:
 - **Probiotic properties**
 - Disease suppression
 - Environmental resilience (spore formation)

Applications & Significance

1. Health

- Probiotic use:
 - Improves gut health
 - Enhances immunity
- Research into microbiome-linked diseases

2. Agriculture

- Promotes plant growth
- Controls plant pathogens
- Improves **soil health** and sustainability

3. Environment

- Bioremediation potential
- Reduces chemical dependency

Biomaterials in India – A New Frontier for Sustainable Manufacturing

Why in News?

As India and other countries pursue **low-carbon and sustainable manufacturing**, **biomaterials** are gaining prominence as alternatives to fossil-based materials. This shift aligns with India's climate commitments, circular economy goals, and industrial self-reliance agenda.

Key Facts / Core Content

- Biomaterials reduce dependence on **petroleum-based inputs**
- Enable **domestic manufacturing** and lower import dependence
- India's biomaterials sector is **nascent but rapidly evolving**
- Global adoption highlights the urgency for India to scale up

Conceptual Understanding

What are Biomaterials?

- Materials **derived from biological sources** or produced through **biological processes**
- Designed to:
 - Lower environmental impact
 - Support sustainable and circular manufacturing

Classification of Biomaterials

1. Drop-in Biomaterials

- Chemically identical to fossil-based materials
- Compatible with existing manufacturing infrastructure
- Example:
 - **Bio-PET** in packaging

2. Drop-out Biomaterials

- Chemically different
- Require new processing and waste systems
- Example:
 - **Polylactic Acid (PLA)** – needs industrial composting

3. Novel Biomaterials

- Entirely new functionalities:
 - Self-healing materials
 - Bioactive implants
 - Advanced bio-composites

Importance for India

- **Environmental:** Lower emissions and plastic pollution
- **Economic:**
 - New manufacturing value chains
 - Import substitution
- **Rural livelihoods:**
 - Use of agricultural residues and biomass as feedstock
- **Strategic:**
 - Supports Make in India and green industrialisation

Current Status in India

- Market size: ~\$500 million
- Key developments:
 - **Balrampur Chini Mills' PLA plant (Uttar Pradesh)**
 - Start-ups converting:
 - Agricultural waste
 - Floral waste into biomaterials
- Sector includes:
 - Bioplastics
 - Biopolymers
 - Bio-derived composites

Setback for PSLV: What Two Consecutive Mission Failures Signal for ISRO

Why in News?

The Indian Space Research Organisation (ISRO)'s **PSLV-C62 mission**, carrying 16 satellites, failed to reach its intended orbit. This follows the **PSLV-C61 failure in May 2025**, marking **two consecutive failures** of a launch vehicle known for its reliability over three decades.

Key Facts / Core Content

- **Launch vehicle:** Polar Satellite Launch Vehicle (PSLV)
- Failures:
 - PSLV-C61 (May 2025)
 - PSLV-C62 (latest)
- In both cases:
 - Initial stages performed normally
 - Failure occurred in the **third stage**

Why the Third Stage is Critical

- Accelerates rocket to **near-orbital velocity**:
 - ~26,000–28,000 km/h
- Insufficient velocity → payload falls back to Earth
- Third stage failure = **mission failure**

Datacentres in Orbit Exploring Space-Based Solutions for AI Energy Demand

Why in News?

With **AI workloads** driving explosive growth in electricity demand, technology firms and space agencies are examining **space-based datacentres** as a radical alternative. India, through **Indian Space Research Organisation (ISRO)**, is studying the feasibility of hosting compute infrastructure in **low-Earth orbit (LEO)**.

Key Facts / Core Content

- Datacentres are among the **fastest-growing electricity consumers** globally
- AI training/inference (GPUs, accelerators) intensifies energy use
- Space-based datacentres could:
 - Harness **near-continuous solar energy**
 - Bypass **land scarcity** and **water-intensive cooling** on Earth
- India is exploring space compute as part of broader **space-for-commerce** ambitions

Concept & Architecture

What are Space-Based Datacentres?

- Compute facilities placed in **LEO**
- Powered primarily by **solar arrays**
- Designed for high-density compute with **inter-satellite links** enabling:
 - High internal bandwidth
 - Modular scaling of AI workloads

Potential Advantages

1. **Energy Access**
 - Near-uninterrupted solar power
 - Reduced reliance on fossil-fuel grids
2. **Cooling Efficiency**
 - Radiative cooling to space
 - Lower water footprint than terrestrial cooling
3. **Land & Siting Relief**
 - No land acquisition
 - Reduced local environmental conflicts

Artificial Intelligence and Its Environmental Impact

An Emerging Policy Challenge for India

Why in News?

As AI transforms healthcare, agriculture, governance, and finance, its **environmental footprint**—energy, water, and emissions—has received limited policy attention. With India aspiring to global AI leadership, ignoring these impacts could undermine **climate and sustainability goals**.

Key Facts / Core Content

- Training a single **large language model (LLM)** can emit **~300,000 kg CO₂**
- An AI query can consume **~10×** the energy of a standard web search
- AI infrastructure could consume **4.2–6.6 billion m³ of water by 2027**
- AI is **not environmentally neutral**

Environmental Dimensions of AI

1. Energy & Emissions

- High power draw from GPUs/accelerators
- Carbon intensity depends on grid mix

2. Water Stress

- Cooling of datacentres drives freshwater demand
- Risks acute in water-stressed regions

3. Material Footprint

- Short hardware cycles
- E-waste and rare-earth dependence

Global Regulatory Signals

- **UNESCO (2021)**: Recommendations on ethical AI including environmental harms
- **European Union: AI Environmental Impacts Act (2024)** aligning AI with sustainability
- **US/EU**: Emerging sustainability-linked AI norms

India's Policy Gaps

- No **standardized measurement** of AI's energy/water/GHG footprints
- **EIA Notification, 2006** does not cover:
 - AI model development
 - Algorithmic projects
- ESG norms lack **AI-specific disclosures**

- Policy discourse emphasizes AI for climate solutions, **not its costs**

Voyager 1: A Historic Milestone in Space Exploration

Why in News?

