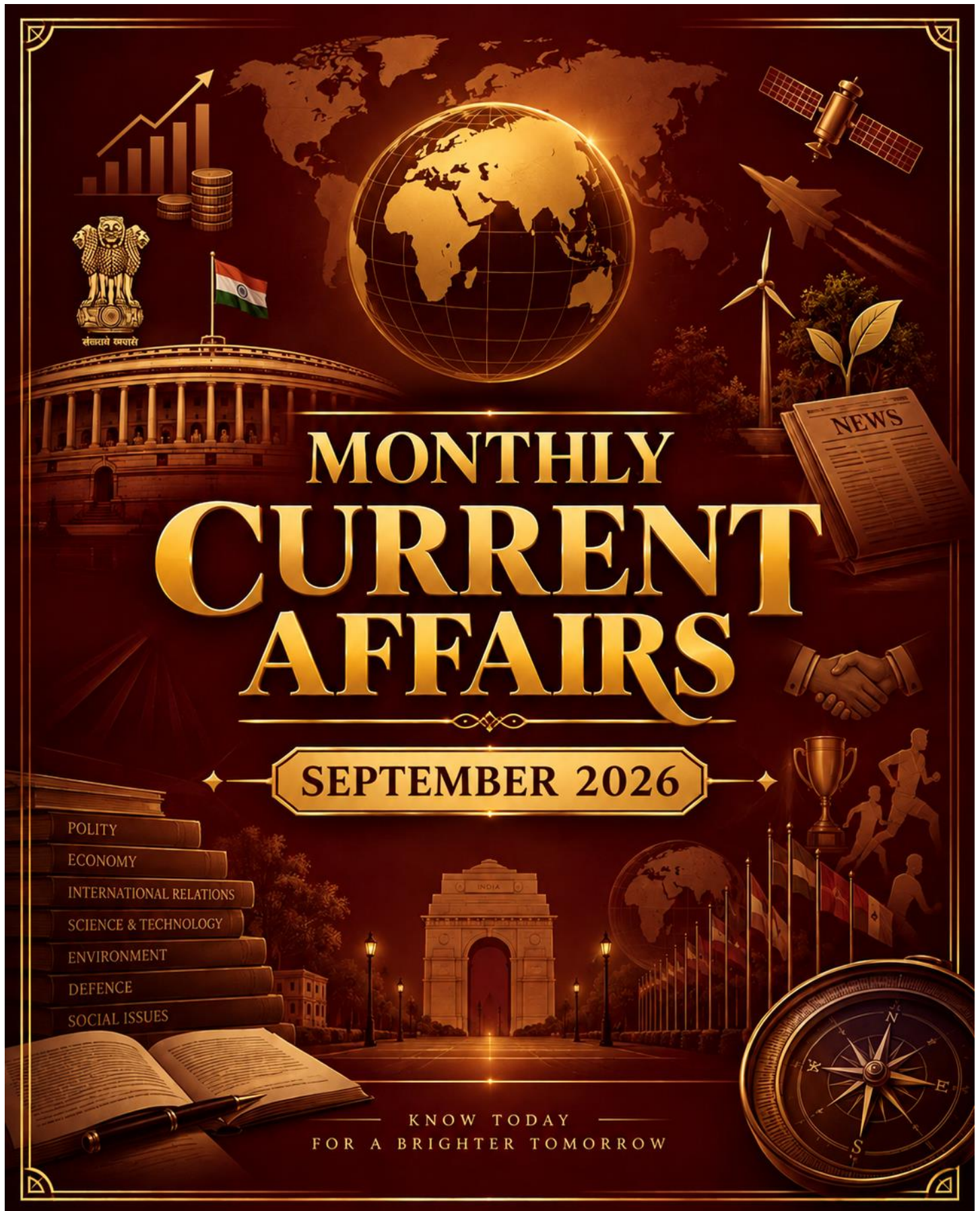


SEPTEMBER 2026



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POLITY
ECONOMY
INTERNATIONAL RELATIONS
SCIENCE & TECHNOLOGY
ENVIRONMENT
DEFENCE
SOCIAL ISSUES

KNOW TODAY
FOR A BRIGHTER TOMORROW

SEPTEMBER 2026

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GOVERNANCE & POLITY

1.1 Advancing Socio-Economic

Empowerment of Scheduled Castes

Why in News?

The Ministry of Social Justice and Empowerment reported that over ₹11,186 crore has been released under the three components of PM-AJAY. 16,022 villages have been declared Adarsh Grams, while the Grant-in-Aid component has benefited 34.61 lakh people.

Pradhan Mantri Anusuchit Jaati Abhyuday Yojana

- **Ministry:** Ministry of Social Justice & Empowerment
- **Target Group:** Scheduled Castes (SCs)
- **Implemented since:** 2021–22 as a merger of three erstwhile Centrally Sponsored Schemes

Objectives

- Reduce poverty among SC communities through employment, skill development and income-generating activities.
- Improve infrastructure and basic services in SC-dominated villages.
- Promote education and literacy through hostels and residential facilities.

Three Major Components

Component	Focus
Adarsh Gram	Development of SC-dominated villages through infrastructure and basic services

Grants-in-Aid	State/District-level projects for livelihoods, skill development, infrastructure and socio-economic development
Hostels	Construction of hostels in eligible schools and higher educational institutions for SC students

Earlier Scheme	Broad Focus
Pradhan Mantri Adarsh Gram Yojana (PMAGY)	Development of SC-dominated villages
Special Central Assistance to SC Sub Plan (SCA to SCSP)	Socio-economic development of SCs
Babu Jagjivan Ram Chhatrawas Yojana (BJRCY)	Hostels for SC students

1.2 Appointment of High Court Chief Justice

Why in News?

The Punjab Cabinet raised objections to the appointment of the Chief Justice of the Punjab and Haryana High Court, bringing renewed attention to the role of the Executive, judiciary and State Government in judicial appointments.

Constitutional Basis

- **Article 217:** Provides for appointment and conditions of service of High Court judges.

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- **Appointing Authority:** President of India.
- **Governor:** Constitutionally consulted in the appointment of High Court judges.
- **Chief Justice:** The President appoints the Chief Justice of a High Court through the established collegium-based process.

Appointment Process

- **High Court Collegium:** Headed by the Chief Justice of the concerned High Court with the two senior-most judges.
- **Supreme Court Collegium:** Headed by the CJI with the two senior-most Supreme Court judges.
- **Union Government:** Processes the recommendation and provides its response.
- **President:** Makes the formal appointment.

Judicial Primacy vs Executive Role

- **Judicial Primacy:** Under the collegium system, the judiciary has the primary role in selecting and recommending candidates.
- **Executive Consultation:** The Union Government participates in the process and can return a recommendation for reconsideration.
- **Limited Veto:** Once the collegium reiterates a recommendation, the established convention is that the Executive is expected to accept it.
- **Federal Dimension:** The process involves the Union, State and judiciary, although

the State Government does not have an independent veto over the appointment.

Why Chief Justices Are Often Appointed From Outside the State?

- **Institutional Independence:** Reduces possible local pressures and influences.
- **Neutrality:** Brings an external perspective to the High Court.
- **Administrative Independence:** Helps avoid excessive familiarity with local legal and political interests.

Constitutional Articles

- **Article 214:** High Court for each State.
- **Article 217:** Appointment and conditions of service of High Court judges.
- **Article 222:** Transfer of High Court judges.
- **Article 224:** Additional and acting judges.
- **Article 226:** Writ jurisdiction of High Courts.

1.3 BNS Section 299: Balancing Religious Harmony and Freedom of Expression

Why in News?

Debate has emerged over the application of Section 299 of the Bharatiya Nyaya Sanhita (BNS) in cases involving allegedly offensive expressions concerning religion.

Key Provisions

- **Section 299:** Penalises deliberate and malicious acts intended to outrage religious feelings of a class of citizens.

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- **Intention:** Mere hurt feelings are insufficient; the required deliberate and malicious intent must be established.
- **Context:** The nature, manner and surrounding circumstances of the expression are relevant.

Constitutional Dimension

- **Article 19(1)(a):** Guarantees freedom of speech and expression.
- **Article 19(2):** Permits reasonable restrictions on specified grounds, including public order.
- The provision seeks to address deliberate acts affecting religious harmony, while protecting legitimate expression.

Key Concerns

- **Frivolous complaints:** Proceedings may be initiated without satisfying the statutory threshold.
- **Chilling effect:** Fear of prosecution may deter legitimate expression.
- **Multiple proceedings:** A single incident may result in proceedings in different jurisdictions.

Way Forward

- **Preliminary scrutiny:** Verify whether the statutory ingredients are prima facie satisfied.
- **Context based assessment:** Examine intention and the complete context rather than isolated words.
- **Procedural safeguards:** Prevent repetitive or unnecessary proceedings.

- **Constitutional balance:** Safeguard freedom of expression and individual liberty while addressing deliberate acts affecting religious harmony.

1.4 Central Drugs Standard Control Organisation (CDSCO)

Why in News?

Central Drug Authority responsible for discharging functions assigned to the Central Government under the Drugs and Cosmetics Act, 1940.

About

- **Head:** Drugs Controller General of India (DCGI)
- **Headquarters:** FDA Bhawan, New Delhi.
- **Ministry:** Ministry of Health & Family Welfare, through the Directorate General of Health Services (DGHS).
- **Regulatory Network:** 6 zonal offices, 4 sub zonal offices, 13 port offices and 7 laboratories.

Key Functions

- **New Drugs & Clinical Trials:** Approves new drugs and regulates clinical trials.
- **Import Control:** Regulates import of drugs and issues relevant registrations/licences.
- **Central Licensing:** Acts as the Central Licence Approving Authority (CLAA) for specified highrisk products such as vaccines, blood banks, LVPs, rDNA products and notified medical devices.

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- **Market Surveillance:** Monitors drug quality and conducts testing through its laboratories.
- **Technical Advice:** Administers the Drugs Technical Advisory Board (DTAB) and Drugs Consultative Committee (DCC).

2026 Regulatory Reforms

- **Prior Intimation:** Introduced for certain drugs manufactured for analytical and nonclinical testing, replacing prior permission.
- **Dossier Based Licensing:** Streamlines approvals by reducing duplication in regulatory assessment.
- **Faster Laboratory Testing:** Immediate issuance of NOCs for laboratory testing of new drugs upon application.
- **BA/BE Studies:** Prior permission replaced by online intimation for specified lowrisk studies of unapproved drugs intended for export.
- **Digital Regulation:** ONDLS and SUGAM provide online platforms for licensing and regulatory processes.

1.5 Election Commission Independence: Appointment and Institutional Credibility

Why in News?

The Supreme Court has delivered a split opinion on whether challenges to the Chief Election Commissioner and Other Election Commissioners (Appointment, Conditions of

Service and Term of Office) Act, 2023 require consideration by a larger Constitution Bench.

Background

In Anoop Baranwal v. Union of India (2023), the Supreme Court directed that, until Parliament made a law, appointments would be recommended by a committee comprising the Prime Minister, Leader of Opposition and Chief Justice of India.

The 2023 Act subsequently established a Selection Committee comprising:

- Prime Minister – Chairperson
- Leader of Opposition in Lok Sabha – Member
- Union Cabinet Minister nominated by the Prime Minister – Member

The President formally appoints the CEC and ECs on the committee's recommendation.

Why Institutional Independence Matters

- **Electoral neutrality:** The election authority must administer elections impartially.
- **Public confidence:** Perceived independence influences trust in electoral institutions.
- **Level playing field:** Political parties require confidence that electoral administration is institutionally neutral.
- **Constitutional democracy:** Free and fair elections are central to representative government.

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Aspect	Anoop Baranwal Case (2023)	T.N. Seshan Case (1995)
Case	Anoop Baranwal v. Union of India	T.N. Seshan v. Union of India
Main Issue	Appointment process of CEC and Election Commissioner	Composition and functioning of a multi-member ECI
Constitutional Focus	Independence of the ECI and safeguards in appointments	Powers and status of the CEC vis-à-vis other ECs
Key Ruling	Until Parliament made a law, appointments were to be made on the advice of a committee comprising PM, LoP and CJI.	The Court upheld the multi-member Election Commission and rejected the idea that the CEC has unilateral supremacy over other ECs.
CEC-EC Relationship	Focused mainly on institutional independence through the appointment process	CEC functions as Chairman of a multi-member Commission ; ECs have a meaningful

		role in decision-making.
Core Principle	Independence of electoral appointments	Collegiality of the Election Commission
Article	Article 324	Article 324

1.6 E KIDS ACT

Why in News?

The proposed EU KIDS Act (Keeping Internet Digital Spaces Accountable and Trustworthy) reflects a shift from regulating only harmful content to addressing platform design, algorithms and addictive features that may expose children to online risks.

Major Risks

- **Addictive Design:** Infinite scrolling, autoplay and engagement maximising features can encourage excessive use.
- **Algorithmic Exposure:** Recommendation systems may repeatedly expose children to inappropriate content.
- **Cyberbullying:** Anonymity and viral communication can amplify online harassment.

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- **Online Exploitation:** Risks include grooming, manipulation and commercial exploitation.
- **Age Inappropriate Content:** Children may access content unsuitable for their developmental stage.

Key Features

- **Age Restrictions:** Proposes restricting access for children below 13 years on covered services and setting 15 years as the proposed EUwide age for independently creating accounts.
- **Safety by Design:** Child safety must be incorporated at the design stage, rather than addressed only after harm occurs.
- **Age Assurance:** Promotes privacy preserving mechanisms to verify age without unnecessarily revealing users' identities.
- **Parental Tools:** Parents and guardians would receive greater tools to manage children's online experiences.
- **Research:** Promote the study of Indian and international affairs.
- **Informed opinion:** Develop informed public opinion on international issues.
- **Foreign relations:** Promote India's relations with other countries through research, dialogue and exchange of ideas.
- **Knowledge hub:** Serve as a clearing house of information on world affairs.
- **Publications:** Publish books, journals and other literature, including India Quarterly.
- **Dialogue:** Organise conferences and seminars on India's foreign policy.
- **Bilateral Dialogues:** Engagements with institutions from Russia, Vietnam, South Korea and other countries.
- **Outreach:** University Outreach Programme, Foreign Policy Awareness Scheme and Conference Grants.
- **Library:** Houses around 1.53 lakh books, rare documents and UN publications.

1.7 Indian Council of World Affairs (ICWA)

Why in News?

Vice-President C.P. Radhakrishnan addressed the 25th Anniversary Celebrations of ICWA as an Institution of National Importance on September 15, 2026, at Sapru House, New Delhi

About

- **Mandate** – Section 13, ICWA Act, 2001

Historical Significance of Sapru House

- **Asian Relations Conference, 1947:** A landmark conference held at Sapru House under the leadership of Sarojini Naidu.
- **Jawaharlal Nehru:** Regularly visited Sapru House for discussions with scholars on international affairs.
- **Institution building centre:** Institutions such as IDSA, the School of International Studies (later merged with JNU), Children's Film Society of India and Press Institute of India were established in the building.

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1.8 Marital Rape in India – Balancing Bodily Autonomy and Institution of Marriage

Why in News?

The Supreme Court is examining petitions challenging the constitutional validity of the marital rape exception retained under the Bharatiya Nyaya Sanhita (BNS), 2023.

Current Legal Position

- **BNS Section 63, Exception 2:** Non-consensual sexual intercourse by a man with his wife aged 18 years or above is excluded from the definition of rape.
- **Section 67:** Non-consensual intercourse with a legally separated wife is punishable with 2–7 years imprisonment.
- **Domestic Violence Act, 2005:** Recognises sexual abuse, but primarily provides civil remedies.

Impact

- **Gender Justice:** Recognition of sexual autonomy within marriage.
- **Article 14:** Raises questions regarding differential treatment between married and unmarried women.
- **Article 21:** Links marital sexual autonomy with privacy, dignity and bodily integrity.

Significance

- **Constitutional Morality:** Tests whether personal relationships can justify

differential protection of fundamental rights.

- **Women's Rights:** Moves from viewing women primarily through the institution of marriage towards individual autonomy.
- **Legal Reform:** Can bring Indian criminal law closer to evolving international standards.
- **J.S. Verma Committee:** Recommended removal of the marital rape exception after the Nirbhaya case.

Challenges

- **Evidentiary Difficulty:** Establishing absence of consent within a continuing marital relationship.
- **Potential Misuse:** Concerns regarding weaponisation of criminal provisions in matrimonial disputes.
- **Institution of Marriage:** Government has argued that criminalisation could increase state intervention in family relationships.

Way Forward

- **Consent-Centred Law:** Clearly recognise that marriage does not imply perpetual consent.
- **Victim-Centric Justice:** Provide confidential reporting, counselling and legal assistance.
- **Judicial Sensitivity:** Ensure privacy and dignity during investigation and trial.

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1.9 Measuring the Substance of Indian Democracy

Why in News?

V-Dem Institute released the Democracy Report 2026, assessing democracy through a multidimensional institutional framework.

What is V-Dem?

Varieties of Democracy (V-Dem) is a research project that evaluates democracy beyond the mere conduct of elections. It examines the quality, functioning and institutional foundations of democracy.

Five Dimensions of Democracy

- **Electoral Democracy:** Ensures that elections are free, fair, regular and competitive, allowing citizens to choose their representatives.
- **Liberal Democracy:** Protects individual rights, rule of law and institutional checks and balances against arbitrary exercise of state power.
- **Participatory Democracy:** Enables citizens to participate in public affairs beyond voting, including through civil society, consultations and other democratic processes.
- **Deliberative Democracy:** Emphasises reasoned discussion, public debate and justification of government decisions before policies are made.
- **Egalitarian Democracy:** Seeks to ensure that citizens have equal political influence and opportunities, irrespective of their social or economic status.

1.10 Article 371(K) – Ladakh

Why in News?

The proposal for a new Article 371(K) seeks to create a special constitutional governance framework for Ladakh, responding to demands for greater political representation and protection of the region's distinctive land, culture, tribal interests and ecology.

What is Article 371?

- The Constitution already contains special provisions for certain States under Articles 371 to 371J.
- These provisions give different regions special safeguards based on their unique historical, cultural, social and administrative circumstances.
- The proposed 371(K) would be a new special provision specifically for Ladakh.

What is being proposed ?

- **Directly Elected Body:** Ladakh could get a UT-level elected governing institution, strengthening democratic representation.
- The proposed framework may provide powers concerning land, property transfer, culture, language, forests and environment.
- **Protection of Tribal Interests:** It could provide stronger constitutional safeguards for Ladakh's tribal and indigenous communities.
- **Ecological Protection:** Special powers over land and natural resources could help balance development with the fragile Himalayan ecosystem.

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Why Articles 371A & 371G are important?

- **Article 371A – Nagaland** : Provides special protection relating to Naga religious/social practices, customary law, administration of civil/criminal justice involving customary law, and ownership/transfer of land and its resources
- **Article 371G – Mizoram** : Provides similar protection to Mizo religious/social practices, customary law and land-related matters.
- **Article 240** – Empowers the President to make regulations for certain Union Territories, including provisions relating to peace, progress and good government.

How will the new elected body's powers coexist with the President's regulatory powers under Article 240?

- **Significance** **Democratic Representation:** Could address concerns regarding the absence of a conventional legislative assembly in Ladakh.
- **Land Protection:** Can provide stronger safeguards against inappropriate or excessive changes in land ownership/use.
- **Cultural Protection:** Helps preserve local languages, customs and traditions.
- **Tribal Safeguards:** Could provide constitutional recognition to the interests of tribal communities.
- **Ecological Security:** Important because Ladakh is a fragile high-altitude Himalayan ecosystem facing pressure

from tourism, infrastructure and climate change.

1.11 Registered Unrecognised Political Parties (RUPPs): Registration, Regulation and Recognition

Why in News?

India has over 2,800 Registered Unrecognised Political Parties (RUPPs), while only around 750 RUPPs contested the 2024 General Elections, highlighting concerns regarding the proliferation, regulation and electoral participation of political parties.

What is an RUPP?

- A Registered Unrecognised Political Party (RUPP) is a political party that is registered with the Election Commission of India (ECI) under Section 29A of the Representation of the People Act, 1951, but has not fulfilled the conditions required for recognition as a State or National Party.
- A party can therefore be registered with the ECI without receiving the status of a recognised State or National Party.