As **Voyager 1** approaches **50 years since launch (1977–2026)**, it is set to reach a symbolic milestone: **radio signals from Earth will take nearly a full day to reach the spacecraft**, underscoring humanity’s farthest reach into space.

Key Facts / Core Content

- **Launch agency:** NASA
- **Launch year:** 1977
- **Current distance:** Over **15 billion miles** from Earth
- **Historic first:**
 - Entered **interstellar space** in **August 2012**
- **Signal delay:** **~22.5–24 hours** (one-way, at speed of light)

Mission Objectives & Instruments

Primary Mission

- Exploration of **outer planets**, especially:
 - **Jupiter**
 - **Saturn**

Key Scientific Instruments

- **Cosmic Ray Subsystem**
- **Infrared Interferometer Spectrometer and Radiometer (IRIS)**

Major Discoveries

Jupiter

- Active **volcanoes on Io**
- Discovery of a **thin ring**
- Identification of moons **Thebe** and **Metis**

Saturn

- Discovery of **five new moons**
- Identification of the **G-ring**

Heliopause & Interstellar Space

- **Heliopause:**
 - Boundary where solar wind pressure balances interstellar medium
- Voyager 1’s crossing marked humanity’s **first direct sampling of interstellar space**

The Golden Record

- A **12-inch gold-plated copper disc**
- **Contents:**
 - Sounds of Earth
 - Images
 - Music
 - Greetings in multiple languages
- **Purpose:**
 - A cultural message to potential extraterrestrial life

Introduction of Humanoid Robot ASC ARJUN by Indian Railways

Why in News?

Indian Railways has unveiled ASC ARJUN, a humanoid robot, at Visakhapatnam Railway Station, marking a major step in AI-enabled public service delivery and station security.

Key Facts / Core Content

- Developed **indigenously in Visakhapatnam**
- Operates alongside the **Railway Protection Force (RPF)**
- Deployment focus:
 - Passenger assistance
 - Surveillance
 - Emergency response

Technical & Functional Features

Artificial Intelligence

- **Face Recognition System (FRS)** for:
 - Intrusion detection
 - Suspect identification
- **AI-based crowd monitoring**
 - Real-time alerts to RPF control rooms

Multilingual Interface

- Automated announcements in:
 - English
 - Hindi
 - Telugu

Mobility & Patrolling

- Semi-autonomous navigation
- Obstacle avoidance
- Continuous platform patrolling

Human-Robot Interaction

- Greets passengers with ‘**Namaste**’
- Salutes RPF personnel
- Provides directions and safety information

Emergency Preparedness

- **Fire and smoke detection systems**
- Early warning for rapid response

Significance

- Enhances **station safety** and surveillance
- Optimises manpower deployment
- Demonstrates:
 - Indigenous AI capability
 - Smart infrastructure integration

Forever Chemicals (PFAS)

Why in News?

A new **filtration technology** developed by **Rice University** can absorb certain **PFAS (forever chemicals)** at rates **100 times higher** than earlier methods—offering a breakthrough in tackling persistent chemical pollution.

What are Forever Chemicals?

- A group of **synthetic, toxic compounds**
- Known as **PFAS (Per- and Poly-Fluoroalkyl Substances)**
- Characterised by:
 - **Extreme persistence**
 - Resistance to natural degradation

Chemical Basis of Persistence

- Strong **carbon-fluorine (C-F) bonds**
- Among the strongest chemical bonds known
- Gives PFAS:
 - Water repellence
 - Oil resistance
 - Thermal stability

Environmental & Health Concerns

Environmental

- Leach into:
 - Soil
 - Groundwater
 - Surface water
- Bioaccumulate and biomagnify

Health Impacts

- Immune system suppression
- Liver damage
- Thyroid disorders
- Increased cancer risk

Reusable Launch Vehicle (RLV) Technology

Why in News?

Reusable Launch Vehicles (RLVs) are transforming the global space industry by **cutting launch costs by 5–20 times** and enabling **high-frequency, sustainable access to space**, as the global space economy is projected to approach **USD 1 trillion by 2030**.

Key Concepts & Facts

What are Reusable Launch Vehicles?

- Launch systems designed to **recover and reuse** rocket stages
- Unlike **expendable launch vehicles**, RLVs follow an **aviation-like operational model**

Core Objective

- **Drastic cost reduction** through reuse
- Overcomes inefficiency highlighted by the **Tsiolkovsky rocket equation**, where:
 - **90%+ of launch mass is propellant**

Operational Mechanism

1. **Launch**
2. **Stage separation**
3. **Controlled re-entry**
4. **Deceleration**
 - Atmospheric drag
 - Retro-propulsion
5. **Landing**
 - Vertical (e.g., boosters)
 - Horizontal (spaceplane concepts)
6. **Inspection & refurbishment**
7. **Relaunch**

Relevance for India

- Supports long-term goals of:
 - Affordable access to space
 - Commercial launch competitiveness
 - Human spaceflight sustainability
- Aligns with India's reusable spaceplane and next-gen launcher ambitions

Sexual Dimorphism and Spider Silk Quality

Why in News?