Constitutional and Legal Basis

- **Article 19(1)(c):** Guarantees citizens the fundamental right to form associations or unions, subject to reasonable restrictions.
- **Section 29A, RPA 1951:** Provides the statutory framework for registration of political parties with the ECI.
- **Article 324:** Vests the ECI with the superintendence, direction and control of elections.

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Registration Requirements

- **Application:** A political party seeking registration under Section 29A must apply to the ECI within 30 days of its formation.
- **Constitution of the Party:** Its rules must conform to the Constitution and contain an express commitment to the principles of socialism, secularism and democracy, as required under Section 29A.
- **Election Participation:** A registered party is required to participate in elections as prescribed under the ECI's regulatory framework; failure to comply can have consequences under applicable rules.
- **Financial Disclosure:** Political parties are subject to statutory requirements concerning contributions, accounts and financial reporting.

Feature	Registered Political Party	Recognised Political Party
Registration	Registered under Section 29A of the Representation of the People Act, 1951	Must fulfil prescribed electoral performance criteria
Authority	Election Commission of India (ECI)	Election Commission of India (ECI)

Status	May remain unrecognised	Recognised as a State Party or National Party
Reserved Symbol	Registration alone does not confer recognised-party benefits	Recognised parties receive reserved-symbol status
Electoral Performance	Electoral performance is not required for registration	Prescribed electoral performance is required for recognition

1.12 Tulu as Second Official Language: Linguistic Recognition and Cultural Preservation

Why in News?

Language Karnataka approved Tulu as a second official language for administrative purposes in Dakshina Kannada and Udupi districts.

Constitutional Provision:

- **Article 345 – Official Language of a State** : The State Legislature may adopt one or more languages in use in the State, or Hindi, for all or any of the official purposes of the State.

About Tulu

- **Language Family:** Dravidian.

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- **Group:** South Dravidian.
- **Major Area:** Coastal Karnataka, particularly Dakshina Kannada and Udupi.
- Also spoken in parts of Kasaragod district, Kerala.

1.13 Protecting Women's Careers and Workplace Dignity

Why in News?

In *Rakhi Bisht v. Union of India*, the Delhi High Court emphasised that maternity leave should not adversely affect a woman's professional status, responsibilities or career prospects.

Key Observations

- **Beyond Job Retention:** Maternity protection extends beyond merely retaining employment and receiving wages.
- **Restoration of Position:** A woman returning from maternity leave should ordinarily be restored to her previous position.
- **Equivalent Position:** If the previous position genuinely ceases to exist, she should be provided an equivalent position in terms of pay, grade, status and responsibilities.
- **No Career Discrimination:** Maternity cannot be used as a basis for demotion, humiliation or career disadvantage.
- **Substantive Equality:** The judgment advances substantive equality by recognising that treating women equally

requires addressing disadvantages arising from maternity and caregiving responsibilities.

Statutory & International Context

Maternity Benefit Act, 1961

- Provides statutory maternity protection to eligible women employees.
- Seeks to protect women's employment and ensure maternity-related benefits.

Constitutional Basis

- Article 14: Equality before law.
- Article 15(3): Permits special provisions for women and children.
- Article 16: Equality of opportunity in public employment.
- Article 42: Directs the State to secure just and humane conditions of work and maternity relief.

ECONOMY

2.1 ASUSE 2025: District-Level Mapping of India's Unincorporated Economy

Why in News?

The National Statistical Office (NSO) under the Ministry of Statistics and Programme Implementation (MoSPI) released the first comprehensive district-level estimates of India's unincorporated non-agricultural sector based on ASUSE 2025.

What is ASUSE?

The Annual Survey of Unincorporated Sector Enterprises (ASUSE) collects information on India's unincorporated non-agricultural enterprises.

It covers three broad sectors:

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- Manufacturing
- Trade
- Other Services

Key Findings

Geographical Concentration

- The top 10 districts account for around 10% of establishments, workers and GVA.
- The top 50 districts account for around 33% of establishments, workforce and GVA.
- Only 16 districts have more than 5 lakh unincorporated establishments.

Labour Productivity

- The national average GVA per worker is around ₹1,56,539.
- 280 districts exceed the national benchmark.
- 331 districts record GVA per worker between ₹1 lakh and ₹1.5 lakh.

Women's Participation

- In 237 districts, women constitute at least one-third of the unincorporated workforce.
- In 25 districts, women constitute more than 50% of workers.
- In Mizoram, female-owned proprietary units constitute at least 50% of establishments in every district.

State	Leading District	Share of State
West Bengal	North 24 Parganas	15.99%
Telangana	Rangareddy	23.53%
Gujarat	Surat	19.43%
Punjab	Ludhiana	14.74%

Karnataka	Bengaluru Urban	12.83%
Kerala	Thiruvananthapuram	12.38%
Rajasthan	Jaipur	11.70%
Maharashtra	Pune	9.14%
Bihar	Patna	8.23%
Tamil Nadu	Chennai	7.13%
Uttar Pradesh	Prayagraj	5.77%

Significance

- **Decentralised Planning:** Moves economic policymaking beyond broad state-level averages towards district-specific interventions.
- **Targeted Credit Delivery:** District-level enterprise data can help financial institutions identify areas requiring better access to formal credit and working capital.
- **Formalisation:** The findings can support the transition of unincorporated enterprises towards formal systems through platforms such as the Udyam Assist Platform.
- **Women-Led Entrepreneurship:** District-level gender-disaggregated data can improve the targeting of women entrepreneurship and livelihood programmes.
- **Employment Generation:** ASUSE provides evidence on the role of small and unincorporated enterprises in generating non-farm employment.

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2.2 Authorised Economic Operator Programme: Securing Trade, Facilitating Commerce

Why in News?

India's Authorised Economic Operator (AEO) Programme completed 10 years, highlighting its role in strengthening supply-chain security and facilitating international trade.

What is the AEO Programme?

The AEO Programme is a voluntary customs-trade partnership programme under which businesses that demonstrate strong compliance and supply-chain security standards receive customs facilitation benefits.

Key Facts

- **Implemented by:** Central Board of Indirect Taxes and Customs (CBIC), Ministry of Finance.
- **Nature:** Voluntary programme.
- **International basis:** WCO SAFE Framework of Standards.
- **Three main tiers:** AEO T1, AEO T2 and AEO T3.
- Higher tiers generally involve stronger compliance and security requirements and provide greater facilitation.
- A separate category exists for logistics operators, recognising their role in international supply chains.

Benefits

- **Faster Customs Clearance:** Reduces delays in the movement of eligible cargo.

- **Reduced Physical Examination:** Greater reliance on risk-based customs assessment.
- **Lower Transaction Costs:** Reduces time and procedural costs for compliant businesses.
- **Supply-Chain Security:** Encourages businesses to adopt stronger security and compliance practices.
- **Export Competitiveness:** Improves the efficiency and predictability of international trade.

2.3 Census Town & Urbanisation Metrics

Why in News?

Old Census town criteria will not capture India's urbanisation, Ministry tells House panel

About

Current Definition of a 'Census Town' As per the 1981 Census, a settlement must meet all three criteria:

- A minimum population of 5,000.
- At least 75% of the male main working population engaged in non-agricultural activities.
- A population density of at least 400 persons per sq. km.

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The Urbanisation Data Gap

- **Official Figure (Census 2011):** Pegs India's urbanisation at 31.2%.
- **Satellite Estimate (EAC-PM):** The Economic Advisory Council to the Prime Minister estimates that actual urbanisation might be as high as 63% (as of 2015).

Key Objections Raised by MoHUA

- **Male Bias:** The 75% non-agricultural workforce criteria only considers males, completely ignoring female workforce participation.
- **Flawed Density Calculation:** Population density is calculated using arbitrary administrative boundaries rather than actual built-up areas.
- **Geographical Disadvantage:** Rigid national thresholds heavily disadvantage hilly and North-Eastern States.
- **Outdated Binary:** The strict rural-urban divide fails to account for rapidly expanding peri urban growth corridors and regional economic diversity.

Official Stance on Reclassification

- **Registrar General of India (RGI):** Maintained that altering the framework for the upcoming Census 2027 is unfeasible as enumeration blocks are already finalised. However, future digital censuses could adapt to updated parameters.
- **Parliamentary Panel Action:** Deferred the adoption of the draft report and

pushed for wider consultations to update the metrics.

2.4 Digital Farmer, Data-Driven Agriculture

Why in News?

Telangana received ₹599 crore in central incentives for achieving milestones under AgriStack.

What is AgriStack?

- Digital Public Infrastructure (DPI) for agriculture.
- It is a key component of the Digital Agriculture Mission, approved in September 2024.

Aim: To create a reliable digital ecosystem connecting farmers, land, crops and agricultural services.

Three Foundational Registries

Registry	Purpose
Farmer Registry	Provides a digital identity through Farmer ID, linked with agricultural records.
Crop Sown Registry	Maintains a digital record of crops sown by farmers.
Geo-referenced Village Map Registry	Provides land- and location-linked geographical infor

Farmer ID

- Links farmer information with: Land records, Crops, Livestock, Demographic information,

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- Government schemes & benefits Target: 11 crore farmers.

Potential Benefits

- Farmer ID + verified agricultural data → targeted & faster service delivery
- Paperless crop loans
- Faster crop-insurance settlement
- Better input availability
- Pest/disease advisories
- DBT delivery
- MSP procurement

Implementation

- Foundational registries are created and maintained by States/UTs.
- Farmer Registry: Target — March 2027
- Northeastern States: March 2028
- Geo-referenced Village Maps: March 2027

Significance

- **Digitalisation of agriculture:** Moves agricultural service delivery towards data-driven governance.
- **Financial inclusion:** Verified farmer data can facilitate easier access to formal agricultural credit.
- **Risk management:** Better crop information can improve crop-insurance processes.
- **Targeted welfare :** Enables more efficient delivery of DBT and agricultural schemes.
- **Precision agriculture :** Crop and location data can support advisories on pests, diseases and inputs.

- **Market integration :** Can improve the efficiency of MSP procurement and other agricultural services.

2.5 Managing Liquidity Without Changing the Policy Rate

Why in News?

The RBI conducted an OMO sale auction of ₹25,000 crore of Government Securities (G-Secs) to absorb durable surplus liquidity from the banking system.

What is OMO?

Open Market Operations (OMO) are the RBI's purchase or sale of Government Securities in the secondary market to regulate liquidity in the financial system.

How Does It Work?

OMO Sale	OMO Purchase
RBI sells G-Secs	RBI buys G-Secs
Banks/investors pay RBI	RBI pays banks/investors
Money moves out of the banking system	Money moves into the banking system
Liquidity decreases	Liquidity increases
Generally contractionary	Generally expansionary

Why is OMO Important?

- OMO allows the RBI to manage durable/systemic liquidity without necessarily changing the policy repo rate.
- It is therefore an important instrument for maintaining appropriate monetary and financial conditions.

OMO vs Repo

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Basis	OMO	Repo	Interest Rate	No repo rate involved	Conducted at the repo rate or applicable auction rate
Primary Purpose	Primarily manages durable liquidity	Primarily manages short-term liquidity and supports monetary-policy transmission	Excess Liquidity Can: ➤ weaken monetary-policy transmission, ➤ push money-market rates away from the desired operating framework, ➤ contribute to demand-side inflationary pressures under certain conditions. Excessive Liquidity Absorption Can: ➤ put upward pressure on bond yields, ➤ increase borrowing costs, ➤ tighten financial-market conditions. 2.6 Measuring Growth Right: India's GDP Debate Why in News? MoSPI defended India's 7.8% real GDP growth in Q1 FY 2026–27, rejecting concerns that the growth rate was inflated because of changes in the GDP base year and methodology. What is Double Deflation? ➤ Under the Double Deflation Method, output and intermediate inputs are deflated separately using appropriate price indices. ➤ $\text{Real GVA} = \text{Deflated Gross Output} - \text{Deflated Intermediate Consumption}$ This is particularly relevant when the prices of inputs and outputs move differently. Key Economic Indicators		
Mechanism	RBI purchases/sells G-Secs	RBI provides collateralised short-term funds against securities			
Impact on Liquidity	Can have a more durable impact on systemic liquidity	Generally provides temporary liquidity			
Market/Framework	Operates through the Government Securities market	Operates through the RBI's liquidity-management framework			
Nature	Outright purchase/sale of securities	Repurchase agreement with an obligation to reverse the transaction			

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Indicator	Q1 FY 2026-27
Real GDP	₹81.36 lakh crore
Real GDP growth	7.8%
Nominal GDP growth	10.3%
Real GVA growth	8.2%
Manufacturing GVA growth	9.2%
Services growth	10.0%
Agriculture, Forestry & Fishing	3.6%
GFCF growth	11.9%
PFCE growth	7.1%

Why is Double Deflation Important?

- Provides a better estimate of real value addition.
- Separately captures changes in input and output prices.
- Particularly useful for manufacturing where input costs may rise faster than output prices.
- Reduces dependence on broad price proxies.

Significance of the 2022-23 Base Year

- Introduces Producer Price Indices (PPI).
- Expands sectoral deflators to 300+ items.
- Incorporates modern services and digital-sector changes.
- Uses high-frequency economic indicators.
- Improves measurement of the changing structure of India's economy.

2.7 Mega Ports: New Classification of High-Throughput Ports in India

Why in News?

The Ministry of Ports, Shipping and Waterways has notified Deendayal, Jawaharlal Nehru, Paradip and Mundra as India's first mega ports.

Key Features

Mega-Port Threshold: The classification is based on prescribed annual cargo throughput, with different thresholds for bulk cargo and containerised cargo.

Port	Key Fact
Deendayal Port	Mega port located on India's western coast in Gujarat
Jawaharlal Nehru Port	Major container port located on the western coast of India
Paradip Port	Only east-coast port among the four notified mega ports
Mundra Port	Only non-major port among the four notified mega ports

Validity of Status

- Mega-port designation remains valid for five years.
- A port does not automatically lose its mega-port status if its cargo throughput subsequently falls below the prescribed threshold during this period.

Why is the Classification Significant?

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- **Port Efficiency:** Recognises ports handling very large volumes of cargo and highlights their importance to India's logistics network.
- **Trade Facilitation:** High-throughput ports are critical for India's international trade and supply chains.
- **Logistics Competitiveness:** Identification of mega ports can support greater attention to port connectivity, multimodal logistics and capacity expansion.
- **Maritime Development:** Supports India's broader objective of strengthening its port-led development and maritime economy.

2.8 Transfer Pricing

Why in News?

Growing concerns over Base Erosion and Profit Shifting (BEPS) have renewed attention on transfer pricing rules used to ensure that transactions between related companies are conducted at fair market values and that taxable profits are not artificially shifted across jurisdictions.

What is Transfer Pricing?

Transfer pricing refers to the prices charged for goods, services, loans, or intellectual property exchanged between related entities under common control, such as a parent company and its foreign subsidiary.

Arm's Length Principle (ALP)

- The Arm's Length Principle is the international standard for determining

whether a transaction between related parties is appropriately priced.

- It requires related entities to price their transactions as though they were independent enterprises dealing with each other under comparable market conditions.

Transfer Pricing and BEPS

Base Erosion and Profit Shifting (BEPS) occurs when multinational enterprises exploit differences in tax rules across countries to shift taxable profits away from jurisdictions where economic activity occurs.

For example:

- High-tax jurisdiction → Artificially high expenses → Lower taxable profit
- Low-tax jurisdiction → Artificially high income → Greater profit allocation
- Such practices can reduce the tax base of countries where production, sales or other economic activities actually take place.

Why is Transfer Pricing Important?

- **Tax Revenue:** Prevents artificial shifting of taxable income.
- **Fair Competition:** Ensures MNCs do not gain an unfair advantage through aggressive tax planning.
- **Investment Climate:** Provides clearer rules for cross-border transactions.
- **International Cooperation:** Supports global efforts to address BEPS and tax avoidance.

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- **Revenue Protection:** Helps developing countries protect their corporate-tax base.

2.9 Anti-Dumping Duty: Protecting Domestic Industry Without Closing the Market

Why in News?

India extended the anti-dumping duty (ADD) on decor paper imports from China until March 2027.

What is Anti-Dumping Duty?

- **Anti-Dumping Duty:** A trade-remedy measure imposed when imported goods are exported at a price below their normal value, causing injury to the domestic industry.
- **Objective:** It seeks to counter unfair pricing practices and provide a level playing field for domestic producers.

How ADD Works

- **Dumping:** Export price is lower than the product's normal value.
- **Material Injury:** The domestic industry suffers significant injury or faces a threat of injury.
- **Causal Link:** The injury must be linked to the dumped imports.

Institutional mechanism

- **DGTR** – Directorate General of Trade Remedies
- **Ministry:** Ministry of Commerce and Industry.
- **Role:** India's specialised authority for traderemedy investigations.

- **Investigates:** Antidumping, countervailing duties and safeguard measures.
- **Function:** Examines whether imports are harming domestic industries and recommends appropriate trade remedies to the Central Government.
- **Key Point:** DGTR recommends trade remedy measures; the final decision on imposing duties rests with the Department of Revenue, Ministry of Finance.

Basis	Anti-Dumping Duty (ADD)	Countervailing Duty (CVD)
Targets	Dumped imports	Subsidised imports
Unfair Practice	Export price is below normal value	Foreign government provides a subsidy
Purpose	Counter injury caused by dumping	Offset the advantage from foreign subsidies
Key Requirement	Dumping + material injury + causal link	Subsidy + material injury + causal link
International Basis	GATT Article VI + WTO	GATT Article VI + WTO SCM Agreement

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	Anti-Dumping Agreement	
Indian Legal Basis	Section 9A, Customs Tariff Act, 1975	Section 9, Customs Tariff Act, 1975
Investigating Authority	DGTR	DGTR
Recall	Dumping → ADD	Subsidy → CVD

2.10 SWIFT: The Messaging Backbone of Global Banking

Why in News?

BRICS and other Global South countries are exploring alternatives to existing international financial infrastructure amid concerns over sanctions, financial dependence and concentration within the global payments architecture.

What is SWIFT?

- **SWIFT:** Society for Worldwide Interbank Financial Telecommunication.
- **Nature:** A secure global financial messaging network used by banks and other financial institutions.
- **Function:** Transmits standardised financial messages relating to international transactions.

- **Critical distinction:** SWIFT does not itself transfer, hold or settle money. The actual movement and settlement of funds occur through banks, correspondent-banking arrangements and payment/settlement systems.

SWIFT and Sanctions

- **Access restriction:** A country's banks can face severe difficulties in communicating internationally if they are excluded from SWIFT.
- **Not sufficient alone:** SWIFT exclusion does not automatically freeze or confiscate funds; the practical effect also depends on correspondent banking, sanctions and access to other payment channels.
- **Strategic concern:** Dependence on globally dominant financial infrastructure can create vulnerabilities during geopolitical conflicts.

Emerging Alternatives

System	Country/Origin	Broad Function
CIPS	China	Cross-border RMB clearing

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		and settlement infrastructure
SPFS	Russia	Financial messaging system developed as an alternative to SWIFT
CBDC	Multiple countries	Facilitate/explore cross-border payments using central bank digital currencies (CBDCs)

INTERNATIONAL RELATIONS

3.1 A Maritime Space at the Heart of Northeast Asian Geopolitics

Why in News?

Recent military activity by North Korea occurred in waters of the East Sea, internationally widely known as the **Sea of Japan**.

Significance

- **Strategic Location:** Forms an important maritime space in Northeast Asia, connecting the Korean Peninsula, Japan and the Russian Far East.
- **Security:** Relevant to the strategic interactions among North Korea, South Korea, Japan and Russia.

- **Maritime Trade:** Supports regional shipping and economic activity.
- **Fisheries:** Important fishing grounds and marine resources support coastal economies.
- **Geopolitics:** Its location makes it significant for monitoring missile tests, naval activity and regional military movements.

About

- **Location:** Marginal sea of the western Pacific Ocean.
- **Boundaries:** Located between the Korean Peninsula, Japanese archipelago and Russian Far East.
- **Countries bordering it:** North Korea, South Korea, Japan and Russia.

Major connecting straits:

- **Tsushima (Korea) Strait** – connects with the East China Sea.
- **Tsugaru Strait** – connects with the Pacific Ocean.
- **La Pérouse (Soya) Strait** – connects with the Sea of Okhotsk.
- **Tatar Strait** – connects towards the Sea of Okhotsk.
- **Major Current:** Tsushima Current, a warm branch of the Kuroshio system, enters through the Korea/Tsushima Strait.
- **Terminology:** “East Sea” is the name used by South Korea; “Sea of Japan” is the internationally predominant English name.

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3.2 A Regional Bloc with Wider Geopolitical Linkages

Why in News?

The four Visegrád countries recently supported India's bid for permanent membership of the UN Security Council at the first V4+India Foreign Ministers' Meeting, held on the sidelines of the 81st UN General Assembly in New York.

What is the Visegrád Group?

- The Visegrád Group (V4) is a regional cooperation platform of four Central European countries.
- It was established in 1991 in the Hungarian city of Visegrád.
- It promotes cooperation in political, economic, security, cultural and other areas.
- The name derives from Visegrád, a town in Hungary where the leaders met in 1991
- Visegrád Group (V4): Regional grouping of Czech Republic, Hungary, Poland and Slovakia.

3.3 BRICS New Delhi Declaration 2026: Strengthening Global South Multilateralism

Why in News?

The 18th BRICS Summit was held in New Delhi on 12–13 September 2026 under India's chairship. The summit adopted the New Delhi Declaration, focusing on reform of global governance, economic resilience, technology, climate change, health and food security.

Key Focus Areas

- **Reformed Multilateralism:** Called for greater representation of developing countries in the UNSC, IMF and WTO.
- **Economic Resilience:** Promoted local currency settlements, payment interoperability and NDB financing.
- **Trade Governance:** Supported restoration of the WTO's two tier dispute settlement mechanism and opposed unilateral trade barriers.
- **Technology:** Proposed cooperation on AI governance and Digital Public Infrastructure (DPI).
- **Resource Security:** Focused on critical minerals, energy transition and resilient supply chains.
- **Food Security:** Proposed a BRICS Grain Exchange and established BRICS AGRIN.
- **Health Security:** Proposed an infectious disease early warning mechanism and a BRICS mental health Centres of Excellence network, coordinated by NIMHANS, Bengaluru.
- **Employment:** Launched BRICS CONNECT for skills and employability amid green and digital transitions.

Significance for India

- **UNSC Reform:** Reinforces India's demand for greater representation in global governance.

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- **Global South Leadership:** Provides India a platform to articulate developing country concerns.
- **Digital Diplomacy:** Creates avenues for internationalising India's DPI experience.
- **Energy Security:** Cooperation on critical minerals supports India's clean energy transition.
- **Strategic Autonomy:** Enables India to engage with emerging economies while maintaining partnerships across other multilateral platforms.

3.4 Global 6G Network Coalition

Why in News?

India has joined a US-led coalition of 26 countries to coordinate the development of secure, competitive and interoperable 6G networks, ahead of expected commercial deployment in the 2030s.

Global 6G Coalition

Aspect	Key Facts
Lead Country	United States
Lead Agency	National Telecommunications and Information Administration (NTIA)
Members	26 countries, including India, US, UK, Germany and Japan
Core Focus	6G security, interoperability,

	competitiveness and innovation
Timeline	Commercial deployment expected in the 2030s
Broader Areas	Semiconductors, AI, data centres and robotics

India's Bharat 6G Vision

Aspect	Key Fact
Launched	March 2023
Ministry	Department of Telecommunications, Ministry of Communications
Vision	Make India a frontline contributor to 6G technology
Target	Design, develop and deploy 6G technologies by 2030
Focus Areas	Indigenous R&D, standards, spectrum, industry-academia collaboration and global partnerships
Institutional	Bharat 6G Mission

Significance for India

- **Technology Leadership:** Enables Indian researchers, start-ups and telecom companies to participate in global 6G technology and standards development.
- **Strategic Autonomy:** Cooperation in telecom, semiconductors and AI can

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strengthen India's technological resilience and reduce critical dependencies.

- **Digital Economy:** 6G can enable advanced applications involving AI, IoT, immersive communication, robotics and intelligent systems.

Challenges

- **High R&D Costs:** 6G requires substantial investment in advanced chips, AI-native networks, spectrum technologies and next-generation infrastructure.
- **Security & Supply Chains:** Highly interconnected networks increase exposure to cyberattacks, technological dependencies and supply-chain disruptions.
- **Global Standards:** Differences in spectrum allocation, technical standards and national priorities can hinder interoperability and global deployment.

Way Forward

- **Boost Indigenous R&D:** Increase public-private investment and strengthen industry-academia collaboration to develop indigenous 6G technologies.
- **Build Secure Ecosystems:** Integrate cybersecurity, trusted supply chains and data protection into 6G architecture from the design stage.
- **Shape Global Standards:** Actively participate in international standard-setting and strengthen partnerships to ensure India's interests are reflected in global 6G norms.

3.5 India-Japan Defence Cooperation: From Strategic Convergence to Operational Convergence

Why in News?

Japanese Defence Minister Shinjiro Koizumi's visit to India highlighted a shift in India-Japan defence relations from institutional cooperation towards operational interoperability, defence technology transfer and joint capability development.

Aspect	Key Fact
Strategic Partnership	India-Japan Special Strategic and Global Partnership
Security Foundation	2008 Joint Declaration on Security Cooperation
2+2 Dialogue	Foreign and Defence Ministers
ACSA	Signed in 2020; entered into force in 2021
Defence Technology Agreement	Defence Equipment and Technology Cooperation Agreement, 2015
Key Focus	Maritime security, interoperability, defence technology and logistics

Significance

- **Indo-Pacific Security:** Supports cooperation for a free, open and rules-based Indo-Pacific.
- **Maritime Domain Awareness:** Information-sharing and naval

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cooperation strengthen monitoring of maritime activity and critical sea lanes.

- **Defence Industrialisation:** Japanese technology and Indian manufacturing capabilities create scope for joint production and technology development.

Major India–Japan Military Exercises

Exercise	Service	Started	Key Focus
JIMEX	Navy	2012	Maritime operations, interoperability and naval manoeuvres
Dharma Guardian	Army	2018	Joint operations, counter-terrorism and tactical interoperability
Veer Guardian	Air Force	2023	Fighter operations, air combat tactics and aerial interoperability

3.6 India–Russia Engagement in the Far East

Why in News?

The Eastern Economic Forum (EEF) has gained attention as a platform for economic cooperation, investment and development of Russia's Far East.

What is EEF?

- Eastern Economic Forum (EEF) is an international forum focused on the

economic development of Russia's Far East.

- Established: 2015.
- Held annually: Vladivostok, Russia.
- Hosted by: Russia.
- Venue: Far Eastern Federal University, Vladivostok.
- It brings together governments, businesses, investors and experts to promote investment and economic cooperation.

Significance of Russia's Far East

Factor	Significance
Geography	Russia's gateway to the Asia-Pacific region
Natural Resources	Rich in oil, gas, coal, timber and minerals
Maritime Access	Direct access to the Pacific Ocean
Arctic Link	Important for the Northern Sea Route (NSR) and Arctic connectivity
Asia-Pacific Markets	Geographical proximity to China, Japan and the Korean Peninsula
Strategic Location	Links Russia's European and Asian economic dimensions

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India & EEF

Key Areas of Cooperation

- **Energy:** Oil, gas and other energy resources.
- **Mining:** Cooperation in resource-rich regions.
- **Transport connectivity:** Development of alternative routes between India and Russia.
- **Arctic cooperation:** Increasing relevance of the Northern Sea Route.
- **Defence:** Complements wider India–Russia defence cooperation.
- **Trade & investment:** Diversification of bilateral economic relations.

EEF vs SPIEF

Feature	EEF	SPIEF
Full form	Eastern Economic Forum	St. Petersburg International Economic Forum
Location	Vladivostok	St. Petersburg
Established	2015	1997
Primary focus	Development of Russian Far East	Broader Russian and global economic issues
Geographic orientation	Asia-Pacific / Far East	Europe + Global

Challenges

- **Geographical Remoteness:** Large distances increase transportation and logistics costs.
- **Harsh Climate:** Extreme climatic conditions raise infrastructure and operational costs.
- **Infrastructure Deficit:** Limited transport, logistics and supporting infrastructure constrain development.

Way Forward

- **Connectivity Corridors:** Strengthen India–Russia transport and logistics connectivity.
- **Energy Partnerships:** Expand cooperation in energy and natural resources.
- **Infrastructure Cooperation:** Promote joint investment in ports, transport and logistics.
- **Sustainable Development:** Ensure environmentally responsible and sustainable resource utilisation.

3.7 Luxembourg: Small Country, Big Strategic Significance

Why in News?

During a visit to India, Luxembourg's Deputy Prime Minister and Foreign Minister supported India's permanent membership of

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the UN Security Council, highlighting the growing India–Luxembourg partnership.

Geographical Location

- Continent: Europe
- Region: Western/Northwestern Europe
- Type: Landlocked country
- Capital: Luxembourg City
- Located between Belgium, Germany and France.

Neighbours

- North & West → Belgium
- East → Germany
- South → France

Major Physical Features

Oesling

- Located in northern Luxembourg.
- Forms part of the Ardennes region.
- Characterised by forested and hilly terrain.
- Higher elevation than southern Luxembourg.

Gutland / Bon Pays

- Covers most of southern and central Luxembourg.
- Relatively lower and more fertile terrain.
- More densely populated and agriculturally productive.

Major Rivers

River	Key Feature
Sûre (Sauer)	Longest river in Luxembourg; forms part of the Luxembourg–Germany border and joins the Moselle

Alzette	Major river flowing through Luxembourg City; tributary of the Sûre
Moselle	Forms the natural border between Luxembourg and Germany in the southeast

Strategic Significance for India

- **UNSC Reform:** Luxembourg's support for India's permanent membership contributes to India's diplomatic engagement on UN Security Council reform.
- **European Partnership:** Luxembourg is an important EU member state and provides another channel for India's engagement with Europe.
- **Financial Cooperation:** Luxembourg's role as a major international financial and investment fund centre creates scope for cooperation in investment and financial services.
- **India–EU Engagement:** Bilateral ties can complement wider India–EU cooperation in trade, investment, technology and green transition.
- **Multilateral Cooperation:** Both countries engage through multilateral institutions and can cooperate on issues relating to rules based international cooperation and institutional reform.

3.8 MERCOSUR Group

Why in News?

In September 2026, India and MERCOSUR signed the First Additional Protocol to the

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India–MERCOSUR Preferential Trade Agreement (PTA) to facilitate the acceptance of electronic Certificates of Origin (eCoO).

What is MERCOSUR?

- MERCOSUR (Mercado Común del Sur / Southern Common Market) is a South American regional economic and trade bloc.
- Established: Treaty of Asunción, 1991
- Legal/institutional framework: Protocol of Ouro Preto, 1994
- Headquarters: Montevideo, Uruguay
- Objective: Promote regional economic integration through the movement of goods, services, people and capital.

Institutional Structure

Common Market Council (CMC)

- Highest decision making body of MERCOSUR.
- Coordinates broad foreign and economic policies.
- Comprises the foreign and economic ministers (or equivalents) of member states.
- Decisions are generally taken by consensus.
- Presidency : Rotates among full members every six months.

India–MERCOSUR

- India and MERCOSUR signed a Preferential Trade Agreement (PTA) in 2004.
- The agreement provides preferential market access for selected products.
- The First Additional Protocol (2026) focuses on facilitating the acceptance of electronic Certificates of Origin.

What is a Certificate of Origin?

- A Certificate of Origin (CoO) certifies the country in which a product originates.
- It is important for determining whether imported goods qualify for preferential tariff treatment under a trade agreement.
- Electronic CoO → faster verification → lower paperwork → easier utilisation of PTA benefits.

Significance for India

- **Trade facilitation:** Reduces documentation and administrative burden.
- **Faster customs procedures:** Electronic verification can facilitate smoother clearance.
- **Better utilisation of PTA:** Makes it easier for eligible Indian exporters to claim preferential tariffs.
- **Export diversification:** Strengthens India's commercial engagement with South America.

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- **Digital trade facilitation:** Supports greater adoption of paperless trade procedures

Members of MERCOSUR

Category	Countries
Full Members	Argentina, Brazil, Paraguay, Uruguay, Bolivia
Suspended Member	Venezuela
Associate Members	Chile, Colombia, Ecuador, Guyana, Peru, Suriname

3.9 OECD (Organisation for Economic Co-operation and Development)

Why in News?

The OECD's September 2026 Interim Economic Outlook projected global GDP growth at 2.9% in 2026 and 3.0% in 2027. It projects India's growth at 7.1% in FY 2026–27, following 7.8% in FY 2025–26. OECD

The OECD also released Education at a Glance 2026 on 29 September 2026, with a special focus on teacher shortages. OECD

What is OECD?

- **Full Form:** Organisation for Economic Cooperation and Development
- **Established:** 1961
- **Predecessor:** Organisation for European Economic Cooperation (OEEC),

established in 1948 to administer the Marshall Plan.

- **Headquarters:** Paris, France
- **Nature:** Intergovernmental organisation; not a UN agency.
- **Official Languages:** English and French.
- **Core objective:** Promote policies and international standards that improve economic and social wellbeing, through evidence, policy comparison and peer learning.

Membership

- The OECD currently has 38 member countries.
- Costa Rica became the 38th member on 25 May 2021, following Colombia's accession in 2020.
- Accession candidate countries currently listed by the OECD: Argentina, Brazil, Bulgaria, Croatia, Indonesia, Peru, Romania and Thailand.

India and OECD

- India has been an OECD Key Partner since 2007, alongside Brazil, China, Indonesia and South Africa. India participates in selected
- OECD committees and subsidiary bodies.

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Major areas of cooperation:

- Economic policy
- Trade and investment
- Corporate governance
- Anticorruption
- Sustainable development
- G20related policy cooperation

Major Areas of Work

- **Economic Policy:** OECD Economic Outlook tracks global and national economic trends.
- **Taxation:** BEPS Inclusive Framework addresses tax avoidance and profit shifting by multinational enterprises.
- **Education:** PISA assesses educational performance and Education at a Glance provides comparative education statistics.
- **AntiCorruption:** OECD Anti Bribery Convention.

Important OECD Reports

Report Database	Key Focus
OECD Economic Outlook	Global and national economic growth, inflation and policy trends
PISA	International assessment of education systems and student performance
Education at a Glance	Comparative education statistics and indicators

Global Report	Debt Sovereign borrowing, debt markets and financing trends
OECD Data	Cross-country economic, social and policy indicators

OECD Economic Outlook – September 2026

- Global growth: 2.9% in 2026
- Global growth: 3.0% in 2027
- India: 7.1% growth in FY 2026–27
- OECD notes that stronger price pressures, weaker real incomes and higher interest rates could moderate growth, while AIrelated investment remains a supporting factor.

OECD - Education at a Glance 2026

- Released: 29 September 2026
- Special focus: Teacher shortages
- OECD data indicate that 9.1% of primary and secondary teachers were not fully qualified in OECD countries, while 6.4% of fully qualified teachers left the profession during 2024/25.

OECD - Governance Structure

- **Council:** Highest governing body; representatives of all member countries.
- **Committees:** More than 300 committees and working groups dealing with specialised policy areas.
- **Secretariat:** Provides research, analysis and administrative support and is headed by the Secretary General.

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- **Secretary General:** Mathias Cormann.
- **European Union:** Participates in OECD work but is not an OECD member and does not have voting rights as a member country.

3.10 Organisation of Islamic Cooperation (OIC)

Why in News ?

The Organisation of Islamic Cooperation (OIC) issued remarks on Jammu & Kashmir, which India rejected, stating that the OIC has no locus standi to comment on India's internal affairs.

What is OIC?

- **Established:** 1969
- **Nature:** Intergovernmental organisation
- **Members:** 57 countries across four continents
- **Headquarters:** Jeddah, Saudi Arabia
- **Official Languages:** Arabic, English and French
- **Role:** Collective platform of Muslim-majority countries for political, economic and social cooperation.

Institutional Structure

Institution	Role
Islamic Summit Conference	Supreme policymaking authority; meets every 3 years
Council of Foreign Ministers	Coordinates policies and implements Summit decisions; meets annually

General Secretariat	Executive and administrative body
IPHRC	Independent human-rights body established in 2011

Important OIC Institutions

Institution	Full Name	Key Focus
ISDB	Islamic Development Bank	Development financing and economic development
ICESCO	Islamic World Educational, Scientific and Cultural Organization	Education, science and culture
SESRIC	Statistical, Economic and Social Research and Training Centre for Islamic Countries	Economic and social research, statistics and training

India-OIC Relations

- 1969: India was invited to the inaugural OIC Summit in Rabat but was subsequently disinvited.
- 2019: India participated as Guest of Honour at the OIC Council of Foreign Ministers meeting in Abu Dhabi.
- India maintains strong bilateral relations with several OIC members, particularly Gulf countries.

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- India rejects the OIC's attempts to comment on Jammu & Kashmir, considering such remarks interference in India's internal affairs.

3.11 RAKSHA – Defence Diplomacy

Document

Why in News?

The Defence Minister released RAKSHA, a strategic document providing a 10-year roadmap for India's global defence partnerships.

Aim

To transform defence diplomacy from ad-hoc military engagement into a long-term strategic instrument for:

- **Strategic Partnerships:** Deepen bilateral and multilateral defence cooperation.
- **Capacity Building:** Expand military exercises, training, institutional exchanges and best-practice sharing.
- **Defence Exports:** Promote Make in India and position India as a defence manufacturing and export hub.
- **Maritime Security:** Strengthen India as a Net Security Provider and First Responder, particularly in the Indian Ocean Region.

3.12 Recasting Global Governance through Global South Cooperation

Why in News?

China has proposed the 'POWER' framework ahead of the 18th BRICS Summit in New Delhi to deepen cooperation among BRICS

countries and strengthen the voice of the Global South.

Five Pillars – POWER

Letter	Pillar	Key Focus
P	Principle	Sovereign equality, UN Charter and peaceful settlement of disputes
O	Openness	Open trade and strengthening the multilateral trading system
W	Win-Win	Development-oriented cooperation and greater use of local currencies
E	Engine	Growth through AI, digital infrastructure and green technologies
R	Responsibility	Greater Global South representation and reform of global institutions

Significance for India

- **Strategic Autonomy:** Strengthens India's pursuit of strategic autonomy.
- **Global Governance Reform:** Supports India's demand for UNSC and Bretton Woods reforms.

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- **Emerging Technologies:** Creates opportunities in AI and digital public infrastructure.
- **Critical Minerals:** Facilitates cooperation for secure and diversified mineral supplies.
- **Global South Leadership:** Provides a platform for India to shape the Global South agenda.

3.13 Red Sea Insecurity and the Geopolitics of Maritime Chokepoints

Why in News?

Houthi military activity around Yemen's Red Sea coast has renewed attention to maritime security around the Bab-el-Mandeb Strait.

What are the Houthis?

- **Houthis (Ansar Allah):** Political and armed movement originating in northern Yemen.
- Emerged from Yemen's Zaydi Shia community.
- Became a major actor in Yemen's civil conflict.
- Controls significant territory in northern and western Yemen, including Sana'a.

Core Issue

- Houthi attacks and maritime activity demonstrate how a regional conflict can disrupt global commerce due to the strategic location of Yemen near the Bab-el-Mandeb.
- The key challenge is to protect freedom of navigation and commercial shipping while preventing further regional escalation.

Significance

Dimension	Significance
Strategic Chokepoint	Bab-el-Mandeb connects the Red Sea with the Gulf of Aden.
Global Trade	Forms part of the maritime route connecting the Indian Ocean → Red Sea → Suez Canal → Mediterranean Sea.
Energy Security	Disruption can affect the movement of oil and other energy commodities.
Regional Security	Connects Yemen's internal conflict with wider West Asian geopolitical tensions.
Supply Chains	Prolonged insecurity can force vessels to take longer routes, increasing shipping time, freight costs and insurance premiums.

3.14 SCO 2.0: India in the Emerging Eurasian Order

Why in News?

The 26th SCO Council of Heads of State Summit concluded in Bishkek, Kyrgyzstan, with the adoption of the Bishkek Declaration.

About SCO

- SCO: Shanghai Cooperation Organisation.
- It is a Eurasian regional organisation focusing on security, economic and developmental cooperation.

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- India became a full member in 2017.
- Founding members: China, Kazakhstan, Kyrgyzstan, Russia, Tajikistan and Uzbekistan.
- India and Pakistan joined as full members in 2017.

Key Points

- Host: Bishkek, Kyrgyzstan.
- Summit Chair: Sadyr Japarov.
- Presidency: Handed over to Pakistan for 2026–27.
- Theme: “25 Years of the SCO: Together for Sustainable Peace, Development and Prosperity.”