A **2025 study** revealed that **only large adult female Darwin's bark spiders (Caerostris darwini)** produce the **toughest silk ever recorded**, with a tensile strength of **~1.6 GPa**, nearly **three times stronger than iron**, driven by **extreme sexual size dimorphism** and ecological pressures.

Key Findings

- Female spiders are **3–5 times larger** than males
- Only **large adult females** produce:
 - Extremely tough
 - High-stiffness silk
- Silk is rich in **proline**, an amino acid critical for elasticity and toughness

Biological Explanation

Sexual Dimorphism

- Females:
 - Build **giant webs** spanning rivers/lakes (up to **25 metres**)
 - Capture large, high-impact prey
- Males & juveniles:
 - Smaller bodies
 - Lower energy investment
 - Weaker, more stretchable silk

Evolutionary Context

- Silk production is **metabolically expensive**
- Natural selection favours:
 - Superior silk only where **survival advantage** outweighs energy cost
- Genetic elasticity is conserved across sexes
- Extreme toughness evolves only in **large females** due to ecological necessity

Scientific & Applied Significance

- Demonstrates **sex-specific evolutionary optimisation**
- Highlights **trade-offs between energy cost and material performance**
- Inspires:
 - Bio-inspired materials
 - High-strength, lightweight fibres

Doomsday Clock

Why in News?

The **Bulletin of the Atomic Scientists** has set the **Doomsday Clock to 85 seconds to midnight (January 2026)**—the closest ever—reflecting heightened risks of a **man-made global catastrophe**.

What is the Doomsday Clock?

- A **symbolic, metaphorical clock**
- Represents humanity's proximity to **existential disaster**
- **Midnight = total annihilation**

Background

- Established in **1947**
- Initially set at **7 minutes to midnight**
- Reset **27 times** based on global risk assessment
- Time adjusted annually by:
 - Bulletin's Board of Sponsors
 - Leading scientists and security experts

Key Determinants

- **Nuclear weapons & arms race**
- **Climate change**
- **Biological threats**
- **Cyber risks**
- **Disruptive technologies (including AI)**

Significance of 85 Seconds

- Closest setting in history
- Indicates:
 - Escalating weaponisation
 - Weak global governance
 - Insufficient climate action
- Serves as a **warning signal**, not a prediction

Policy Relevance

- Emphasises need for:
 - Nuclear arms control
 - Climate cooperation
 - Responsible tech governance
 - Strengthened multilateralism

Governance

Calling Out the ED's Actions and Media Trials

Why in News?

During 2024–25, actions by the **Directorate of Enforcement (ED)** in the case involving film producer Akash Bhaskaran triggered controversy over **illegal raids, media leaks, and misuse of investigative powers**. The **Supreme Court of India** intervened, terming certain ED actions unlawful and violative of federal principles.

Key Takeaways

- Tension between **investigative authority and constitutional safeguards**
- Misuse concerns under **Prevention of Money Laundering Act, 2002 (PMLA)**
- Rise of **media trials**
- Importance of **judicial oversight**

Key Issues Involved

1. Inversion of Legal Process

- PMLA requires a **predicate (scheduled) offence**.
- Recent trend:
 - Allegation first
 - Evidence searched later
- Undermines **due process of law (Article 21)**.

2. Media Trials

- Leaks and sensational coverage:
 - Label individuals as guilty before trial
 - Damage reputation irreversibly
- Violates:
 - **Presumption of innocence**
 - Right to fair trial

3. Institutional Misuse

- Allegations of:
 - Bribery
 - Extortion
 - Politically selective enforcement
- Weakens public trust in anti-corruption institutions.

Grok Controversy: Platform Accountability and AI Regulation

Why in News?

Social media platform **X**, owned by **Elon Musk**, curtailed capabilities of its AI tool **Grok** after global backlash over the generation of **sexualised images of women and children**, including minors.

Key Takeaways

- AI misuse can enable **non-consensual and exploitative content**
- Platform responsibility under **due diligence obligations**
- Rising **regulatory scrutiny** across jurisdictions
- Gaps in AI governance frameworks

What is the Grok Controversy?

1. Nature of the Issue

- In December 2025:
 - Grok allowed generation of sexualised images using real photos
 - Often without consent
- Raised concerns regarding:
 - Child safety
 - Online harassment
 - Platform ethics

2. Initial Response by X

- Elon Musk initially:
 - Placed responsibility on users
 - Claimed ignorance of misuse involving minors
- Stated illegal content creators would face consequences similar to uploaders.

3. Regulatory Pressure

- **India:**
 - Government issued notice for failure of due diligence
 - X removed ~3,500 content pieces
 - Blocked ~600 accounts
- **UK & Malaysia:**
 - Legal proceedings against X and xAI
- Reflects global demand for **AI accountability**

Governance & Legal Dimensions

- Highlights inadequacy of:
 - Existing IT laws for AI-generated content
- Raises questions about:
 - Intermediary liability
 - Consent and privacy
 - Child protection online
- Reinforces need for **proactive AI regulation**, not reactive bans

Combating ‘Digital Arrest’ Scams: Kill Switch & Fraud Insurance as New Digital Safety Nets

Why in News?

India is witnessing a sharp rise in “**digital arrest**” scams, prompting the **Ministry of Home Affairs (MHA)** to set up a **high-level Inter-Departmental Committee (IDC)** to explore systemic solutions such as a **transaction “kill switch”** and a **fraud insurance mechanism** to protect users and restore trust in digital payments.