Major Outcomes

- **Counter-Terrorism:** Condemned terrorism in all its forms and manifestations.
- **Sovereignty & Territorial Integrity :** Reaffirmed respect for sovereignty, territorial integrity and political independence of states.
- **Not a Military Alliance:** Its cooperation covers security, economic, cultural, technological and developmental areas.
- **De-dollarisation / Local Currencies :** This can reduce dependence on dominant international currencies and strengthen financial cooperation among member states.
- **Connectivity:** Support for major connectivity initiatives such as China–Kyrgyzstan–Uzbekistan (CKU) railway, International North-South Transport Corridor (INSTC)

Significance for India

- **Eurasian Engagement :** SCO provides India with an important platform to engage with Central Asia, Russia and China within a multilateral framework.
- **Counter-Terrorism :** The SCO's focus on terrorism is particularly relevant to India's security concerns.
- **Connectivity to Central Asia :** Initiatives such as the INSTC can help India overcome its geographical constraints in accessing Central Asian markets.

Major Eurasian Connectivity Corridors

Corridor / Initiative	Route / Countries	Significance
INSTC	India–Iran–Caspian Sea–Russia–Europe	Alternative connectivity to Eurasia; facilitates trade and reduces dependence on traditional routes.
China–Kyrgyzstan–Uzbekistan (CKU) Railway	China–Kyrgyzstan–Uzbekistan	Strengthens China–Central Asia connectivity and regional trade.

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CPEC	China–Pakistan–Gwadar	Flagship BRI corridor; India objects to its passage through Pakistan-occupied Jammu & Kashmir.
Middle Corridor	China–Central Asia–Caspian Sea–Caucasus–Türkiye–Europe	Alternative east–west Eurasian trade route, reducing reliance on routes through Russia.
Trans-Caspian International Transport Route (TITR)	China–Central Asia–Caspian Sea–Caucasus–Europe	Promotes multimodal connectivity across the Caspian region.
Ashgabat Agreement	Central Asia–Iran–Oman	Facilitates transport connectivity between Central Asia and the Persian Gulf;

		India joined in 2018.
Lapis Lazuli Corridor	Afghanistan–Turkmenistan–Caspian Sea–Azerbaijan–Georgia–Türkiye	Connects Afghanistan with European markets through Central Asia and the Caucasus.
China–Central Asia–West Asia Economic Corridor	China–Central Asia–West Asia	BRI-linked corridor promoting trade, infrastructure and regional connectivity.

3.15 Strengthening India–Sri Lanka Maritime Interoperability

Why in News?

- The 13th edition of the Sri Lanka–India bilateral naval exercise, SLINEX-26, was conducted at Visakhapatnam from 17–21 September 2026.
- It was conducted under the operational supervision of the Indian Navy's Eastern Naval Command.

What is SLINEX?

- SLINEX = Sri Lanka–India Naval Exercise. It is an annual bilateral maritime

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exercise between the Indian Navy and Sri Lanka Navy.

- The exercise was conceptualised in 2005 and has evolved into a platform for maritime cooperation, interoperability and professional exchange.

Participating Ships

India

- INS Kavaratti – indigenous Anti-Submarine Warfare (ASW) Corvette.
- INS Jyoti – Fleet Tanker.

Sri Lanka

- SLNS Sindurala – Offshore Patrol Vessel.

Phase	Key Activities
Harbour Phase	Professional interactions, Cross-deck visits, Sharing of naval best practices, Subject-matter expert exchanges, Sports and cultural activities
Sea Phase	Tactical manoeuvring, Live surface-firing exercises, Anti-piracy operations, Cross-deck helicopter manoeuvres, Coordinated maritime operations

3.16 West Bank: Israeli Settlement Expansion and the Two-State Solution

Why in News?

The United Kingdom announced an import ban on goods from Israeli settlements in the occupied territories, along with measures

targeting entities and individuals involved in settlement expansion.

About the West Bank

- The West Bank is a landlocked territory in West Asia, located west of the Jordan River and bordering Israel and Jordan.
- It is internationally regarded as part of the Occupied Palestinian Territory, and its future status is central to negotiations over a Palestinian state.

Oslo II and the Three Areas

The 1995 Oslo II Interim Agreement divided the West Bank into Areas A, B and C as an interim administrative arrangement.

Area	Approx. Share of West Bank	Administrative Arrangement
Area A	18%	Palestinian civil and security administration
Area B	22%	Palestinian civil administration with Israeli-Palestinian shared security arrangements
Area C	60%	Full Israeli civil and security control

Area C is particularly significant because it contains all Israeli settlements and constitutes about 60% of the West Bank.

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Israeli Settlements

- Israeli settlements are civilian communities established by Israel in territories occupied since the 1967 Arab–Israeli War, including the West Bank and East Jerusalem.
- The UN Security Council, through Resolution 2334 (2016), stated that Israeli settlements in the Palestinian territory occupied since 1967, including East Jerusalem, have no legal validity under international law and constitute an obstacle to the two-state solution.

Why Settlement Expansion Matters?

- **Territorial Contiguity** : Expansion of settlements and associated infrastructure can fragment Palestinian-populated areas, creating difficulties for establishing a geographically contiguous Palestinian state. UN reporting has highlighted the fragmentation of Areas A and B within Area C.
- **Viability of Two-State Solution** : The two-state framework envisages Israel and an independent Palestinian state coexisting. Settlement expansion is therefore a major issue in debates over the territorial basis of such a settlement.
- **Control over Land and Resources** : Area C contains significant land and natural resources and remains under Israeli control, making its status important for Palestinian economic and infrastructure development.

- **International Law** : Settlement activity has remained a major issue in discussions involving the Fourth Geneva Convention, UN resolutions and international humanitarian law.

Significance for India

- **Strategic Balancing** : India maintains relations with Israel as well as the Palestinian Authority, requiring a balanced diplomatic approach.
- **West Asian Stability** : The Israel–Palestine conflict affects regional security, energy markets, trade routes and India's wider interests in West Asia.
- **Diaspora and Energy Interests** : The Gulf region hosts a large Indian diaspora and remains important for India's energy security and economic relations.

GEOGRAPHY

4.1 Glacial Lake Outburst Floods (GLOFs)

Why in News?

A catastrophic flood along the Nepal–Tibet border in August 2026 swept through the Bhotekoshi River corridor.

What is a GLOF?

A Glacial Lake Outburst Flood (GLOF) is the sudden release of a large volume of water from a glacial lake, generally following the failure of a natural moraine dam.

Formation

- **Glacier retreat**: Rising temperatures cause glaciers to retreat, leaving depressions that fill with meltwater.

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- **Moraine formation:** Rock, rubble and debris accumulate at the glacier's snout, forming a terminal moraine.
- **Lake formation:** Meltwater accumulates behind the natural moraine barrier.
- **Outburst:** Failure of the unstable barrier releases water, ice, boulders and sediment at high velocity.

Why the Himalayas are Highly Vulnerable?

- **Climate change:** Glacier retreat and increasing meltwater are altering the size and stability of glacial lakes.
- **Fragile geology:** Young and tectonically active mountains are prone to landslides, rockfalls and earthquakes.
- **Steep valleys:** Concentrate floodwater and debris into narrow downstream corridors.
- **Infrastructure concentration:** Hydropower projects, roads and settlements increase exposure.
- **Unplanned development:** Road cutting and construction on floodplains amplify disaster impacts.
- **Transboundary rivers:** Flood hazards can rapidly cross national boundaries, requiring regional earlywarning cooperation.

Recent Examples

Year	Event	Significance
2026	Bhotekoshi–Lhende Khola, Nepal–Tibet	Rock–ice collapse → debris flood; highlights cascading and transboundary Himalayan hazards

2025	Bhotekoshi River, Nepal	Supraglacial lake outburst caused severe flooding and damaged bridges, roads and hydropower infrastructure
2025	Nielangpu & Purepu, China–Nepal border	Successive supraglacial GLOFs demonstrated risks from unstable high-altitude glacial lakes
2024	Thame Valley, Nepal	Lake-to-lake cascading GLOF, where an upstream lake outburst triggered failure of a downstream lake
2023	South Lhonak Lake, Sikkim	Major GLOF in the Teesta basin; severely damaged infrastructure, including Teesta-III hydropower project
2021	Chamoli, Uttarakhand	Rock–ice avalanche/debris flow triggered a catastrophic flash flood, illustrating a compound mountain hazard

NDMA Mitigation Measures

- **Hazard Mapping:** Satellite imagery and Synthetic Aperture Radar (SAR) to identify and monitor potentially dangerous glacial lakes.

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- **Controlled Drainage:** Siphoning or engineered channels to reduce water levels in highrisk lakes where technically feasible.
- **Early Warning Systems:** Automatic waterlevel sensors, weather stations and downstream warning mechanisms.
- **Risk Sensitive Infrastructure:** Avoid critical infrastructure and settlements in highrisk flood corridors.

4.2 Gucchi Mushroom

Why in News?

Gucchi Marmik at BRICS 2026 dinner: What makes this rare Himalayan mushroom worth ₹40,000 per kg.

Key Features

- **Scientific name:** Morchella esculenta
- **Common name:** Morel mushroom
- **Appearance:** Distinctive honeycomblake cap with a pale, hollow stem.
- **Season:** Generally appears after snowfall and rainfall, particularly during the spring–early summer period.
- **Altitude:** Usually found above 2,000 metres.
- **Habitat:** Coniferous and deciduous forests, alpine and subalpine areas, and humusrich soils.

Distribution

- **India:** Mainly found in the Himalayan regions of: Jammu & Kashmir, Himachal Pradesh, Uttarakhand
- **Jammu & Kashmir:** Important collection areas include Doda, Rajouri, Poonch, Kishtwar, Kupwara and Ramban, with Doda traditionally associated with highquality gucchi.
- **Global:** Primarily distributed across the Northern Hemisphere; China has made significant progress in outdoor cultivation

Nutritional & Medicinal Value

- **Nutritional:** Contains proteins, fibre, carbohydrates, iron and vitamins, including B and D vitamins.
- **Bioactive properties:** Studies have reported antioxidant, antimicrobial.

4.3 Northern Sea Route (NSR)

Why in News?

The Northern Sea Route (NSR) is gaining strategic and commercial importance as a potential alternative maritime corridor between Europe and Asia, amid declining Arctic sea ice and growing interest in Arctic shipping.

What is the Northern Sea Route?

- The NSR is a maritime route along the Russian Arctic coast, connecting the Atlantic and Pacific Oceans.
- It runs from the Kara Gate in the west through the Russian Arctic waters to the Bering Strait in the east.

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- Approximate length: 5,600 km.
- The Bering Strait provides the maritime connection between the Arctic Ocean and the Pacific Ocean.

Why is it Important?

- **Shorter Europe–Asia Route:** Provides a potentially shorter maritime link between Northern Europe and East Asia compared with the traditional Suez Canal route.
- **Reduced Sailing Time:** Shorter distances can lower fuel consumption, voyage time and transportation costs under suitable ice conditions.
- **Arctic Resources:** Provides access to Russia's Arctic region, which is rich in oil, natural gas and mineral resources.
- **Strategic Significance:** Enhances Russia's economic and geopolitical importance in the Arctic.
- **Changing Climate:** Declining seasonal sea ice is increasing the period during which parts of the route may be navigable.
- **India's Interest:** Greater Arctic shipping could influence India's energy security, trade routes and engagement with Russia and the Arctic region.

Challenges

- **Extreme Climate:** Severe cold, storms and rapidly changing weather conditions.

- **Ice Conditions:** Seasonal and unpredictable sea ice can restrict navigation.
- **Limited Infrastructure:** Ports, search-and-rescue facilities and emergency services remain limited in several Arctic areas.
- **Environmental Risks:** Shipping activity can increase risks to fragile Arctic ecosystems.
- **Geopolitical Concerns:** Most of the route lies within Russian Arctic waters, making sovereignty, navigation rights and international geopolitics important considerations.

4.4 Mount Anak Krakatau

Why in News?

Intense volcanic activity at Mount Anak Krakatau generated ash clouds, highlighting the continuing volcanic and tsunami hazards associated with the Sunda Strait.

Location & Tectonic Setting

- **Location:** Sunda Strait, between Java and Sumatra, Indonesia.
- **Tectonic setting:** Part of the Sunda volcanic arc, formed by the subduction of the Indo Australian Plate beneath the Sunda/Eurasian Plate system.
- **Pacific Ring of Fire:** Indonesia lies within this globally active belt of earthquakes and volcanoes.

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- **Krakatau Caldera:** Anak Krakatau emerged within the caldera left by the catastrophic 1883 Krakatau eruption.
- **Origin:** Began emerging above the sea in 1927 and has continued to grow through repeated eruptions.
- **Type:** Active stratovolcano.
- **Meaning:** Anak Krakatau means “Child of Krakatau.”

Why is it Geographically Important?

- **Subduction volcanism:** Demonstrates the link between convergent plate boundaries and volcanic activity.
- **Island arc formation:** Part of the Indonesian volcanic island arc system created by plate convergence.

Feature	Krakatau	Anak Krakatau
Location	Sunda Strait, Indonesia	Sunda Strait, Indonesia
Major event	1883 catastrophic eruption	Emerged after the 1883 eruption
Nature	Volcanic island/volcano complex	Active volcanic cone/stratovolcano
Origin	Pre-existing volcanic system	New cone formed within the Krakatau caldera

Significance	Famous for the devastating 1883 eruption and tsunami	Continuing volcanic activity and island growth
Meaning	Krakatau	“Child of Krakatau”

4.5 Paniya Tribe

Why in News?

The Paniya tribe is among the major Scheduled Tribe communities of the Western Ghats, with its largest concentration in Wayanad, Kerala.

Key Features

- **Distribution:** Primarily found in Wayanad (Kerala); also present in Kannur, Kozhikode and Malappuram. Their population also extends into Gudalur and Pandalur in Tamil Nadu and southern Kodagu in Karnataka.
- **Language:** Paniya, a Dravidian language closely associated with Malayalam.
- **Traditional Settlements:** Traditionally live in settlements consisting of bamboo huts with thatched roofs; houses may be single or double storied.
- **Religious Beliefs:** Traditionally worship Kali and the banyan tree.
- **Cultural Belief:** The banyan tree is considered sacred, and cutting it is

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traditionally believed to cause illness or misfortune.

4.6 Raja Mircha (Capsicum chinense)

Why in News?

Raja Mircha, also known as Naga King Chilli, has been highlighted for its exceptionally high pungency and its importance as a GI-tagged horticultural product of Northeast India.

Key Features

- **Other names:** Raja Mircha, Naga King Chilli, Bhut Jolokia.
- **Scientific name:** Capsicum chinense.
- **Origin/Association:** Primarily associated with Nagaland and Northeast India.
- **Pungency:** Can record over 1 million Scoville Heat Units (SHU), placing it among the world's hottest chillies.
- **Scoville Scale:** Measures the pungency of chilli peppers, expressed in Scoville Heat Units (SHU).
- **Colour:** Changes from green when immature to red at maturity.
- **Shape:** Subconical to conical, with thin flesh and finely wrinkled skin.
- **GI Tag:** Naga Mircha received GI registration in 2008.

ENVIRONMENT & ECOLOGY

5.1 Aadi Farmer Carbon Programme

Why in News?

India has recorded its first-ever soil carbon payments, with over 2,500 smallholder farmers in Punjab and Haryana receiving direct digital payments for internationally

certified carbon credits generated through climate-smart agricultural practices adopted during 2019–2022.

About the Programme

- **Implementing Entity:** Grow Indigo, an agritech joint venture between Mahyco and Indigo Ag.
- **Technical Guidance:** Indian Council of Agricultural Research (ICAR).
- **Objective:** To promote climate-smart agriculture while addressing stubble burning, groundwater depletion and farm incomes.
- **Carbon Standard:** Carbon credits are generated under Verra's VM0042 methodology, which provides a framework for quantifying GHG emission reductions and carbon sequestration from improved agricultural land management.
- **Farmer Share:** Farmers receive 75% of the net carbon revenue generated from the sale of credits.
- **Payments:** Participating farmers received approximately ₹3,000–₹15,000 through direct digital payments.

Regenerative Farming Practices

- **Direct Seeded Rice (DSR):** Reduces water use and can lower methane emissions compared with conventional flooded rice cultivation.
- **Crop Residue Management:** Avoids stubble burning and improves soil health.

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by retaining or incorporating crop residues.

- **Reduced/Minimum Tillage:** Limits soil disturbance, conserves moisture and reduces fuel consumption.

Environmental Impact

- During the 2019–2022 monitoring cycle, the programme reportedly:
- Saved around 45 billion litres of water.
- Kept over 2 lakh tonnes of crop residue out of fires.
- Avoided around 1,000 tonnes of PM2.5 emissions.

5.2 Bakhira Lake: 25,000-Year Record of Indian Monsoon Variability

Why in News?

Researchers reconstructed nearly 25,000 years of Indian Summer Monsoon (ISM) variability using magnetic minerals preserved in sediments beneath Bakhira Lake, Uttar Pradesh.

What Does the Sediment Record Reveal?

- **Last Glacial Maximum (LGM):** The coldest phase of the last Ice Age, characterised by extensive ice sheets and major changes in monsoon intensity.
- **Bølling-Allerød:** A relatively warm and humid phase during the transition from the last glacial period to the Holocene.
- **Younger Dryas:** A period of abrupt cooling that temporarily reversed the warming trend near the end of the last Ice Age.

- **Holocene Climatic Optimum:** A relatively warm period of the Holocene, associated with significant changes in Indian monsoon behaviour.
- **Late Holocene:** The sediment record indicates a shift towards relatively drier conditions, reflecting longterm changes in monsoon strength and regional hydrology.

5.3 Bhoramdev Wildlife Sanctuary

Why in News?

The Bhoramdev Wildlife Sanctuary in Chhattisgarh is planning to use soundrecording technology to monitor birds and other wildlife by recording and analysing their vocalisations.

Key Features

- **Location:** Kawardha (Kabirdham) district, Chhattisgarh.
- **Physiography:** Located in the Maikal Range, which forms part of the Satpura hill system.
- **Wildlife Corridor:** Lies within the Kanha–Achanakmar corridor, connecting Kanha National Park (Madhya Pradesh) with Achanakmar Wildlife Sanctuary (Chhattisgarh).
- **River:** The Sakari River flows through the sanctuary and provides an important water source for wildlife.
- **Ecological importance:** The forest landscape provides habitat and movement corridors for diverse wildlife.

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Bhoramdeo Temple Connection

- The sanctuary derives its name from the Bhoramdeo Temple.
- The temple is associated with the Nagvanshi dynasty and is generally dated to the 11th century.
- Dedicated to Lord Shiva.
- Often described as the “**Khajuraho of Chhattisgarh**” because of its intricate erotic and other sculptural carvings.

New Wildlife Monitoring Approach

- **Bioacoustic monitoring:** Recording animal and bird sounds can help identify species and monitor changes in wildlife activity.
- **Noninvasive technique:** Wildlife can be monitored without physically capturing or disturbing animals.
- **Longterm monitoring:** Repeated recordings can help assess species presence, abundance and habitat changes.

5.4 Blue Bonds: Financing India's Transition from Maritime Potential to Blue Economy

Why in News?

India is preparing for its first blue bond, with Sagarmala Finance Corporation Limited (SFCL) planning a blue bond issue to mobilise finance for sustainable marine and coastal activities.

What are Blue Bonds?

- Blue bonds are debt instruments through which governments, financial institutions

or other issuers raise capital for projects that promote the sustainable use and conservation of marine and water resources.

- Seychelles issued the world's first sovereign blue bond in 2018.

Potential Areas of Investment

- **Clean Ports:** Financing electrification, renewable energy and low-emission port infrastructure.
- **Sustainable Fisheries:** Supporting responsible fishing practices, modernisation and sustainable value chains.
- **Wastewater Management:** Reducing the flow of untreated waste and pollutants into marine ecosystems.
- **Marine Ecosystem Restoration:** Supporting restoration of mangroves, coral reefs, seagrass ecosystems and other coastal habitats.