Key Takeaways

- Digital arrest scams exploit **social engineering** and leaked personal data.
- Estimated losses ~ **₹3,000 crore** nationwide; the issue has drawn **judicial attention**.
- Proposed safeguards: **Kill switch, transaction tracking, and fraud insurance**.
- Requires tight coordination among **RBI, MeitY, banks, insurers, and law enforcement**.

What are ‘Digital Arrest’ Scams?

- Fraudsters impersonate **law enforcement officials** via video calls.
- Use **fake IDs, warrants**, and personal data to threaten victims.
- Victims are psychologically coerced for hours into transferring money to **mule accounts**.

Proposed Systemic Solutions

1. Transaction “Kill Switch”

- **Emergency feature** embedded in UPI/banking apps to **instantly freeze transactions** upon suspected fraud.
- Objective: prevent **rapid fund outflow** and splitting into mule accounts.
- Challenges:
 - Avoid **accidental activation/misuse**
 - Ensure **interoperability** across banks/fintechs

2. Tracking & Blocking Fraudulent Transactions

- **AI-driven detection** of suspicious patterns
- **Velocity checks** to stop immediate dispersal of funds

- Real-time coordination with banks and platforms

3. Fraud Insurance Mechanism

- Recognises limits of traditional audits/compliance
- Current cyber insurance **does not cover first-party fraud** due to customer manipulation
- Preferred model: **Insurance pool** funded by banks & insurers (akin to terrorism pools)
- Linked to **RBI's Payment Vision 2025** (Digital Payment Protection Fund concept)

Key Challenges

- **Operational complexity** of kill switch
- **Moral hazard** (reduced vigilance if insurance is guaranteed)
- **Regulatory coordination** (RBI-IRDAI-MeitY-banks)
- Need for **public awareness** alongside tech fixes

'NATGRID': The Search Engine of Digital Authoritarianism

Why in News?

Post-26/11 security reforms led to the creation of **National Intelligence Grid (NATGRID)** to consolidate intelligence. Its **operational expansion** now raises concerns about **privacy, civil liberties, and oversight** in a constitutional democracy.

Key Takeaways

- NATGRID began as a **counter-terrorism data platform**.
- Expanded into **routine policing and broader surveillance**.
- Integration with population databases heightens **profiling risks**.
- **Oversight mechanisms remain weak** despite the right to privacy.

Background & Evolution

1. Origins (Post-26/11)

- Designed to enable security agencies to **query multiple databases** quickly.
- Addressed intelligence silos exposed by the attacks.

2. Operational Expansion

- From counter-terrorism to **everyday law enforcement**.
- Increased number of users and query types → **scale risks**.

Core Concerns

1. Privacy & Civil Liberties

- Surveillance at scale risks **population-wide profiling**, especially with links to population registers.
- Tension with the constitutional right to privacy (Article 21).

2. Algorithmic Bias

- Data-driven systems can **encode and amplify social biases**.
- Disproportionate impact on **vulnerable communities**.

3. Accountability & Oversight

- Thousands of queries monthly with **limited independent oversight**.

- Normalisation of invasive practices without robust checks.

4. Tyranny of Scale

- Large datasets + automation increase **false positives** and errors in policing.

Democratic Stakes

- Security gains vs **erosion of due process**.
- Need to prevent a drift towards **digital authoritarianism**.

Street Dogs, Supreme Court and the Judicial Overreach Debate

Why in News?

The issue of **street dogs** has escalated from a civic and public-safety concern to a **constitutional debate**, following **suo motu interventions** by the **Supreme Court of India**. The controversy revolves around **judicial overreach**, **separation of powers**, **animal welfare**, and **governance capacity**.

Key Takeaways

- The Supreme Court has issued **far-reaching directives** on street dog management.
- Questions arise over **judicial encroachment into executive policymaking**.
- India already has a **statutory and regulatory framework** for humane dog population control.
- The real challenge lies in **implementation failure**, not legal vacuum.
- Global experience supports **executive-led, science-based solutions**.

Judicial Overreach Concerns

1. Suo Motu Directions

- Orders such as **confining all street dogs to dog pounds**:
 - Issued without hearing affected stakeholders (urban local bodies, States)
 - Logistically and financially **unfeasible**
 - Risk violating animal welfare norms

2. Separation of Powers

- Under the **Basic Structure Doctrine**, each organ must act within its domain.
- Policy design and execution fall under the **executive**, not the judiciary.
- Courts are meant to:
 - Test legality
 - Ensure rights
 - Not manage day-to-day governance

Governance & Ground Realities

- **Dog pounds and shelters** often:
 - Lack space, funds, trained staff
 - Fail to meet basic welfare standards

- Weak **municipal capacity** and poor coordination remain core issues.
- Judicial mandates without administrative readiness lead to **policy chaos**.

Global Best Practices

- Countries like **France and the Netherlands**:
 - Reduced stray populations through:
 - Sterilisation
 - Registration
 - Responsible pet ownership
 - Achieved results via **executive planning**, not judicial orders

Ethical & Constitutional Balance

- **Article 21**: Right to life includes public safety.
- **Article 51A(g)**: Fundamental Duty to show compassion to living creatures.
- Governance must balance:
 - Human safety
 - Animal welfare
 - Institutional propriety

Indian Society and Social Issues

Early Investment in Children: The Key to India's Future

Why in News?

India's aspiration to become a **developed nation with a \$30 trillion economy by 2047** has renewed focus on **human capital formation**. A crucial yet under-recognised pillar of this is **Early Childhood Care and Development (ECCD)**, which delivers long-term social and economic returns.

Key Takeaways

- **First 1,000 days** are decisive for brain development and lifelong outcomes.
- ECCD policy focus has been **skewed towards low-income groups**, ignoring middle- and upper-income challenges.
- Need for **integrated ECCD interventions** from preconception to age eight.

Why Early Childhood Matters

1. Biological & Cognitive Foundations

- Around **85% of brain development** occurs in the first **1,000 days**.
- This period shapes:
 - Cognitive ability
 - Emotional regulation
 - Social behaviour

Deficits here are **hard and costly to reverse** later.

2. Economic & Social Returns

- ECCD investment leads to:
 - Higher educational attainment
 - Better productivity and employability
 - Lower healthcare and social welfare costs
- Expands the **future workforce quality**, not just quantity.

Gaps in India's Current ECCD Approach

1. Narrow Targeting

- Major interventions focus on:
 - Nutrition
 - Survival (IMR, MMR reduction)

- **Developmental potential** (socio-emotional skills, mental health) remains under-addressed.

2. Missing the Early Window

- Many policies start around **age three**.
- Critical phases like:
 - Preconception health
 - Pregnancy
 - Infancy
 are insufficiently covered.

3. New Challenges in Higher-Income Groups

- Rising issues:
 - Childhood obesity
 - Screen addiction
 - Delayed socio-emotional skills
- These are largely **outside traditional welfare frameworks**.

Kathputli Art of Rajasthan

Why in News?

The traditional **Kathputli** art of Rajasthan—concentrated in **Kathputli Nagar, Jaipur**—is under pressure due to declining patronage and competition from modern entertainment, raising concerns about the survival of this **intangible cultural heritage**.

Key Takeaways

- One of India’s **oldest folk puppet traditions**.
- Term derived from:
 - Kath (wood)
 - Putli (doll)
- Hereditary art practiced by **~250 artisan families**.
- Puppets operated using **strings**, with painted faces and colourful costumes.

Historical & Cultural Significance

1. Traditional Role

- Performed by **travelling storytellers**.
- Narrated:
 - Tales of Rajput kings
 - Folk legends
 - Moral and social messages
- Served as a **mass communication medium** before print and digital media.

2. Artistic Features

- Puppets made of:
 - Wood
 - Cloth
- Performance combines:
 - Music
 - Dance
 - Dialogue
- Reflects:
 - Rajasthani aesthetics
 - Social values and history

Contemporary Challenges

- Economic insecurity of artisans.
- Declining audience due to:
 - Digital entertainment
 - Reduced tourism-based demand

- Limited institutional support and market access.

Social & Cultural Importance

- Kathputli represents:
 - Community-based cultural transmission
 - Living heritage dependent on livelihood support
- Preservation requires:
 - Economic sustainability
 - Integration with education, tourism, and digital platforms

Urban Is the New Political: Urbanisation, Infrastructure and the Recasting of Indian Democracy

Why in News?

India marked **20 years of the Jawaharlal Nehru National Urban Renewal Mission (JNNURM)**—one of the first large-scale urban regeneration initiatives. Since 1990, India’s urban population has risen from **~25% to about one-third**, and is projected to reach **~40% by the end of the decade**, signalling a profound shift in **demography, governance, and democratic politics**.

Key Takeaways

- Urbanisation is transforming **cities into centres of political power**, not just habitation.
- Urban priorities now shape **economic strategy, infrastructure spending, and aspirations**.
- Urban change is **political and infrastructural**, not merely spatial expansion.

Understanding India’s Urban Turn

1. From Village-Centric to Urban India

- India’s self-image long aligned with **Gandhian village-centric ideals**.
- Today, **500+ million citizens** live in urban areas.
- Cities increasingly:
 - Decide electoral outcomes
 - Influence policy narratives
 - Set developmental benchmarks

Urban India is no longer peripheral—it is **politically decisive**.

2. Evolution of Urban Policy Since 1990

Post-liberalisation reforms reoriented urban governance towards **growth and infrastructure**:

- **JNNURM** – Urban renewal, service delivery reforms
- **AMRUT** – Water, sanitation, urban infrastructure
- **Smart Cities Mission** – Technology-led urban management

Shift from **welfare-oriented planning** to **growth-oriented urbanism**.

3. Capital-Centric Urban Design

- Contemporary cities increasingly designed to:
 - Attract **global capital**
 - Promote **urban beautification**
 - Cater to **elite consumption**
- **Consequences:**
 - Marginalisation of informal workers
 - Displacement of urban poor
 - Shrinking affordable housing

Cities risk becoming **exclusive economic zones** rather than inclusive habitats.

Implications for Indian Democracy

- Urban voters demand:
 - Efficient services
 - Accountability
 - Infrastructure delivery
- But lack:
 - Strong municipal autonomy
 - Effective ward-level participation
- Result: A **centralised, infrastructure-heavy democracy** with limited grassroots voice.

INTERNATIONAL RELATIONS

India–UAE Relations: Strategic Defence Partnership amid West Asia Turbulence

Why in News

Amid escalating instability in **West Asia/Gulf** (Gaza conflict, Yemen crisis, Iran-related tensions), India and the **United Arab Emirates** have elevated their ties through a **Strategic Defence Partnership**, marked by the visit of UAE President **Sheikh Mohamed bin Zayed Al Nahyan** to New Delhi and the signing of a **Letter of Intent (LoI)**.