Instrument	Primary Focus	Key Point
Green Bonds	Environmental and climate-friendly projects	Renewable energy, clean transport, energy efficiency, pollution control
Blue Bonds	Oceans and marine ecosystems	Sustainable fisheries, marine

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		conservation, coastal resilience
Social Bonds	Social-development projects	Healthcare, education, affordable housing, employment
Sustainability Bonds	Both environmental and social objectives	Combines Green + Social bond purposes
Sustainability-Linked Bonds (SLBs)	Issuer's sustainability performance	Bond terms can be linked to pre-defined sustainability targets
Climate Bonds	Climate mitigation and adaptation	Financing projects that address climate change
Transition Bonds	Financing transition of high-emission sectors	Helps carbon-intensive industries move towards lower emissions
Catastrophe Bonds (Cat Bonds)	Disaster-risk financing	Transfers specified disaster risks from insurers/governments to investors
SDG Bonds	Sustainable Development Goals	Funds projects aligned with

		specific UN SDGs
Pandemic Bonds	Pandemic/emergency preparedness	Designed to mobilise funds during major disease outbreaks

5.5 Boma-Badingilo Migratory Landscape

Why in News?

The Boma-Badingilo Migratory Landscape was inscribed on the UNESCO World Heritage List in 2026, becoming South Sudan's first World Heritage property. It was inscribed under the emergency procedure and simultaneously placed on the List of World Heritage in Danger.

Key Features

- **Location:** South Sudan, at the interface of the Sudd wetland system and the East Sudanian Savanna.
- **Components:** Includes Boma National Park, Badingilo National Park and surrounding floodplains and savanna landscapes.
- **Area:** About 11.24 million hectares.
- **Ecosystems:** Seasonally flooded grasslands, wetlands, floodplains, woodlands and savannas.
- **Migration:** Supports one of the world's largest remaining terrestrial mammal migrations, involving an estimated 6 million animals.

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- **Key migratory species:** Whiteeared Kob, Tiang and Mongalla Gazelle. UNESCO World Heritage Centre

UNESCO Status

- The site was inscribed under three natural criteria: (vii), (ix) and (x):
- **(vii):** Exceptional natural phenomenon — spectacular wildlife migration.
- **(ix):** Ongoing ecological and biological processes, particularly largescale ungulate migration.
- **(x):** Important habitats for insitu conservation of biodiversity. UNESCO World Heritage Centre

5.6 Buellia maharajensis

Why in News?

A new species of lichen, *Buellia maharajensis*, has been discovered in Mathikettan Shola National Park, Idukki, Kerala. The species was formally described in the journal *Taiwania* in September 2026.

Key Features

- **Type:** New species of lichen.
- **Genus:** *Buellia*.
- **Habitat:** Saxicolous — grows directly on rock surfaces.
- **Location:** Mathikettan Shola National Park, Idukki, Kerala.
- **Elevation:** Recorded at approximately 1,351 m.
- **Family:** Caliciaceae.
- **Name:** *maharajensis* was given in honour of Maharaja's College, Ernakulam,

recognising its contribution to biodiversity research.

About Lichens

- Lichens are a symbiotic association between a fungus and a photosynthetic partner, usually an alga or cyanobacterium.
- The composite body of a lichen is called a thallus.
- Saxicolous: growing on rocks.
- Lichens can serve as bioindicators of environmental conditions, including air quality.

Mathikettan Shola National Park

- Located in the Western Ghats of Kerala.
- Part of the Cardamom Hills.
- The park is noted for rich lichen diversity.
- *Buellia maharajensis* is the fourth lichen species newly discovered from the park.

5.7 Changthang Wildlife Sanctuary

Why in News?

- Changthang Wildlife Sanctuary is an important highaltitude protected area of Ladakh, located on the Changthang Plateau.
- It is known for its cold desert ecosystem, High altitude lakes, pastoral communities and unique trans Himalayan wildlife.

Key Features

- **Location:** Leh district, Ladakh.
- **Physiography:** Changthang Plateau, part of the TransHimalayan region.

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- **Ecosystem:** Highaltitude cold desert, grasslands and wetlands.
- **Important Lakes:** Tso Moriri, Pangong Tso and Tso Kar.
- **Community:** Changpa – traditional pastoralists who rear yaks, sheep and goats.
- **Pashmina:** The Changra goat is an important source of highquality Pashmina wool.

Species	Common Name	IUCN Status
Snow Leopard	—	Vulnerable
Kiang	Tibetan Wild Ass	Least Concern
Black-necked Crane	—	Vulnerable
Tibetan Wolf	—	Least Concern
Wild Yak	—	Vulnerable
Bharal	Himalayan Blue Sheep	Least Concern
Tibetan Argali	Tibetan Wild Sheep	Near Threatened

5.8 Deltachion ravenshaw

Why in News?

A new clam species, Deltachion ravenshaw, has been discovered from the sandy intertidal

stretches of the Devi Estuary in Puri district, Odisha.

Key Features

- **Type:** New species of clam.
- **Scientific name:** Deltachion ravenshaw.
- **Habitat:** Sandy intertidal zone.
- **Location:** Devi Estuary, Puri, Odisha.
- **Ecosystem:** Estuarine and coastal ecosystem.
- **Taxonomic significance:** Adds to the documented molluscan biodiversity of Odisha's coast.

Habitat – Intertidal Zone

The intertidal zone is the coastal area that is:

- Exposed during low tide, and
- Submerged during high tide.

Such environments support organisms adapted to periodic exposure, changing salinity, tides and wave action.

5.9 Digital Growth vs Ecological Limits:

India's Data-Centre Challenge

Why in News?

India's rapidly expanding datacentre industry is projected to reach around 6.5 GW capacity by 2030. While supporting digitalisation and Allied growth, the sector is raising concerns over electricity demand, water consumption and urban environmental stress.

India's DataCentre Growth

Indicator	Status
Data-centre capacity, 2020	~520 MW
Capacity, 2026	~1.5 GW

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Projected capacity, 2030	~6.5 GW
Electricity consumption, 2024	~13 TWh
Projected electricity consumption, 2030	~57 TWh
Water use	A 100-MW data centre may consume ~2 million litres/day

What is the Ecological Concern?

- **Water stress:** Data centres require substantial quantities of water, particularly for cooling systems. Locating facilities in already waterstressed cities can intensify competition for freshwater.
- **Electricity demand:** Continuous operation of servers and cooling infrastructure creates high and roundtheclock electricity requirements.
- **Carbon emissions:** Where electricity is generated from fossil fuels, rising datacentre demand can increase associated GHG emissions.
- **Urban heat:** Concentration of large computing facilities and associated energy infrastructure can contribute to localised heat stress.

Way Forward

- **Waterefficient cooling:** Promote closedloop, liquid and other efficient cooling technologies suited to local conditions.
- **Nonpotable water:** Increase use of treated wastewater instead of freshwater wherever technically feasible.
- **Renewable energy:** Couple data centres with renewable power and storage to reduce carbon intensity.
- **Location planning:** Encourage new facilities in regions with adequate water and power availability, rather than concentrating them in stressed urban centres.

5.10 Dipturus dhritiae

Why in News?

Scientists from the Zoological Survey of India (ZSI) have discovered a new deep sea skate species, *Dipturus dhritiae*, from the Arabian Sea. It is commonly known as the Arabian skate.

Key Features

- **Scientific name:** *Dipturus dhritiae*
- **Common name:** Arabian skate
- **Type:** Deepsea skate, a group of cartilaginous fishes related to sharks.
- **Habitat:** Deepsea benthic environment, living on or near the ocean floor.
- **Distribution:** Arabian Sea.
- **Discoverers:** Scientists from the Zoological Survey of India (ZSI).

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What is a Skate?

- Skates are cartilaginous fishes, belonging to the same broad group as sharks and rays.
- They generally have a flattened body adapted to life on the seabed.
- Unlike most bony fishes, their skeleton is primarily made of cartilage.
- Deepsea skates inhabit dark, cold and high pressure marine environments.

5.11 India's Geothermal Energy Frontier

Why in News?

India has taken a significant step towards harnessing geothermal energy with the commissioning of two 1,000metre deep geothermal wells in Puga Valley, Ladakh. The wells are intended to support the development of a 1 MW demonstration scale geothermal power plant.

What is Geothermal Energy?

Geothermal energy is energy obtained from the Earth's internal heat.

Major sources of Earth's internal heat include

- **Primordial heat:** Heat retained from the formation of the Earth.
- **Radiogenic heat:** Heat produced by the radioactive decay of elements such as uranium, thorium and potassium.
- **Hydrothermal systems:** In tectonically active areas, groundwater enters

underground fractures, gets heated by hot rocks and forms geothermal reservoirs.

Why Puga Valley?

- Located in Ladakh, within a tectonically active Himalayan region.
- Puga is known for its geothermal springs and high geothermal activity.
- The presence of naturally occurring hot water and geothermal resources makes it suitable for geothermal exploration.
- The project can serve as a demonstration for future geothermal development in India.

India's Geothermal Potential

- The Geological Survey of India (GSI) has estimated India's theoretical geothermal potential at around 10.6 GW.
- Major geothermal resource areas include parts of the Himalayas, Ladakh, Western Ghats and other tectonically/geologically favourable regions.

5.12 Ingerana aizawl

Why in News?

A new species of frog, *Ingerana aizawl*, has been discovered from Hratdawng Stream on the campus of Mizoram University, Aizawl, Mizoram.

Key Features

- **Scientific name:** *Ingerana aizawl*
- **Taxonomic group:** Amphibia – Frog
- **Discovery site:** Hratdawng Stream, Mizoram University campus
- **Location:** Aizawl, Mizoram

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It highlights the rich but underexplored amphibian diversity of Northeast India.

Significance

- **Biodiversity hotspot:** Northeast India forms part of the Indo-Burma biodiversity hotspot and supports high amphibian diversity.
- **Indicator species:** Amphibians are sensitive to changes in water quality, habitat degradation and climate, making them useful ecological indicators.

5.13 Kamlang Tiger Reserve

Why in News?

Wildlife Trust of India (WTI) provided field gear to frontline staff of Kamlang Tiger Reserve in Arunachal Pradesh to strengthen wildlife protection and patrolling.

Key Features

- **Location:** Arunachal Pradesh, near the India–Myanmar international border.
- **Ecological Significance:** Part of the Eastern Himalayas Biodiversity Hotspot and an important landscape for biodiversity conservation.
- **Origin of Name:** Named after the Kamlang River, which flows through the reserve and ultimately forms part of the Brahmaputra river system.
- **Neighbouring Protected Area:** Shares its southern boundary with Namdapha National Park.

Boundaries:

- North: Lang River

- West: Lati River
- East: Tawe River

Landscape: Includes tropical forests, grasslands, riverine ecosystems and hilly terrain, supporting diverse flora and fauna

5.14 Kawal Tiger Reserve

Why in News?

Kawal Tiger Reserve (KTR) is an important tiger habitat and wildlife corridor in the northeastern part of Telangana, forming a vital link with tiger landscapes of central India.

Key Features

- **Location:** Northeastern Telangana, mainly in the Mancherial and Nirmal districts.
- **Landscape:** Forms part of the Deccan Peninsula landscape and lies at the southern edge of the Central Indian Tiger Landscape.
- **Tiger Corridor:** Provides habitat connectivity with:
- **North:** Tadoba Andhari Tiger Reserve, Maharashtra
- **East:** Indravati Tiger Reserve, Chhattisgarh
- **River System:** Acts as an important catchment for the Godavari River.
- **Drainage:** Major local streams include Kadam and Peddavagu.
- **Terrain & Vegetation:** Predominantly dry deciduous forests, with teak and associated vegetation.

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5.15 Leopardus tilcayo

Why in News?

Scientists have formally identified Tilcayo (*Leopardus tilcayo*), a new species of small wild cat from Bolivia. It is reported as the first new living cat species formally described in more than a century.

Key Features

- **Scientific Name:** *Leopardus tilcayo*
- **Common Name:** Tilcayo
- **Distribution:** Endemic to Bolivia, particularly the Bolivian Yungas.
- **Habitat:** Humid cloud forests located in the transition zone between the Andes Mountains and the Amazon Basin.
- **Size:** Very small feline, weighing about 1.4 kg and measuring around 46 cm in length.
- **Appearance:** Light brown coat with distinctive irregular leopard like rosettes.

Evolutionary Significance

- Genetic studies indicate that *L. tilcayo* diverged from other related lineages approximately 1.4 million years ago.
- The discovery has significant implications for the taxonomy of South American tiger cats, indicating that the group contains multiple distinct species rather than being treated as a single species.

5.16 Malabari Goat

Why in News?

A recent study suggests that the ancient spice trade routes may have influenced the genetic history of Kerala's Malabari goat, indicating

historical movement and genetic exchange of livestock along the Malabar coast.

Key Features

- **Native Region:** Kerala, particularly the Malabar region.
- **Other Names:** Tellicherry Goat / Cutch Goat.
- **Breed Type:** Dualpurpose breed, valued for both meat and milk.
- **Skin:** Its skin is also commercially valuable, particularly for the tanning industry.
- **Adaptability:** Well adapted to the hot and humid tropical conditions of Kerala's coastal environment.
- **Reproductive Trait:** Known for high prolificacy, with frequent twinning and triplets, making it economically important for small and marginal farmers.
- **Milk Production:** Generally around 0.5–1.5 litres per day, with considerable variation depending on management and lactation stage.

5.17 Male Mahadeshwara Hills Wildlife Sanctuary

Why in News?

Male Mahadeshwara Hills Wildlife Sanctuary (MM Hills WLS) is an important wildlife landscape in Karnataka, located at the ecological transition between the Western Ghats and Eastern Ghats.

Key Features

- **Location:** Chamarajanagar district, Karnataka.

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- **Geographical Significance:** Located at the intersection/meeting zone of the Western and Eastern Ghats, making it important for ecological connectivity.
- **Legal Status:** Declared a Wildlife Sanctuary in 2013.
- **Protected Area Connectivity:** Contiguous with:
 - Biligiri Rangaswamy Temple (BRT) Tiger Reserve
 - Sathyamangalam Tiger Reserve, Tamil Nadu
 - Cauvery Wildlife Sanctuary, Karnataka
- **Religious Significance:** Known for the Male Mahadeshwara Temple, dedicated to Lord Shiva.

5.18 Mindoro bleeding-heart Pigeon (Gallicolumba platenae)

Why in News?

The Mindoro bleeding heart dove (*Gallicolumba platenae*) is a highly threatened and strictly endemic bird of Mindoro Island, Philippines, known for its distinctive blood red chest patch.

Key Features

- **Scientific Name:** *Gallicolumba platenae*
- **Common Name:** Mindoro bleedingheart
- **Distribution:** Endemic to Mindoro Island, Philippines.
- **Family:** Columbidae — the pigeon and dove family.
- **Group:** One of the seven species of bleedingheart doves found globally.

- **Philippine Endemism:** Five of the seven bleeding heart dove species are endemic to the Philippines.
- **Distinctive Feature:** A striking orangered patch on the white breast, resembling a bleeding wound, giving the group its name.
- **Habitat:** Primarily associated with lowland forests; recent observations indicate movement towards higher transitional and montane rainforests, likely reflecting habitat pressures.

5.19 Myristica Swamps

Why in News?

Myristica swamps are rare freshwater swamp forests dominated by evergreen trees of the Myristicaceae family. They are important wetland ecosystems found in parts of the Western Ghats.

Key Features

- **Ecosystem:** Freshwater swamp forest dominated by Myristicaceae species.
- **Distribution:** Mainly associated with the Western Ghats, particularly low lying, highrainfall areas of Kerala and Karnataka.
- **Hydrology:** Develop in areas that remain waterlogged for prolonged periods, often throughout the year.
- **Adaptations:** Trees possess specialised root systems such as:
 - **Stilt roots** – provide support in soft, unstable soil.

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- **Pneumatophores** – specialised aerial roots that facilitate gaseous exchange in waterlogged soils.
- **Ecological Importance:** Act as freshwater wetlands, helping regulate water flow, retain water and support specialised biodiversity.
- **Global Rarity:** Freshwater swamp forests are highly restricted ecosystems.

5.20 Osbeckia ulotricha

Why in News?

Osbeckia ulotricha is a newly identified flowering plant discovered in the Agasthyamala Biosphere Reserve of the Western Ghats.

Key Features

- **Scientific Name:** Osbeckia ulotricha
- **Category:** Newly discovered flora.
- **Family:** Melastomataceae.
- **Location:** Agasthyamala Biosphere Reserve, Western Ghats.
- **Habitat:** Found in the shola grasslands of the Agasthyamala landscape.
- **Distinctive Feature:** Described as a woolly haired flowering plant, reflecting its characteristic hairy appearance.

5.21 Parbati-II: Hydropower Expansion versus Himalayan Fragility

Why in News?

A water leakage from the Parbati II Hydroelectric Project in Kullu, Himachal Pradesh, affected nearby settlements and agricultural land, raising concerns over the

safety of hydropower infrastructure in the fragile Himalayan ecosystem.

Key Facts

- **Location:** Kullu district, Himachal Pradesh.
- **Developer:** NHPC Limited, under the Ministry of Power.
- **Capacity:** 800 MW.
- **Type:** Runoftheriver hydropower project.
- **Dam:** 83.7metre concrete gravity dam.
- **Head Race Tunnel:** 31.56 km.
- **Powerhouse:** Siund in Sainj Valley.

Why It Matters

- **Himalayan Fragility:** Young, tectonically active geology makes the region susceptible to landslides, slope instability and flash floods.
- **Tunnel Vulnerability:** Long tunnels can encounter fractured rock, groundwater seepage and unforeseen geological conditions.
- **Cumulative Impact:** Concentration of hydropower projects can increase stress on river valleys and mountain slopes.

Way Forward

- Conduct cumulative basin level environmental assessments, rather than project wise assessments alone.
- Strengthen geological and geotechnical investigations before and during construction.
- Install real time tunnel, slope and seepage monitoring systems.

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- Integrate climate risk and extreme weather scenarios into project design.
- Ensure independent safety audits and effective early warning systems for downstream communities.

5.22 Pichavaram Mangrove Ecosystem

Why in News?

A recent study estimated the Total Economic Value (TEV) of the Pichavaram mangrove ecosystem at about ₹2,485.38 crore, highlighting the economic value of ecosystem services provided by mangroves.

Geographical Setting

- **Location:** Pichavaram, Cuddalore district, Tamil Nadu.
- **Between:**
 - North: Vellar Estuary
 - South: Coleroon/Kollidam Estuary
- Forms part of the Vellar-Coleroon estuarine system.
- Connected to the Bay of Bengal through a network of coastal backwaters and estuarine channels.

Ecological Significance

- **Mangrove Ecosystem:** One of India's important mangrove ecosystems, supporting diverse coastal and aquatic biodiversity.
- **Blue Carbon:** Stores carbon in mangrove vegetation and waterlogged sediments, contributing to climate change mitigation.

- **Coastal Protection:** Acts as a natural barrier against cyclones, storm surges and coastal erosion.
- **Fisheries:** Provides nursery and breeding grounds for several fish and other aquatic species.
- **Livelihood Support:** Supports fisheries, tourism and other ecosystem dependent livelihoods.

5.23 Pilibhit Tiger Reserve: Terai Ecology and Transboundary Conservation

Why in News?

Tourism access to the Pilibhit Tiger Reserve has been extended, allowing visitors to access the reserve for a longer period.

Location

- Located in Uttar Pradesh, primarily across Pilibhit and Lakhimpur Kheri districts.
- Forms part of the Terai Arc Landscape (TAL).
- Located along the India-Nepal border, making landscape connectivity important for wildlife conservation.

Ecological Significance

- Important habitat for tigers and other Terai fauna.
- Characterised by Sal-dominated forests, grasslands and wetlands.

Supports species such as:

Species	Scientific Name	IUCN Status	Key Information
Tiger	Panthera tigris	Endangered (EN)	Apex predator; India

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			supports the world's largest wild tiger population.
Swamp Deer	Rucervus duvaucelii	Vulnerable (VU)	Also called Barasingha; associated with grasslands and wetlands.
Hog Deer	Axis porcinus	Endangered (EN)	Small deer associated with grasslands and floodplains; found in parts of South and Southeast Asia.
Leopard	Panthera pardus	Vulnerable (VU)	Highly adaptable big cat found in forests, grasslands and human-dominated landscapes.
Bengal Florican	Houbaropsis bengalensis	Critically Endangered (CR)	Rare grassland bird associated with the Terai grasslands

			and Brahmaputra floodplains.
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Hydrological Importance

- The reserve forms part of an important Terai river and wetland system.
- It is associated with rivers and streams including the Sharda, Mala and Khannot.
- The Gomti River originates in the Pilibhit region, making the landscape significant from a watershed perspective.

5.24 PLA-Based Bioplastics: From Agricultural Feedstocks to Sustainable Materials

Why in News ?

India has initiated commercial development of Polylactic Acid (PLA)-based biodegradable plastics under the BioE3 framework, reflecting efforts to expand sustainable biomanufacturing and reduce dependence on fossil-fuel-based plastics.

What is PLA?

- Polylactic Acid (PLA) is a bio-based biodegradable aliphatic thermoplastic polyester produced from renewable biological feedstocks.
- Common feedstocks include: Sugarcane, Corn starch, Tapioca, Other carbohydrate-rich biomass

Significance

- **Sustainable alternative:** Provides a renewable-source alternative to conventional plastics.

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- **Agricultural value addition:** Converts carbohydrate-rich agricultural resources into higher-value materials.
- **Multiple applications:** Useful in packaging, agricultural products and 3D printing.
- **Medical applications:** Its biocompatibility enables applications such as absorbable surgical sutures.
- **Bioeconomy:** Supports India's transition towards biotechnology-driven manufacturing.
- **Circular economy:** Can contribute to resource-efficient material systems when appropriate collection and end-of-life infrastructure exists.

5.25 River Interlinking and India's Water Security

Why in News?

River interlinking is being debated as a strategy to address India's spatial and seasonal imbalance in water availability by transferring water from relatively water surplus basins to water deficit regions.

What is River Interlinking?

- It involves transferring water between river basins through a network of:
 - Dams and reservoirs
 - Canals
 - Watertransfer systems
 - Associated pumping and hydrological infrastructure

India's River Interlinking Framework

- The National Perspective Plan (NPP) for interlinking of rivers was formulated in 1980.

Implementing agency: National Water Development Agency (NWDA)

- Himalayan Component: 14 links
- Peninsular Component: 16 links
- Total: 30 proposed links

Potential Benefits

- **Water Security:** Transfers water to waterstressed regions.
- **Irrigation:** Can expand irrigation potential and reduce dependence on monsoon variability.
- **Flood Management:** Potentially diverts part of excess flood flows in some basins.
- **Drought Mitigation:** Can provide additional water to droughtprone areas.
- **Hydropower:** Reservoirs and associated infrastructure may generate additional electricity.
- **Regional Development:** Improved water availability can support agriculture and rural livelihoods.

Why is River Interlinking Controversial?

Ecological Concerns

- Alteration of natural river flows can affect aquatic ecosystems.
- Submergence of forests and habitats may cause biodiversity loss.
- Changes in sediment transport can affect deltas, wetlands and coastal ecosystems.

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Social Concerns

- Large dams and reservoirs may lead to displacement and loss of agricultural land.
- Rehabilitation and compensation can become major challenges.

Economic Concerns

- Interbasin transfer requires large capital investment in dams, canals and pumping infrastructure.
- Cost overruns and long construction periods can affect economic viability.

Federal Concerns

- Water is primarily a State subject, while interstate river water management involves the Union and States.
- Differences between basin States over water availability, sharing and project impacts can delay implementation.

Way Forward

- Adopt basin level integrated water resource planning rather than relying solely on inter basin transfers.
- Prioritise water conservation, watershed development, groundwater management and demand side efficiency.
- Undertake cumulative environmental and social impact assessments.
- Ensure cooperative federalism and transparent benefitsharing among basin States.
- Incorporate climate projections into project design and water availability assessments.

- Treat river interlinking as one component of water security, rather than a standalone solution.

5.26 Safeguarding Kerala's Freshwater Security

Why in News?

Sasthamcotta Lake has received attention for its ecological significance and importance as a freshwater resource in Kerala.

Feature	Details
Location	Kollam district, Kerala
Type	Freshwater lake
Status	Ramsar Site
Ramsar designation	2002
Importance	Major source of drinking water
Named after	Sastha temple at Sasthamcotta
Geographical setting	Part of Kerala's lowland/wetland landscape

Why is it Important?

- **Drinking Water** : Provides drinking water to a large population in the surrounding region.
- **Biodiversity** : Supports aquatic organisms and wetland-associated biodiversity. Wetland ecosystems provide habitat, groundwater-related functions and ecological services.

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Challenges

- **Catchment Degradation:** Deterioration of the lake's catchment reduces water inflow and ecological health.
- **Encroachment:** Land-use pressures can shrink and fragment the wetland ecosystem.
- **Pollution:** Domestic and other pollutants threaten water quality.
- **Water Stress:** Reduced freshwater availability can affect the lake's ecological functions.
- **Land-Use Change:** Unplanned development around the lake increases ecological pressure.

Way Forward

- **Land-Use Regulation:** Prevent encroachment and regulate development around the wetland.
- **Pollution Control:** Strengthen treatment and monitoring of wastewater and other pollutants.
- **Water Monitoring:** Regularly monitor water quality, inflows and seasonal water levels.
- **Community Participation:** Involve local communities in conservation and sustainable wetland management.

Wetland	Location	Broad character
Sasthamcotta Lake	Kollam	Freshwater lake
Vembanad-Kol Wetland	Kerala	Large wetland/backwater system
Ashtamudi Wetland	Kollam	Backwater/wetland and ecosystem

5.27 Status of the World's Soil Resources 2026

Why in News?

The FAO's Status of the World's Soil Resources 2026 assessed major threats to global soil resources using evidence from 75 countries. It highlights growing concerns over soil biodiversity loss and deterioration in sustainable soil-management practices.

What is Soil Biodiversity?

Soil biodiversity refers to the variety of living organisms present in soil and their interactions with one another and with the soil environment.

Major Components:

- **Microorganisms:** Bacteria, fungi, archaea and protozoa.
- **Soil fauna:** Nematodes, earthworms and arthropods.

Why is Soil Biodiversity Important?

Soil organisms perform essential ecological functions:

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Decomposition → Nutrient Cycling → Soil Formation → Plant Growth → Ecosystem Productivity

They also contribute to:

- Soil fertility and nutrient availability.
- Organic matter decomposition.
- Carbon storage and climate regulation.
- Water infiltration and soil-water retention.
- Disease suppression and plant productivity.

Key Findings

- **Soil Biodiversity Loss:** Ranked 4th among seven major threats to global soil resources.
- **Intensive Agriculture:** Excessive irrigation, heavy machinery, excessive fertiliser use and pesticides can adversely affect soil habitats and biological activity.
- **Declining Sustainable Management:** Several regional assessments indicate deterioration in sustainable soil-management practices.

Why Soil Biodiversity Matters for India?

- **Agriculture:** Supports nutrient cycling, soil fertility and crop productivity.
- **Food Security:** Soil degradation can reduce the long-term productive capacity of agricultural land.
- **Climate Change:** Healthy soils act as important carbon reservoirs, while

degradation can reduce carbon-storage capacity.

- **Water Security:** Healthy soil structure improves water infiltration and water-holding capacity.
- **Sustainable Agriculture:** Maintaining soil biodiversity can reduce excessive dependence on external chemical inputs.

Global Soil Partnership (GSP)

The Global Soil Partnership (GSP) was established by the FAO in 2012 as a mechanism for promoting sustainable soil management globally.

Objectives:

- Promote sustainable soil management.
- Strengthen soil governance.
- Maintain healthy and productive soils.
- Support ecosystem services.
- Contribute to food security and climate action.

5.28 World Circular Economy Forum (WCEF) 2026

Why in News?

India is hosting the World Circular Economy Forum (WCEF) 2026 in Gandhinagar, Gujarat, from 15–18 September 2026, focusing on accelerating the global transition towards a circular economy.

What is a Circular Economy?

A circular economy seeks to move beyond the conventional “take–make–waste” model by keeping resources and products in use for as long as possible through: Reduce → Reuse →

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Repair → Refurbish → Recycle → Resource Recovery

Key Focus Areas of WCEF 2026

- **Circular Transition:** Promote resource-efficient and sustainable production and consumption systems.
- **Circular Innovation:** Encourage new technologies, business models and solutions based on reuse, repair and recycling.
- **Mobilising Finance:** Connect circular-economy solutions with investors, financial institutions and markets.
- **Global Cooperation:** Strengthen international collaboration, particularly among Global South countries.
- **Circular-Economy Diplomacy:** Provides India a platform to showcase initiatives such as Extended Producer Responsibility (EPR), resource efficiency and Mission LiFE.
- **Private Investment:** Create stronger linkages between circular technologies, investors and markets.

CULTURE & HISTORY

6.1 Acharya Vinoba Bhave

About

- **Born:** 11 September 1895
- **Original Name:** Vinayak Narahari Bhave
- **Died:** 15 November 1982
- **Associated with:** Mahatma Gandhi and the Sarvodaya Movement
- **Known for:** Bhoodan Movement, Gramdan, Gandhian constructive work and non-violence
- **First Individual Satyagrahi:** Selected by Mahatma Gandhi in 1940 for the Individual Satyagraha.

Major Contributions

- **Gandhian Constructive Work:** Promoted Khadi, village development, sanitation and basic education as instruments of social transformation.
- **Individual Satyagraha (1940):** Chosen by Gandhi as the first individual satyagrahi to assert the right to oppose India's participation in the Second World War.
- **Bhoodan Movement (1951):** Initiated the Bhoodan (Land Gift) Movement at Pochampally, Telangana, appealing to landowners to voluntarily donate land to the landless.
- **Gramdan Movement:** Extended the Bhoodan approach by encouraging entire

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villages to place land within a community-oriented framework of ownership and use.

- **Sarvodaya:** Advocated “Sarvodaya” — welfare of all, based on equality, non-violence, social justice and self-reliant village communities.

Literary Works

- **Geetai:** A Marathi poetic rendering of the Bhagavad Gita, written in simple language to make its teachings accessible to the wider public.
- **Gita Pravachane:** A collection of his discourses on the Bhagavad Gita, delivered during his imprisonment.

6.2 Barakuru (Barkur)

Why in News?

A medieval-era ‘Sidithale’ hero stone was discovered at Barkur in Udupi district, Karnataka, highlighting the region’s rich archaeological and cultural heritage.

About Barakuru

- **Location:** Ancient historical port town in Udupi district, Karnataka.
- **Riverine Setting:** Situated on the banks of the Sita River, which flows towards the Arabian Sea.
- **Historical Names:** Known in different periods as Varakula, Barakanur and Barahkanyapura.
- **Early History:** Archaeological evidence points to Mesolithic and Megalithic remains. Barkur developed as a

commercial and maritime centre from around the 2nd century BCE.

Historical Evolution

- **Alupas:** Barkur reached prominence under the Alupa dynasty and served as an important political centre during the medieval period, becoming associated with the development of Tuluva culture.
- **Hoysalas:** Subsequently became an important administrative centre under the Hoysalas.
- **Vijayanagara Empire:** Barkur continued to be strategically important under the Vijayanagara rulers, who expanded its fortifications.
- **Later Period:** Came under the Keladi Nayakas, followed by the rule of Haider Ali and Tipu Sultan, and eventually the British.

Architectural & Cultural Significance

- **Keris:** Medieval Barkur was organised into ten extensions or ‘Keris’, traditionally associated with particular occupational communities.
- **Temple Architecture:** Known for temples with sloping tiled roofs, adapted to the heavy rainfall of coastal Karnataka.
- **Panchalingeshwara Temple:** One of the prominent surviving temples of Barkur.
- **Jain Heritage:** Barkur was also an important Jain settlement.
- **Epigraphy:** The region has yielded numerous stone inscriptions and copper plates associated with the Alupas,

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Hoysalas, Vijayanagara and Keladi periods.

‘Sidithale’ Hero Stone

- Sidithale refers to a distinctive form of ritual self-sacrifice, associated with the offering of one's life to a deity.
- Sidi in Kannada is associated with the idea of springing/being propelled, while Thale means head.
- In the ritual described in historical accounts, the devotee's head was severed as a votive offering, with a tensioned bamboo mechanism reportedly propelling the head upwards.
- Such practices are associated with extreme votive offerings, undertaken in connection with war, protection of the community, royal welfare or appeasement of fierce deities.

6.3 Jatindranath Das (Jatin Das)

Why in News?

Jatindranath Das (Jatin Das) was remembered on his death anniversary on 13 September, highlighting his role in the revolutionary nationalist movement and his protest against the harsh treatment of political prisoners in colonial jails.

Key Facts

- **Born:** 1904, Calcutta (present-day Kolkata).
- **Revolutionary Association:** Associated with the Anushilan Samiti, a revolutionary organisation active in Bengal.

- **Revolutionary Networks:** Became associated with revolutionary groups linked to the Hindustan Republican Association (HRA).
- **Lahore Conspiracy Case:** Arrested in connection with revolutionary activities and imprisoned in Lahore Jail.
- **Hunger Strike:** Participated in a prolonged hunger strike demanding better treatment and equal rights for political prisoners.
- **Death:** Died in 1929 following the prolonged hunger strike.

6.4 Mandar: Traditional Musical Instrument of Jharkhand

Why in News?

Jharkhand's traditional folk percussion instrument Mandar has received a Geographical Indication (GI) tag.

About Mandar

Parameter	Key Fact
Type	Traditional percussion instrument
Structure	Double-headed, barrel-shaped drum
Materials	Traditionally made using red clay and leather
Region	Jharkhand, particularly the Chotanagpur region
Communities	Oraon, Munda, Santhal and Ho, among others

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Uses	Festivals, marriages, rituals and community dances
Playing Method	Traditionally suspended from the shoulder and played with the hands
Cultural Significance	Forms an important part of tribal musical and community traditions in Jharkhand

Cultural Significance

- **Tribal Heritage:** Mandar is closely associated with the folk and community traditions of Jharkhand's tribal societies.
- **Community Performance:** Its rhythmic use accompanies traditional dances, festivals and social ceremonies, making it an important part of collective cultural expression.
- **Traditional Craftsmanship:** The instrument reflects indigenous knowledge relating to the selection and preparation of clay, leather and drum construction techniques

6.5 Meenakshi Sundareswarar Temple

Why in News?

The Maha Kumbabishekam (consecration ceremony) of the Meenakshi Sundareswarar Temple, Madurai, was held on 17 September 2026, after a gap of 17 years.

About the Temple

- **Location:** Situated on the southern bank of the Vaigai River in Madurai, Tamil Nadu.
- **Principal Deities:** Meenakshi – regarded as a form of Parvati. Sundareswarar – regarded as a form of Shiva.
- **Religious Association:** The temple is primarily associated with Shaivism and Shaktism. The wider religious traditions of Madurai also include the Vaishnavite tradition associated with Kallazhagar (Alagar), regarded as Meenakshi's brother in the temple's mythology.
- **Cultural Importance:** It is one of the most important living temple complexes of Tamil Nadu and a major symbol of Madurai's religious and cultural identity.

Chronological History & Legacy

Early Origins

- The temple tradition has ancient roots associated with the Pandya rulers of Madurai.
- The foundational shrine is traditionally associated with Kulasekara Pandya.

7th Century – Literary Prominence

- The temple finds an important place in the Shaiva Bhakti tradition.
- Thirugnanasambandar, one of the Nayanmar saints, is associated with

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the temple through the Tevaram hymns.

14th Century – Destruction and Restoration

- The temple complex suffered extensive damage during the Delhi Sultanate's military campaigns in South India, particularly the invasion led by Malik Kafur.
- The temple was subsequently restored and rebuilt by later rulers.

16th–17th Century – Nayaka Expansion

- The temple underwent major architectural expansion under the Madurai Nayakas.
- Thirumalai Nayak (1623–1659) played a major role in the development of Madurai's monumental architecture and the temple precinct.

Architectural Marvels

Dravidian Architecture

The temple is a major example of South Indian Dravidian temple architecture.

Major characteristics include:

- Monumental gopurams
- Large mandapams
- Enclosed temple precincts
- Extensive sculptural decoration
- Elaborately carved pillars and corridors

Gopurams

- The temple complex is renowned for its large, richly sculpted gateway towers.
- The Eastern Gopuram is among the older surviving gopurams and is traditionally associated with the Pandyan period.
- The gopurams are covered with numerous colourful stucco figures depicting deities, mythical beings and narrative themes.

Mandapams

Important structures include:

- Kilikoondu Mandapam
- Golu Mandapam
- Pudu Mandapam

These spaces served religious, ceremonial and cultural functions.

- Aayirankaal Mandapam – Thousand Pillared Hall
- Traditionally known as the Thousand Pillared Hall.
- Associated with Ariyanatha Mudaliar during the Nayaka period.

Despite its name, it contains 985 pillars.

- The hall demonstrates the sophisticated stonecarving and architectural skills of the Nayaka period.
- It now houses a museum displaying artefacts and sculptures.

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Musical Pillars

- The temple complex contains musical pillars carved from stone.
- When struck, different sections of the pillars can produce distinct musical tones.

6.6 Nuakhai Festival

Why in News?

The Nuakhai Festival was celebrated in Western Odisha and adjoining parts of Jharkhand, marking the traditional celebration of the new agricultural harvest.

About Nuakhai

- **Regional Festival:** Primarily celebrated in Western Odisha, particularly in the Sambalpur region, and adjoining areas of Jharkhand.
- **Meaning:** The term Nuakhai is derived from:
 - Nua – new
 - Khai – food/eating
- **Nature:** It is primarily an agricultural and harvest festival associated with the arrival of the season's new rice.
- **Cultural Significance:** It reflects the close relationship between agriculture, community life and religious traditions in western Odisha.

Major Rituals & Features

- **Nabanna/Nabanha Offering:** The newly harvested crop, particularly new rice, is

first offered to the presiding deity before being consumed by the community.

- **Nine Sets of Rituals:** The festival is traditionally associated with a sequence of nine rituals, culminating in the main Nuakhai celebration.
- **Community Feast:** Families prepare traditional dishes using the new harvest and share food with relatives and community members.
- **Nuakhai Juhar:** A significant social tradition in which people exchange greetings, seek blessings and show respect to elders.

6.7 Preserving Rajasthan's Fresco Heritage

Why in News?

Several historic Shekhawati havelis of Rajasthan have been included in the UNESCO Tentative List, highlighting the region's exceptional architectural, artistic and cultural heritage.

About Shekhawati Region

- **Location:** Northeastern Rajasthan, mainly covering Jhunjhunu, Sikar and Churu districts.
- **Period of Flourishing:** Particularly from the 18th to 20th centuries.
- **Merchant Patronage:** Many havelis were constructed by wealthy Marwari merchant families, whose fortunes grew through longdistance trade.
- **Architectural Identity:** The region is famous for its richly painted mansions and

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is popularly described as the “OpenAir Art Gallery of Rajasthan.”

- The havelis reflect the economic prosperity, social status and cultural aspirations of merchant communities.

Feature	Description
Haveli	Large traditional mansion organised around one or more courtyards
Chowk	Central courtyard providing light, ventilation and social space
Entrance	Elaborately decorated gateway reflecting the owner's status
Jharokha	Projecting enclosed or semi-enclosed window/balcony
Chhatri	Pavilion-like architectural element, often topped by a dome
Frescoes	Painted murals adorning interior and exterior walls
Climate Adaptation	Courtyard-based design facilitates ventilation, daylight and thermal comfort

Frescoes: Themes & Evolution

The frescoes represent a combination of religious traditions, local culture and changing historical influences.

- **Religious themes:** Hindu deities and mythological narratives.

- **Epics:** Episodes from the Ramayana and Mahabharata.
- **Folk traditions:** Local legends, stories and cultural practices.
- **Nature:** Animals, birds, trees and floral motifs.

6.8 Ramanathaswamy Temple,

Rameswaram

Why in News?

The Ramanathaswamy Temple at Rameswaram, Tamil Nadu, was featured as a major cultural backdrop during the 18th BRICS Summit in New Delhi, highlighting India's rich civilisational heritage and cultural traditions.

About the Temple

- **Location:** Situated on Rameswaram Island, Tamil Nadu.
- **Deity:** Dedicated to Lord Shiva, worshipped as Ramanathaswamy.
- **Architectural Style:** A prominent example of Dravidian temple architecture, particularly renowned for its monumental corridors and intricately carved pillars.
- **Jyotirlinga:** One of the 12 Jyotirlingas associated with Lord Shiva.
- **Char Dham:** Rameswaram is one of the four major pilgrimage centres traditionally associated with the Char Dham.
- **Ramayana Tradition:** Closely associated with the Ramayana tradition, particularly the belief that Rama worshipped Shiva at Rameswaram before proceeding towards Lanka.