Key Developments

- **Letter of Intent (LoI)** signed for a **Strategic Defence Partnership**
- Target to **double bilateral trade to USD 200 billion by 2032**
- **10-year LNG supply agreement**
- Expansion of cooperation in:
 - Defence
 - Energy
 - Nuclear
 - Space
 - Digital finance
- Reinforced cooperation on **counter-terrorism and financial security**

Strategic Defence Partnership: Significance

- Institutionalises:
 - Regular joint military exercises
 - Exchange of Service Chiefs
- Enhances interoperability and trust
- Explicitly stated as **not reactionary** to any specific conflict
- Reflects India's shift from transactional to **strategic security partnerships** in West Asia

Economic & Trade Cooperation

- Trade target: **USD 100 billion → USD 200 billion by 2032**
- Driven by **Comprehensive Economic Partnership Agreement (CEPA)** (2022)
- Focus sectors:
 - Infrastructure
 - Manufacturing

- Logistics
- Digital trade

10 Years of the Paris Agreement (2015–2025)

Why in News

The **Paris Agreement** completed **10 years** in November 2025, prompting a global reassessment of its effectiveness, ambition, and equity.

What is the Paris Agreement?

- Adopted in **2015** at COP21 under **UN Framework Convention on Climate Change**
- Replaced the Kyoto Protocol
- **Legally binding framework**, but **voluntary national commitments**

Objectives

- Limit global warming to:
 - **Well below 2°C**
 - Pursue efforts towards **1.5°C**
- Promote:
 - Mitigation
 - Adaptation
 - Climate finance

How It Works

- **Five-year action cycle**
- Countries submit **Nationally Determined Contributions (NDCs)**
- **Global Stocktake** every five years
 - First concluded at **COP28 (2023)**
- Paris Rulebook finalised at:
 - COP24 (Katowice)
 - COP26 (Glasgow)

Key Achievements

- **Universal participation** (194 countries + EU)
- Mainstreamed climate action into:
 - National budgets
 - Development planning
- Climate finance commitment:
 - USD 100 bn/year till 2025
 - **New Collective Quantified Goal (NCQG)**:
 - USD 300 bn/year by 2035 (agreed at COP29)
- Embedded **CBDR principle**
- Growth of:
 - Green bonds

- Carbon markets
- Climate investments

China Reiterates Claim Over Shaksgam Valley

Why in News

China has recently **reaffirmed its cartographical and territorial claim over the Shaksgam Valley**, justifying its infrastructure activities in the region. India has **strongly rejected** these claims, reiterating that the territory is an **integral part of India**, illegally ceded by Pakistan to China under the **1963 Sino-Pakistan Agreement**, which India considers **null and void**.

About Shaksgam Valley

- **Location:** North of the **Karakoram Range**
- **Borders:** China's Xinjiang region
- **Political Status:** Part of **Pakistan-Occupied Kashmir (PoK)**, within the Hunza-Gilgit region
- **Area:** ~ 5,180 sq km
- **Strategic Proximity:**
 - Near **Siachen Glacier**
 - Close to **Aksai Chin**

Background of the Dispute

- In **1963**, Pakistan signed the **Sino-Pakistan Border Agreement** with China
- Pakistan **illegally ceded Shaksgam Valley** to China
- **India was neither consulted nor a party** to the agreement

Article 6 of the 1963 Agreement

- Declares the boundary settlement as **temporary**
- To be renegotiated after the **final resolution of the Kashmir dispute**

India's Position (Consistent & Clear)

- Pakistan **had no sovereign authority** to transfer Indian territory
- Hence, the 1963 agreement is:
 - **Illegal**
 - **Invalid**
 - **Non-binding on India**
- Infrastructure development by China in the area is **illegitimate**

Strategic Significance

- Reinforces the **China-Pakistan strategic nexus**

- Adds pressure on India along:
 - Northern borders
 - Western front (PoK linkage)
- Highlights risks of **cartographic aggression** and **salami slicing**

US Strike on Venezuela: The Maduro Factor

Why in News

The **United States** has apprehended Venezuelan President **Nicolás Maduro** following a major military-law enforcement operation, charging him in New York on allegations of **drug trafficking and weapons offenses**. This has intensified debates on **sovereignty, regime change, and international law**, placing India in a diplomatic dilemma.

US Justifications

1. Migration Crisis Narrative

- US links Venezuela to:
 - Mass migration at southern border
- Claim:
 - ~8 million Venezuelans fled since 2013
- Venezuela disputes this narrative

2. Drugs & "Narco-Terrorism"

- Venezuela alleged as cocaine transit hub
- US designated:
 - Tren de Aragua
 - Cartel de los Soles
 as **Foreign Terrorist Organizations**
- Maduro accused of leading cartel (denied by Venezuela)

Venezuela's Counter-Claim

- US actions framed as:
 - **Regime change strategy**
 - Not genuine anti-drug enforcement
- "War on drugs" used as political cover

International Reactions

- **Russia:** Condemned US action
- **European Union:** Emphasised international law
- **Chile & Colombia:** Expressed concern over military intervention

India's Diplomatic Dilemma

- India's tradition:
 - Non-intervention
 - Respect for sovereignty
- Pressures:

- Global South expects principled stance
- Strategic ties with US complicate response
- India remains **cautious and measured**

India and the EU — A Fit Partnership in a Divided World

Why in News

Recent high-level engagements, including senior **EU leaders attending India's 77th Republic Day celebrations (26 Jan 2026)** and the **16th India-EU Summit**, signal renewed political momentum in India-EU ties amid global uncertainty.

Core Theme

Both India and the **European Union** are seeking **greater strategic autonomy** as trust in traditional alliances weakens, pushing both sides to diversify partnerships.