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Architectural Features

- **Pillared Corridors:** The temple is renowned for its exceptionally long and expansive corridors lined with rows of carved pillars.
- **Dravidian Architecture:** Characterised by monumental gateways, mandapams, sculpted pillars and a large enclosed temple complex.
- **Temple Complex:** Combines architectural grandeur with an extensive network of sacred spaces and water bodies.

22 Theerthams

- The temple complex is traditionally associated with 22 sacred theerthams (water bodies).
- Pilgrims undertake ritual bathing in these sacred waters as part of the pilgrimage tradition.

Religious & Cultural Significance

- **Jyotirlinga Tradition:** Forms part of the pan-Indian sacred geography associated with Shiva worship.
- **Char Dham Tradition:** Connects southern India with the broader four-directional pilgrimage network.
- **Ramayana :** Rameswaram is an important sacred landscape associated with the Ramayana tradition.

6.9 Shivneri Fort

Why in News?

Authorities have directed concerned agencies to take action against unauthorised

structures near Shivneri Fort, highlighting concerns related to the protection and conservation of the historic fort and its surrounding heritage landscape.

About Shivneri Fort

- **Location:** Situated near Junnar in Pune district, Maharashtra.
- **Type:** Hill fort strategically located on an important route through the Western Ghats.
- **Historical Importance:** Shivneri was an important strategic stronghold controlling routes connecting the Deccan (Desh) with the western coastal region.
- **Maratha History:** The fort is traditionally associated with Chhatrapati Shivaji Maharaj, who was born at Shivneri in 1630.

Historical Significance

- **Ancient Trade Route:** Its strategic location enabled the fort to oversee an important trade route connecting the inland Desh region with Kalyan, a major commercial centre and port.
- **Strategic Fortification:** Its elevated terrain provided a natural defensive advantage and helped control movement through the surrounding region.
- **Shivaji's Birthplace:** Shivneri is historically significant as the birthplace of Chhatrapati Shivaji Maharaj, making it an important site in Maratha history.
- **Maratha Heritage:** The fort forms part of the wider network of hill forts that played

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a crucial role in the military and political history of the Marathas.

Architecture & Fortification

- **Shape:** The fort has a distinctive triangular hilltop layout.
- **Defensive Design:** Massive fortifications and a series of winding and strategically positioned gateways made direct military assault difficult.
- **Entrance:** The principal approach is through the fortified gateway system on the southwestern side.
- **Natural Defence:** Steep slopes and elevated terrain complemented the constructed fortifications.

Water Management

- **Badami Talav:** A prominent water reservoir located within the fort.
- **Ganga and Yamuna:** The fort is also associated with perennial water springs traditionally known as Ganga and Yamuna.
- **Strategic Importance:** Reliable water sources were essential for maintaining a long-term military garrison during sieges.

6.10 The Legacy of Dr. Sarvepalli

Radhakrishnan

Why in News?

September 5 is observed as Teachers' Day in India to commemorate the birth anniversary of Dr. Sarvepalli Radhakrishnan, one of India's prominent philosophers, educationists and statesmen.

Who was Dr. Sarvepalli Radhakrishnan?

- Born: 5 September 1888
- Birthplace: Tiruttani, presentday Tamil Nadu
- Profession: Philosopher, educationist, academic and statesman
- He played an important role in introducing and interpreting Indian philosophical traditions to Western audiences.
- He emphasised education as a means of developing moral values, intellectual ability and responsible citizenship.

Educational & Academic Contributions

- Taught philosophy at several leading institutions and became an influential academic.
- Served as Vice Chancellor of Andhra University and later Banaras Hindu University (BHU).
- Was associated with the University Education Commission (1948–49), which examined the state and future direction of higher education in independent India.
- Advocated education that combined intellectual development with ethical and spiritual values.

Philosophical Contribution

- Radhakrishnan was a major interpreter of Indian philosophy, particularly Vedanta.
- He sought to explain Indian philosophical thought in a manner accessible to the modern and Western intellectual world.

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Public Life & Statesmanship

Period	Position / Contribution
1949–1952	Ambassador of India to the Soviet Union
1952–1962	Vice-President of India
1954	Awarded the Bharat Ratna
1962–1967	President of India

Teachers' Day

- 5 September is observed as Teachers' Day in India in honour of Radhakrishnan's contribution to education.
- The tradition began in 1962, when his students and admirers wanted to celebrate his birthday; he suggested that the day instead be observed as Teachers' Day.

Major Works

- Indian Philosophy
- The Hindu View of Life
- An Idealist View of Life
- Eastern Religions and Western Thought
- The Principal Upanishads

6.11 Tracing Prehistoric Migration and Cultural Diffusion

Why in News?

Recent archaeological discoveries in Poland have provided new insights into the Corded Ware Culture (CWC), particularly its population movements, burial practices and social organisation in prehistoric Europe.

About Corded Ware Culture

- **Nature:** A prehistoric archaeological culture of Central and Eastern Europe.
- **Period:** Broadly associated with the Late Neolithic–Early Bronze Age, around 2900–2350 BCE.
- **Name:** Derived from its characteristic cord-impressed pottery, produced by pressing twisted cord or textile into wet clay.

Geographical Spread: Extended across

- Central Europe
- Eastern Europe
- Baltic region
- Parts of Scandinavia

6.12 Uncovering India's Submerged Maritime Heritage

Why in News?

A new phase of underwater archaeological exploration is being undertaken off Poompuhar (Kaveripoompattinam), Tamil Nadu, to investigate submerged remains and reconstruct the region's ancient maritime and coastal history.

About Poompuhar

- **Location:** On the Tamil Nadu coast, near the Kaveri River's mouth and the Bay of Bengal.
- **Ancient names:** Kaveripoompattinam / Puhar.
- **Historical period:** Prominent during the Sangam Age and associated with the early Cholas.

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- **Importance:** Major port, urban and commercial centre of ancient Tamilakam.
- **Literary references:** Pattinappalai, Silappadikaram and Manimekalai provide important descriptions of Puhar's urban and maritime life.

Period	Development
3rd century BCE–3rd century CE	Poompuhar emerged as a major port and urban centre during the Sangam Age, associated with the early Cholas.
Sangam Age	Flourished as a centre of maritime trade, connecting the Kaveri delta with wider Bay of Bengal trade networks.
Post-Sangam Period	Poompuhar's urban and maritime life is reflected in Tamil works such as Silappadikaram and Manimekalai.
Later Period	Coastal erosion, shoreline changes and other marine processes contributed to the loss/submergence of parts of the ancient settlement.
Modern Period	Archaeological and underwater investigations identified submerged structures and artefacts, helping reconstruct the ancient coastal landscape.
2026	A new phase of underwater archaeological exploration aims to further investigate Poompuhar's submerged maritime heritage.

Maritime Significance

- **Trade hub:** Connected the Kaveri delta with the Bay of Bengal, facilitating regional and overseas commerce.
- **Urbanisation:** Evidence from literary sources indicates markets, merchants, warehouses, crafts and a cosmopolitan population.
- **Cultural exchange:** Maritime networks facilitated the movement of goods, people, ideas and cultural practices.
- **Chola heritage:** Reflects the importance of maritime trade in the economic and political development of the early Cholas.

Why is Poompuhar Submerged?

The disappearance of parts of the ancient settlement is associated with coastal geomorphological changes, including:

- Coastal erosion
- Changes in sea level
- Sedimentation and shoreline shifts
- Marine processes and extreme coastal events
- Archaeological Importance

6.13 Uparkot Fort

Why in News?

Uparkot Fort, an ancient fortification in Junagadh, Gujarat, has come into focus for its historical and architectural significance. It represents the layered cultural heritage of the Girnar region.

About Uparkot Fort

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- **Location:** Junagadh, Gujarat, at the foothills of Girnar Hill.
- **Ancient name:** Traditionally associated with Revata / Revath Nagari.
- **Historical significance:** One of the important ancient fortifications of the Saurashtra region.
- **Cultural influences:** Reflects a combination of ancient Indian, Buddhist, Islamic and regional architectural traditions.

Period	Development
c. 319 BCE	Traditionally attributed to Chandragupta Maurya; the exact date of the fort's original construction remains debated.
2nd century BCE onwards	Buddhist rock-cut caves developed in the Junagadh region, with carvings and inscriptions reflecting Buddhist activity.
Early Historic–Medieval Period	Uparkot was expanded, modified and reused under successive ruling powers.
Medieval Period	The fort acquired Islamic architectural influences alongside earlier regional traditions.
Later Period	Continued to serve as a strategic fortification of Junagadh.

Modern Period	Recognised as an important archaeological and heritage site showcasing the region's layered history.
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Architecture & Key Features

- **Buddhist Caves:** Rock-cut caves associated with the early historic period, featuring carvings and inscriptions.
- **Fortifications:** Massive defensive walls and gateways reflect its strategic military role.
- **Layered Architecture:** The complex demonstrates the interaction of Buddhist, Hindu, Islamic and regional architectural traditions.
- **Girnar Setting:** Its location near Girnar Hill connected the fort with an important religious and strategic landscape.
- **Water Structures:** Historic water-management structures within the fort highlight the importance of water security in fortified settlements.

6.14 Vasai Fort (Bassein Fort)

Why in News?

Vasai Fort came into focus after controversy over immersed Ganesh idols being found dumped near its jetty, highlighting concerns over the conservation and management of a historically significant heritage site.

About Vasai Fort

- **Location:** Vasai, Palghar district, Maharashtra, north of Mumbai and near

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the Vasai Creek/Ulhas River estuarine region.

- **Historical importance:** A major maritime, military and commercial centre on the western coast.
- **Strategic value:** Its location provided control over important maritime routes and coastal trade.

Period	Development
15th century	Vasai emerged as an important maritime and shipbuilding centre on the western coast.
1530s	Bahadur Shah of Gujarat established a fortification at Vasai.
Portuguese Period (16th century–1739)	The Portuguese captured Vasai, rebuilt and expanded the fort, transforming it into a major fortified city, naval base and commercial centre.
16th–18th centuries	Vasai became the Portuguese Corte do Norte (Court of the North), second only to Goa in regional importance.
1739	The Marathas under Chimaji Appa captured Vasai after a major campaign, significantly weakening Portuguese power in the northern Konkan.
Maratha Period	Vasai remained under Maratha control and continued to retain strategic importance.
Modern Period	The fort survives as an important heritage monument,

reflecting Gujarati, Portuguese and Maratha historical layers.

Architecture & Key Features

- **Fortified complex:** Massive defensive walls, bastions, gateways and ruins of churches and administrative structures.
- **Portuguese influence:** Churches, convents, residential structures and civic buildings reflect the transformation of Vasai into a Portuguese colonial settlement.
- **Maritime setting:** Its coastal location supported naval operations, shipbuilding and trade.
- **Layered heritage:** The site reflects successive phases of Gujarat Sultanate, Portuguese and Maratha rule.

SCIENCE & TECHNOLOGY

7.1 AstroRad

Why in News?

AstroRad, a radiationshielding vest developed for astronauts, is designed to provide targeted protection against space radiation, especially during Solar Particle Events (SPEs).

Key Features

- **Developer:** Israeli company StemRad, in collaboration with Lockheed Martin, with support from the Israel Space Agency, NASA and German Aerospace Center (DLR).
- **Purpose:** Protects astronauts from harmful ionising radiation during space missions,

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particularly sudden radiation bursts from the Sun.

- **Solar Particle Events (SPEs):** Shortduration episodes in which the Sun releases large amounts of highenergy protons and other charged particles.
- **Targeted Shielding:** Provides greater protection around radiationsensitive organs and tissues, including bone marrow, lungs, stomach, colon, breasts and ovaries.
- **Hydrogenrich Material:** Uses highdensity polyethylene (HDPE), a hydrogenrich polymer that is effective against energetic particles while being considerably lighter than conventional heavymetal shielding such as lead.
- **Weight:** The spacetested model weighed about 26 kg (57 lb).
- **Emergency Gear:** It is not a fullbody spacesuit. It is intended to be worn inside a spacecraft, particularly during periods of elevated radiation risk.

Why Targeted Shielding?

- Uniformly shielding the entire body would require extremely large amounts of material and add substantial spacecraft mass.
- AstroRad instead follows a “shield where it matters most” approach—concentrating material around vital organs to achieve better radiation protection with less mass.

7.2 BepiColombo Mission

Why in News?

The BepiColombo mission reached a major milestone on 3 September 2026, when its Mercury Transfer Module (MTM) separated from the two scientific orbiters after an almost eightyyear journey. The spacecraft is now entering the final phase of its approach to Mercury.

Key Features

- **Joint Mission:** European Space Agency (ESA) + Japan Aerospace Exploration Agency (JAXA).
- **Launch:** 20 October 2018 aboard an Ariane 5 from Kourou, French Guiana.
- **Destination:** Mercury, the innermost planet of the Solar System.
- **Arrival:** The two orbiters are scheduled to enter Mercury orbit on 21 November 2026, with full science operations expected from April 2027.
- **Distance Travelled:** More than 10 billion km due to its complex trajectory.
- **MTM:** Uses solar panels + ion thrusters and separated from the orbiters on 3 September 2026.

Three Main Components

Component	Agency	Major Role
Mercury Transfer Module (MTM)	ESA	Solar-electric propulsion; carried the spacecraft

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		towards Mercury
Mercury Planetary Orbiter (MPO)	ESA	Studies Mercury's surface, interior, composition and geology
Mercury Magnetospheric Orbiter (Mio/MMO)	JAXA	Studies magnetic field, magnetosphere and solar-wind interaction

Why Is Mercury Difficult to Reach?

- **Strong solar gravity:** A spacecraft travelling towards the Sun gains orbital energy; slowing down sufficiently to enter Mercury's orbit is difficult.
- **Gravity Assists:** BepiColombo used 9 planetary flybys:
 - 1 Earth
 - 2 Venus
 - 6 Mercury
- **Propulsion:** Combination of solarelectric ion propulsion and gravity assists.
- **2024 Power Problem:** A solarpanel issue reduced available power, requiring trajectory changes and pushing the planned arrival from December 2025 to November 2026.

Scientific Objectives

MPO – ESA

- Map Mercury's surface and topography.

- Study its interior structure and unusually large iron core.
- Investigate geological evolution and surface composition.
- Test aspects of Einstein's theory of general relativity.

Mio – JAXA

- Study Mercury's magnetic field.
- Examine its magnetosphere.
- Understand interaction between Mercury and the solar wind.

Significance

- Europe's first mission to Mercury.

Only the third mission to visit Mercury, after:

1. Mariner 10 (NASA) – flybys, 1974–75
2. MESSENGER (NASA) – orbited Mercury, 2011–2015
3. Bepi Colombo – ESA–JAXA mission
 - It is the first mission to deploy two complementary orbiters around Mercury.
 - MPO: closest orbital altitude about 480 km.
 - Mio: reaches a much higher orbit, up to about 11,000 km, enabling complementary observations of Mercury's magnetosphere.

7.3 BIO-NIVESH and India's Biotech Capital Push

Why in News?

The Ministry of Science & Technology launched BIONIVESH to connect biotechnology and deeptech startups with investors, facilitating private investment in

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innovations ready for scaleup, commercialisation and market deployment.

Feature	Details
Purpose	Connect biotech startups with investors
Focus	Scale-up, commercialisation and market deployment
Engagement	Two-way startup-investor interaction
Startups	20 biotechnology/deep-tech startups in inaugural edition
Investors	Around 50
Nodal Ministry	Ministry of Science & Technology

Significance

- **Lab to Market:** Converts promising scientific innovations into market ready products.
- **Private Capital:** Addresses funding gaps in capital intensive biotech ventures.
- **Deep Tech Ecosystem:** Supports technologies with long development and commercialisation cycles.
- **Investor-Scientist Interface:** Improves understanding of scientific feasibility, regulatory requirements and development timelines.
- **Bio economy:** Strengthens India's innovation ecosystem, employment and technology led growth

7.4 Building Strategic Tech Sovereignty

Why in News?

The Union Cabinet approved Semicon 2.0 with an outlay of ₹1,27,500 crore to strengthen India's semiconductor ecosystem and expand capabilities beyond chip fabrication.

Aim

To develop an endtoend semiconductor ecosystem covering:

Design → Manufacturing → Packaging → Materials → Equipment → R&D → Talent

Key Features

- **Expanded Ecosystem:** Moves beyond fabrication towards materials, equipment, packaging, design, R&D and skilled manpower.
- **Design Capability:** Builds on India's existing strength in semiconductor design.
- **Manufacturing & Packaging:** Continues support for domestic fabrication and expands semiconductor packaging capacity.
- **R&D & Talent:** Greater emphasis on indigenous technological capabilities and specialised workforce.

Significance

- **Strategic Autonomy:** Reduces dependence on external semiconductor supply chains and improves resilience against global disruptions.
- **Industrial Growth:** Strengthens critical sectors such as automobiles, telecom,

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defence, power electronics, consumer electronics and AI.

- **Indigenous Design:** Expands India's capabilities in chip design and semiconductor technologies.
- **Supply Chain Resilience:** Develops domestic capacity across the entire semiconductor value chain, rather than concentrating only on fabrication.

Key Challenges

- **High Capital Intensity:** Semiconductor facilities require large upfront investments and have long gestation periods.
- **Rapid Obsolescence:** Fast technological cycles can make manufacturing technologies outdated quickly.
- **Resource Requirements:** Fabrication requires ultrapure water, uninterrupted power and sophisticated infrastructure.
- **Talent Gap:** Shortage of highly specialised semiconductor engineers and technicians.
- **Global Competition:** India faces competition from established semiconductor hubs with mature ecosystems.

Feature	Semicon 1.0	Semicon 2.0
Outlay	₹76,000 crore	₹1,27,500 crore

Approach	Semiconductor or ecosystem	Expanded end-to-end ecosystem
Design	Supported	Greater emphasis
Manufacturing	Supported	Continued & strengthened
Packaging	Supported	Expanded
Materials & Equipment	Limited ecosystem development	Greater emphasis
R&D & Talent	Supported	Expanded

7.5 CosmoCube Mission

Why in News?

The proposed CosmoCube mission, a UK-led initiative spearheaded by the University of Cambridge, aims to study the early Universe using a compact CubeSat placed in orbit around the Moon.

Key Features

- **Nature:** Proposed lunar orbiting CubeSat mission.
- **Lead:** University of Cambridge, UK.
- **ESA Support:** European Space Agency support for development of the spacecraft's control systems.
- **Orbit:** Planned 100km orbit around the Moon.
- **Lunar Far Side:** During its roughly 2hour orbital period, the satellite would spend

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about 40 minutes over the Moon's far side.

- **Mission Duration:** About 2 years.
- **Expected Data:** Approximately 1,000 hours of radio observations.

Scientific Objective

CosmoCube seeks to observe two poorly understood phases of the early Universe: Big Bang → Cosmic Dark Ages → Cosmic Dawn → First Stars & Galaxies

- **Cosmic Dark Ages:** Period after the formation of neutral hydrogen and before the emergence of the first stars.
- **Cosmic Dawn:** Period when the first stars and galaxies began to form.

Why the 21cm Hydrogen Signal?

- During the Cosmic Dark Ages, the Universe contained abundant neutral hydrogen. Hydrogen produces a characteristic 21cm radio signal.
- As the Universe expanded, this ancient signal underwent cosmological redshift, shifting it to much lower radio frequencies.
- 21cm signal → Cosmological expansion → Redshift → ~10–100 MHz frequencies
- Studying this signal could reveal information about the density and evolution of matter before the first stars formed.

Why Observe from the Moon?

- The lunar far side provides a uniquely radio quiet environment because the Moon can shield instruments from much of the Earth's radiofrequency interference.

- This is particularly valuable for detecting the extremely weak low frequency 21cm signal from the early Universe.

Significance

- **Early Universe Probe:** Could provide observations from an era that is difficult to study through conventional astronomy.
- **Radio Astronomy:** Explores the largely challenging 10–100 MHz frequency range.
- **Lunar Far Side Advantage:** Reduced interference from Earthbased radio transmissions.
- **CubeSat Approach:** Demonstrates how relatively compact spacecraft can support advanced fundamental physics and astronomy missions.
- **Cosmology:** May improve understanding of the transition from the Dark Ages to the formation of the first stars and galaxies

7.6 DILRMP 3.0 (2026–2031): Towards a Digital Land Stack

Why in News?