Key Drivers of Convergence

1) Changing Global Context

- Strains in India-US ties due to trade frictions and Russia-related energy dynamics Europe's growing uncertainty about US priorities in the post-Ukraine environment

2) Untapped Potential

- Despite complementarities, India-EU ties were often secondary to each side's US engagement
- Now the partnership is being repositioned as central to wider global strategy

Key Cooperation Pillars

A. Trade & Economy

- Long-pending **India-EU FTA** (negotiations ongoing since 2007) gains strategic salience as a diversification tool High potential sectors:
 - Textiles, pharma, engineering goods, services

B. Climate & Trade Friction (CBAM)

- EU's **Carbon Border Adjustment Mechanism (CBAM)** may operate as a non-tariff barrier for India's exports
- Calls for a balanced approach to prevent climate policy from undermining trade gains

C. Defence & Security

- Proposal for **security/defence partnership** aligns with:
 - Shared security concerns

- India's defence manufacturing and indigenisation goals

Pax Silica and India – Securing Critical Technology Supply Chains

Why in News

India is expected to receive an invitation to join the US-led **Pax Silica** initiative, aimed at securing global supply chains for **semiconductors, AI, and critical minerals** amid geopolitical competition and China-linked supply risks.

What is Pax Silica?

- A US-led multilateral framework launched around the **Pax Silica Summit (Dec 2025, Washington DC)**.
- “Pax” = peace; “Silica” = silicon-tech → idea of a trusted tech order

Why It Matters

- China dominates critical mineral and processing chains; export controls and licensing can be weaponised
- Chips/AI are now core to:
 - Economic power
 - Defence capability
 - Strategic dominance

India’s Strategic Relevance

- **Human capital + STEM + AI talent**
- Large demand market for next-gen tech
- Ongoing semiconductor push

Challenges for India

- Pressure on **strategic autonomy**
- Potential constraints on:
 - Subsidies and industrial policy
 - Regulatory flexibility
 - Engagement with non-group countries

US Secondary Tariffs over Iran Trade

Why in News

The US President announced a **25% tariff** on any nation trading with **Iran**, raising concerns about secondary economic coercion (the move has been reported publicly).

India–Iran Economic Context

- India–Iran trade reduced sharply to **~USD 1.6 billion in FY25**.
- Likely affected export items:
 - Cereals, tea/coffee, spices, animal fodder, fruits & nuts

Strategic Dimension: Chabahar

India’s long-term strategic investment in **Chabahar Port** remains crucial as a connectivity gateway to Afghanistan and Central Asia:

- 10-year operations contract
- USD 120 million grant
- USD 250 million line of credit

Broader Implications

- Secondary tariffs/sanctions test:
 - Sovereign trade choices
 - Strategic autonomy
 - Connectivity strategy (Chabahar)
- Larger impact expected on major Iran-linked trade flows (notably China’s oil trade), as also reflected in global reporting.



BRICS India Summit Needs a Green and Resilient Agenda

Why in News

With India presiding over **BRICS** in 2026 under the theme "Building Resilience and Innovation for Cooperation and Sustainability", there is a push to anchor the agenda around **climate resilience and inclusive growth**.

Why This Matters

- Developing countries face disproportionate climate impacts → need collective voice
- Global sustainability momentum is weakening in some quarters → leadership vacuum
- BRICS can shape climate governance through:
 - finance, technology cooperation, adaptation focus

Priority Areas for a "Green + Resilient" BRICS Agenda

- 1. Adaptation equity**
 - Early warning systems
 - Climate-resilient infrastructure
- 2. Climate finance**
 - Accessible, affordable flows
 - Reform of multilateral finance
- 3. Energy transition with development**
 - Just transition pathways
- 4. South-South cooperation**
 - Tech sharing, capacity building
- 5. Resilience as common platform**
 - Disaster risk reduction, health and food systems

India-EU Joint Comprehensive Strategic Agenda (Towards 2030)

Why in News

India and the **European Union** adopted the "**Towards 2030: India-EU Joint Comprehensive Strategic Agenda**" during discussions between Prime Minister **Narendra Modi** and European leaders **Ursula von der Leyen** and **Antonio Costa** at the **16th India-EU Summit**.

Significance of the Agenda

- Reaffirms India-EU **Strategic Partnership**
- Provides a **clear five-year roadmap** (2025-2030)
- Aims to:
 - Broaden cooperation
 - Deepen engagement
 - Improve coordination
- Responds to a **fragmented global order**, trade uncertainties, and security challenges

Five Key Pillars of Cooperation

- 1. Prosperity & Sustainability**
 - Trade diversification
 - Green growth
 - Supply-chain resilience
- 2. Technology & Innovation**
 - Digital cooperation
 - Emerging technologies
 - Research & development
- 3. Security & Defence**
 - Maritime security
 - Counter-terrorism
 - Cybersecurity
 - Defence industrial cooperation
- 4. Connectivity & Global Challenges**
 - Infrastructure development
 - Climate action
 - Global health
 - Indo-Pacific cooperation
- 5. Enablers**
 - Skills and mobility
 - Business-to-business links
 - People-to-people exchanges

Trade, Investment & Economic Cooperation

- Reiterates commitment to **early conclusion and implementation** of:
 - India–EU **Free Trade Agreement (FTA)**
 - Investment Protection Agreement
 - Geographical Indications (GI) Agreement
- Enhanced cooperation in:
 - Financial services
 - Customs
 - Macroeconomic dialogue
- Scaling up **Global Gateway** investments
 - Participation of **European Investment Bank**

Trump’s Russia Sanctions Bill: Implications for India–US Trade

Why in News

US President **Donald Trump** enacted a sweeping **Russia sanctions bill** imposing **500% tariffs** on imports from countries trading in **Russian-origin uranium and petroleum products**, raising serious concerns for India–US trade relations.

Key Provisions of the Sanctions Bill

- 500% tariffs on goods/services from countries:
 - Trading in Russian energy or uranium
- Similar tariffs on:
 - Direct Russian imports into the US
- Additional sanctions targeting:
 - Russian leadership
 - Military officials
- Designed to **bypass domestic legal challenges** to tariff imposition

Impact on India

- India imports **discounted Russian crude oil**
- Risk of triggering punitive tariffs on Indian exports
- India–US trade volume:
 - Over **USD 85 billion**
- Potential impact sectors:
 - Electronics
 - Pharmaceuticals
 - Engineering goods

Why India is Vulnerable

- Export basket is **less diversified** and **less technology-intensive**
- Unlike China, India lacks:
 - Scale-based countermeasures
 - Alternative export buffers
- Could weaken India’s position in:
 - Ongoing FTA talks (EU, ASEAN)
 - Global investment negotiations

Strategic Implications

- Challenges India’s **energy security strategy**
- Tests India’s **strategic autonomy**
- Creates uncertainty for:
 - Trade

- Investment
- Macroeconomic stability

Unilateral Use of Force and International Law

Why in News

Recent unilateral military actions by the **United States** have revived global debate on the **erosion of international law**, particularly the weakening of the **UN-centered multilateral order**.

International Legal Framework

- Based on:
 - Sovereign equality of states
 - Non-intervention
- Anchored in the **United Nations Charter**

Key Legal Provisions

Article 2(4)

- Prohibits:
 - Threat or use of force
 - Against territorial integrity or political independence of any state

Article 51

- Allows use of force only:
 - In **self-defense**
 - Against an armed attack
 - Until UNSC acts

Why Recent Actions are Contested

- US military action against **Venezuela**:
 - No UN Security Council authorization
 - Does not meet self-defense criteria
- Hence:
 - Violates Article 2(4)
 - Undermines non-intervention principle

Broader Implications

- Weakening of balance-of-power restraints after Cold War
- Rise of **unilateralism** over multilateralism
- Sets dangerous precedents:
 - Normalisation of force
 - Reduced trust in international institutions

Decisive New Factors in the Iranian Conundrum

Why in News

Widespread civic unrest in **Iran** since late 2025 has drawn global attention. While often framed as regime repression or foreign-instigated dissent, the protests reveal **deep structural socio-economic and political vulnerabilities**.

Immediate Trigger of the Unrest

- Collapse of the **Iranian rial**
- Exchange rate distortion:
 - Official rate: **42,000 rials/USD**
 - Market rate: **~1.45 million rials/USD**
- Created a **35-fold gap**, crippling imports
- Protests initiated by:
 - **Bazaaris (merchant class)** on 28 December 2025

Regime's Four-Stage Response Pattern

1. **Repression & information control**
2. **Dual messaging:**
 - Foreign conspiracy narrative
 - Selective conciliatory gestures
3. **Controlled tolerance**
4. **Attrition strategy** (by early 2026)

Structural Vulnerabilities Exposed

Breakdown of Bazaar–Clergy Nexus

- Historically:
 - Bazaaris + Clerical elite formed regime backbone
- Now weakened due to:
 - Prolonged US sanctions
 - Internal corruption
 - Economic mismanagement

Demographic Shift

- Two-thirds of Iranians are **post-1979 generation**
- Aspirations shaped by:
 - Consumerism
 - Global lifestyle exposure
- Increasing disconnect with revolutionary ideology

Role of External Factors

- Statements supporting protests by:

- US
- Israel
- Counterproductive effect:
 - Reinforces regime narrative of foreign interference
 - Strengthens nationalist resistance within Iran

Implications for Regional Stability

- Persistent unrest threatens:
 - West Asian stability
 - Gulf security
- Risks escalation amid sanctions and regional rivalries

Global Risks Report 2026

Why in News

The **World Economic Forum** has released the **21st edition of the Global Risks Report 2026**, based on the **Global Risks Perception Survey** involving over **1,300 global experts**.

The report identifies **gloeconomic confrontation** as the **most severe immediate global risk**.

Core Finding

Gloeconomic confrontation has overtaken traditional military threats as the dominant risk to global stability.

This reflects a shift from **rules-based multilateralism** to **economic weaponization**.

Top Global Risks – 2026

1. Gloeconomic Confrontation (Rank 1)

- Use of:
 - Tariffs
 - Sanctions
 - Investment restrictions
 - Export controls
 - Control over **critical minerals**
- Indicates erosion of:
 - Free trade norms
 - Global supply chain integration
- Linked to:
 - US–China rivalry
 - Sanctions regimes
 - Fragmentation of global economy

2. State-Based Armed Conflict

- Reflects:
 - Retreat from multilateral conflict resolution
 - Growing unilateralism
- Conflicts increasingly intertwined with:
 - Trade
 - Energy
 - Technology controls

Technological Risks

Short-Term Risks

- **Misinformation & disinformation** – Rank 2
 - Election interference
 - Social instability

- Democratic erosion

- **Cyber insecurity** – Rank 6

- Critical infrastructure vulnerability
- State and non-state cyber actors

AI-Related Risks

- **Adverse outcomes of AI:**
 - Rank **30** (2-year outlook)
 - Rank **5** (10-year outlook)
- Concerns include:
 - Job displacement
 - Mental health impacts
 - Military and surveillance use
 - Social manipulation

Societal Risks

- Rising **political and social polarization**
- Declining **trust in institutions**
- Weakening social cohesion
- Reinforces:
 - Democratic backsliding
 - Governance paralysis