The Digital India Land Records Modernisation Programme (DILRMP) 3.0 (2026–2031) aims to create an integrated, interoperable and GIS-enabled Digital Land Stack by linking land records, cadastral maps, registration data, court information and spatial data.

What is DILRMP?

The DILRMP is a Central Sector Scheme implemented by the Department of Land Resources, Ministry of Rural Development to modernise and digitise India's land record system.

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Evolution

Year	Development
2008	NLRMP launched as National Land Records Modernisation Programme
2016	NLRMP converted into a Central Sector Scheme and renamed DILRMP
2026–2031	DILRMP 3.0 focuses on an integrated Digital Land Stack

Key Components

- **Bhu Aadhaar / ULPIN:** A 14digit Unique Land Parcel Identification Number based on the georeferenced location and characteristics of a land parcel.
- **NGDRS:** National Generic Document Registration System enables standardised and digital property document registration.
- **Multilingual Land Records:** Promotes transliteration into the 22 Scheduled Languages for wider accessibility.
- **Revenue Court Integration:** Connects land records with revenue court proceedings to improve dispute tracking and institutional coordination.
- **NAKSHA:** Uses GIS, aerial imagery, drones and GNSS for mapping urban land and properties.
- **Digital Land Stack:** Integrates cadastral maps + ownership records + registration data + court information + spatial/planning data.

Significance

- **Reduce Land Disputes:** Linking textual records with spatial data can reduce ambiguity over land parcels.
- **Improve Credit Access:** Reliable land records can strengthen the use of land as collateral for institutional credit.
- **Transparency:** Digitisation and interoperability can reduce information asymmetry and scope for manipulation.
- **Urban Planning:** GISbased land information can support infrastructure planning, property taxation and urban development.
- **Ease of Doing Business:** Digital registration and faster ownership verification can simplify property transactions.

7.7 Gallium Nitride Monolithic Microwave Integrated Circuit (GaN MMIC) Technology

Why in News?

In September 2026, DRDO announced the successful integration of indigenous Gallium Nitride (GaN) MMIC chips into the Uttam AESA radar for the Tejas fighter fleet, strengthening indigenous capability in highfrequency radar electronics.

What is GaN MMIC?

- A Monolithic Microwave Integrated Circuit (MMIC) integrates electronic components such as transistors, resistors and capacitors on a single semiconductor substrate to generate, amplify and process microwave frequency signals.

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- GaN MMIC uses Gallium Nitride as the semiconductor material instead of conventional silicon.

Features

- **Material:** Gallium Nitride (GaN)
- **Typical substrate:** Silicon Carbide (SiC), offering high thermal conductivity
- **Frequency:** Indigenous chips designed for applications up to the Xband
- **Size:** About 3.5×3 mm
- **Power:** Up to 30 W

Why GaN is Important for Defence ?

- **High Power Density:** Handles higher power in a compact form.
- **Thermal Performance:** Operates efficiently under high temperature and high load conditions.
- **High Frequency Operation:** Suitable for advanced radar and electronic warfare systems.
- **Energy Efficiency:** Reduces energy losses during high frequency signal amplification.
- **Compact Systems:** Enables lighter and smaller radar and communication systems.

Key Applications

- **AESA Radars:** Transmit/Receive (T/R) modules in fighter aircraft and ground based radars.
- **Electronic Warfare:** Highpower jamming and countermeasure systems.
- **Satellite Communication:** Spacebased communication and SAR payloads.

- **5G/6G:** High efficiency radiofrequency power amplifiers.

- **Missile Systems:** Guidance, target tracking and sensing.

7.8 GSLV-F17 / EOS-05 Mission

Why in News?

On 4 September 2026, ISRO successfully launched GSLVF17 from the Satish Dhawan Space Centre, Sriharikota, placing the 2,367kg EOS05 satellite into a SubGeosynchronous Transfer Orbit (SubGTO).

Key Highlights

- **Launch Vehicle:** GSLV Mk II
- **Mission:** GSLVF17 / EOS05
- **Launch Site:** Satish Dhawan Space Centre, Sriharikota
- **Payload:** EOS05 – 2,367 kg
- **Orbit:** SubGTO
- **Significance:** Heaviest payload placed by GSLV Mk II into a transfer orbit.

GSLV Mk II

- It is a threestage launch vehicle consisting of:
- Solid → Liquid → Indigenous Cryogenic Upper Stage
- Height: ~51.7 m
- **Cryogenic Stage:** Indigenous cryogenic upper stage enables deployment of heavier payloads into geosynchronous transfer type orbits.
- **Payload Fairing:** The mission used a 4metrediameter ogive composite payload fairing to accommodate the large satellite.

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Why the Mission is Significant

- **Heavy Pay load Capability:** Demonstrates GSLV Mk II's ability to handle heavier spacecraft for transfer orbit missions.
- **Launch Reliability:** Successful flight follows the GSLVF10 failure of August 2021, which resulted in the loss of EOS03 (GISAT1) due to a cryogenic upper stage anomaly.

Feature	GSLV-F10 (2021)	GSLV-F17 (2026)
Satellite	EOS-03 (GISAT-1)	EOS-05
Outcome	Failed	Successful
Issue	Cryogenic upper-stage anomaly	—
Launch Vehicle	GSLV Mk II	GSLV Mk II
Orbit	Intended GTO	Sub-GTO
Payload	EOS-03	2,367 kg

7.9 MatsyaMetri

Why in News?

The Central Marine Fisheries Research Institute (CMFRI), Kochi has developed Matsya Metri, an Android based smartphone application that enables noncontact measurement of fish using image based technology.

Key Features

- **Developer:** Central Marine Fisheries Research Institute (CMFRI), Kochi.

- **Platform:** Android based smartphone application.
- **Technology:** Uses AR Core supported image based technology.
- **Function:** Measures the length and width of fish from images without physically handling the specimen.
- **Target Users:** Fisheries scientists, researchers and field survey teams.
- **Purpose:** Supports biological assessment and fisheries research

7.10 National Conference on Quality and Safety of Biosimilars

Why in News?

The Indian Pharmacopoeia Commission (IPC) organised a two-day National Conference on “Quality and Safety of Bio similars: Strengthening India’s Biopharma SHAKTI Vision” in Bengaluru.

What are Bio similars?

- **Definition:** Highly similar biological medicines developed to match an already approved reference biologic in quality, safety and efficacy.
- **Unlike generic drugs:** Bio similars involve complex biological molecules and therefore require extensive analytical and clinical comparability assessment.
- **Applications:** Used in conditions such as cancer, arthritis, kidney diseases, psoriasis, Crohn’s disease and colitis.
- **Affordability:** Competition from biosimilars can reduce the cost of

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expensive biologic therapies and improve patient access.

Biopharma SHAKTI Vision

Announced in the Union Budget 2025–26, the initiative seeks to strengthen India's domestic ecosystem for biologics and biosimilars.

Component	Key Provision
Financial Outlay	₹10,000 crore over 5 years
New NIPERs	Establishment of 3 new NIPERs
Existing NIPERs	Technological upgradation of 7 NIPERs
Clinical Research	Creation of 1,000+ accredited clinical trial sites
Core Objective	Strengthen R&D, clinical development and domestic manufacturing of biologics and biosimilars
Strategic Goal	Reduce import dependence and enhance India's global biopharma competitiveness

Significance

- **Healthcare affordability:** Greater biosimilar competition can reduce treatment costs.
- **Quality assurance:** Reference substances enable standardised and reproducible testing.
- **Biopharma self-reliance:** Supports domestic manufacturing of complex biological medicines.

- **Innovation ecosystem:** Strengthens research, clinical development and technology adoption.
- **Global competitiveness:** Can consolidate India's position as a major supplier of affordable biologic medicines.

Indian Pharmacopoeia Commission (IPC)

- **Status:** Autonomous institution under the Ministry of Health and Family Welfare.
- **Core mandate:** Establishes standards for the identity, purity, strength and quality of medicines manufactured and marketed in India.
- **IPRS:** Provides authenticated reference materials for reliable pharmaceutical testing and quality control.

7.11 ORV Sagar Manthan: Strengthening India's Indigenous Ocean Research Capability

Why in News?

India launched its first indigenously built Ocean Research Vessel (ORV) Sagar Manthan at Rishi Bankim Shipyard, Kolkata, marking a step towards strengthening indigenous capabilities in deep-sea exploration, ocean observation and marine scientific research.

About ORV Sagar Manthan

Component	Details
Type	Ocean Research Vessel (ORV)

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Builder	Garden Reach Shipbuilders & Engineers (GRSE)
Institution	National Centre for Polar and Ocean Research (NCPOR)
Ministry	Ministry of Earth Sciences (MoES)
Primary Focus	Deep-sea exploration, ocean observation and marine research
Launch Location	Rishi Bankim Shipyard, Kolkata

Significance

- **Deep-Sea Research:** Strengthens India's capacity to study deep-ocean ecosystems and resources.
- **Ocean Observation:** Supports systematic collection of oceanographic and environmental data.
- **Blue Economy:** Facilitates sustainable exploration of marine resources.
- **Indigenous Capability:** Reduces dependence on foreign research vessels and strengthens domestic shipbuilding.
- **Strategic Scientific Capacity:** Supports India's long-term ocean research and marine technology programmes.

7.12 Peptides

Why in News?

The concept of a "peptide party" came into focus after an event in Bengaluru was reportedly banned, highlighting growing

public interest in peptide-based products and therapies.

What are Peptides?

- **Definition:** Peptides are short chains of amino acids linked together by peptide bonds.
- **Size:** They generally contain 2–50 amino acids; longer chains are typically classified as proteins.
- **Biological Role:** Many peptides function as hormones, signalling molecules and regulators of physiological processes

Peptide	Source	Major Function
Insulin	Pancreas	Regulates blood glucose levels.
Endorphins	Central nervous system & pituitary	Act as natural pain modulators and influence stress and mood.
GHRH	Hypothalamus	Stimulates the pituitary gland to release growth hormone.

Key Biological Functions

- **Cell Signalling:** Transmit molecular signals that influence cellular activity.

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- **Hormonal Regulation:** Participate in regulation of metabolism, growth and other physiological processes.
- **Tissue Repair:** Certain peptides contribute to cellular growth and tissue-repair processes.
- **Immune Regulation:** Some peptides participate in immune responses.
- **Metabolic Regulation:** Influence processes such as glucose and energy metabolism.

7.13 Reverse Vaccinology

Why in News?

Scientists are using reverse vaccinology to identify potential vaccine candidates for developing a vaccine against pneumonia.

What is Reverse Vaccinology?

- **Genome based approach:** Uses genomics, bioinformatics and computational tools to identify potential vaccine targets.
- **Reverse approach:** Instead of first growing the pathogen and experimentally identifying antigens, scientists begin with its genome and computationally predict suitable antigen candidates.
- **Core Principle:** Genome → Antigen prediction → Experimental validation → Vaccine development.

Conventional vs Reverse Vaccinology

Conventional Vaccinology	Reverse Vaccinology
Starts with the pathogen and identifies suitable antigens through laboratory studies.	Starts with the pathogen's genome and predicts potential antigens computationally.
Relies mainly on culture-based and experimental methods.	Uses genomics, bioinformatics and computational tools.
Antigen identification can be time-consuming.	Enables rapid screening of multiple protein candidates.
More challenging for difficult-to-culture pathogens.	Genomic data can help identify targets without depending entirely on pathogen culture.

7.14 SARAL AI

Why in News?

CSIR-NIScPR is leveraging SARAL AI, an AI-based platform that converts complex scientific research papers and patents into accessible multimedia content, enabling wider dissemination of scientific knowledge.

What is SARAL AI?

- **Purpose:** Simplifies complex scientific literature for students, researchers and non-experts.

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- **Outputs:** Generates presentations, short videos, podcasts, posters and business briefs.
- **Language Accessibility:** Enables content generation in 18 Indian languages.
- **Key Technologies:** Uses Large Language Models (LLMs), automated information extraction and Text-to-Speech (TTS).
- **Surify Extension:** Enables users to generate summaries while browsing academic repositories.

How Does it Work?

- **Input:** Accepts research materials such as arXiv links and LaTeX files.
- **Content Extraction:** Identifies relevant text, figures and scientific information.
- **AI Processing:** LLMs convert technical content into simplified scripts and presentations.
- **Audio Generation:** TTS converts scripts into audio.
- **Multimedia Creation:** Integrates text, visuals, slides and audio into educational content.

Aspect	Details
Established	2023
Legal Basis	ANRF Act, 2023
Administrative Department	Department of Science & Technology (DST)
Core Mandate	Promote, fund and coordinate research and innovation

Key Focus	Industry-academia collaboration and strategic & emerging research
Predecessor	Science and Engineering Research Board (SERB)
Nodal Ministry	Ministry of Science & Technology
Broad Objective	Strengthen India's research ecosystem and enhance global research and innovation capabilities

7.15 Sentinel-3C & FLEX (Fluorescence Explorer)

Why in News?

On 15 September 2026, the European Space Agency (ESA) launched Sentinel-3C and FLEX (Fluorescence Explorer) from the Kourou Space Centre, French Guiana, aboard a Vega-C rocket to strengthen Earth-system and climate monitoring.

Sentinel-3C

- **Programme:** Part of the European Union's Copernicus Earth Observation Programme.
- **Primary Focus:** Monitoring oceans, land and coastal environments.
- **Key Parameters:** Provides data on sea-surface temperature, ocean conditions and wave characteristics.
- **Agriculture:** Land-monitoring data can support crop assessment, agricultural

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productivity and climate-resilient farming.

- **Climate Utility:** Helps improve monitoring of environmental changes and extreme events.

FLEX – Fluorescence Explorer

- **Primary Focus:** Monitoring vegetation health and photosynthetic activity.
- **Core Technology:** Detects the extremely faint fluorescence emitted by plants during photosynthesis.
- **What it Reveals:** Helps assess plant stress, ecosystem productivity and photosynthetic efficiency.
- **Climate Relevance:** Provides insights into how vegetation responds to heatwaves, drought and other environmental stresses.

Parameter	Sentinel-3C	FLEX
Full Name	Sentinel-3C	Fluorescence Explorer
Primary Focus	Oceans, land and coastal areas	Vegetation and ecosystems
Key Observation	Sea-surface temperature, ocean conditions and wave characteristics	Vegetation fluorescence and photosynthetic activity
Major Application	Ocean monitoring,	Plant health, ecosystem

	land management and agricultural assessment	productivity and environmental stress
Climate Relevance	Monitors changes in oceans and terrestrial environments	Assesses plant response to heat, drought and other stresses
Programme	EU Copernicus Programme	ESA Earth-observation mission

7.16 TRISHNA Mission – Thermal Mapping for Water & Climate Security

Why in News?

The TRISHNA (Thermal infraRed Imaging Satellite for High-resolution Natural resource Assessment) is an Indo-French Earth-observation mission being jointly developed by ISRO and CNES to provide high-resolution thermal and optical observations of Earth's surface.

Key Features

- **Nature:** Joint India–France Earth-observation mission.
- **Objective:** Monitor land-surface temperature, evapotranspiration and environmental changes at high spatial resolution.
- **Core Technology:** Combines thermal infrared and optical observations.

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- **Water Security:** Evapotranspiration and surface-temperature data can identify agricultural and ecosystem water stress.

Area	Application
Water Security	Assesses water stress using evapotranspiration and land-surface temperature data
Precision Agriculture	Supports irrigation planning and identification of water-stressed crops
Climate Monitoring	Helps study land-atmosphere interactions and surface-energy balance
Urban Planning	Maps urban heat islands to support heat-mitigation strategies
Disaster Management	Thermal observations can support monitoring of volcanic and geothermal activity

Significance

- **Water-use Efficiency:** Enables better assessment of crop and ecosystem water requirements.
- **Climate Resilience:** Provides high-resolution data on thermal changes and environmental stress.
- **Sustainable Agriculture:** Supports precision irrigation and improved water management.

- **Urban Heat Management:** Helps identify heat hotspots for targeted adaptation measures.
- **Indo-French Cooperation:** Strengthens collaboration in Earth observation and climate science.

Aspect	ISRO	CNES
Full Name	Indian Space Research Organisation	Centre National d'Études Spatiales
Country	India IN	France FR
Established	1969	1961
Role	India's national space agency	France's national space agency
Headquarters	Bengaluru, Karnataka	Paris, France
Major Areas	Space research, satellite technology, launch vehicles, Earth observation and planetary missions	Space science, Earth observation, launch systems, satellite technology and climate monitoring
TRISHNA Role	Jointly develops the	Jointly develops the

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	TRISHNA mission	TRISHNA mission and contributes the Thermal Infrared (TIR) payload
Significance	Strengthens India's Earth-observation and climate-monitoring capabilities	Strengthens Indo-French cooperation in Earth observation and climate science

PLACES IN NEWS

8.1 Emi Koussi Volcano: Volcanic Landmark of the Sahara

Why in News?

Emi Koussi, a prominent volcanic massif in the central Sahara of northern Chad, was in the news for its distinctive volcanic and caldera features.

Key Features

- **Location:** Central Sahara, northern Chad.
- **Mountain Range:** Located at the south eastern end of the Tibesti Mountains.
- **Type:** Large shield volcano.

- **Elevation:** Highest mountain in Chad and the Sahara region.
- **Caldera:** Contains a large caldera with a smaller crater and a salt-covered dry lake at its lowest point.
- **Volcanic Features:** The massif contains various volcanic landforms, including maars.

What is a Maar?

A maar is a broad, low-relief volcanic crater formed when groundwater comes into contact with hot magma or lava, producing a steam-driven explosive eruption.

8.2 Java Sea

Why in News?

The Java Sea, a shallow tropical sea in Southeast Asia, was in the news for its geographical and strategic significance between the major Indonesian islands of Java and Borneo.

Key Geographical Features

- **Location:** Situated between Java and Borneo (Kalimantan) in Indonesia.
- **North:** Borneo (Kalimantan).
- **South:** Java.
- **West:** Sumatra.
- **Northeast:** Southern end of the Makassar Strait.
- **East:** Celebes, Flores and Bali seas.
- **Southwest:** Connected to the Indian Ocean through the Sunda Strait.

Sunda Shelf

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- The Java Sea forms part of the Sunda Shelf, a broad and shallow continental shelf of Southeast Asia.
- The shallow marine environment is associated with extensive coastal and marine ecosystems.

Climate and Ecology

- **Climate:** Predominantly tropical monsoon, with distinct wet and dry seasons.
- **Monsoon Influence:** Seasonal changes in wind patterns influence ocean conditions, fishing and maritime navigation.
- **Resources:** Supports fisheries and other marine resources important to the surrounding island communities.

8.3 Kandaleru Dam

Why in News?

Kandaleru Dam in Andhra Pradesh is an important water-storage structure associated with the Telugu Ganga Project.

Key Features

- **Location:** Nellore district, Andhra Pradesh.
- **River:** Built across the Kandaleru River, a tributary of the Pennar (Penna) River.
- **Type:** Predominantly an earthen dam, constructed using soil and rock.
- **Earth Dam Length:** Approximately 11 km, making it one of India's major earthen dams.

- **Telugu Ganga Project:** The dam forms an important part of the project for water supply and irrigation, including the supply of Krishna water to Chennai.

Telugu Ganga Project – Background

- **Agreement:** The project originated from a 1977 agreement involving Tamil Nadu and the Krishna-basin states of Andhra Pradesh, Karnataka and Maharashtra.
- **Objective:** Transfer of a share of Krishna River water to meet the drinking-water requirements of Chennai, along with irrigation benefits in Andhra Pradesh

8.4 Larak Island

Why in News?

Larak Island, an Iranian island in the Persian Gulf, is strategically significant because of its location near the Strait of Hormuz, a major global maritime chokepoint.

Key Features

- **Country:** Iran
- **Location:** Persian Gulf, near the Strait of Hormuz.
- **Relative Location:** Located south of Hormuz Island, southeast of Bandar Abbas, and southeast of the eastern end of Qeshm Island.
- **Strategic Location:** Lies close to one of the world's most important maritime chokepoints.
- **Strait of Hormuz:** A narrow waterway connecting the Persian Gulf with the Gulf

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of Oman, providing access to the Arabian Sea and the wider Indian Ocean.

Strategic Significance

- **Energy Security:** The Strait of Hormuz is a crucial route for the transportation of oil and liquefied natural gas (LNG) from the Persian Gulf region.
- **Maritime Security:** Larak's location gives it relevance to shipping, naval activity and surveillance in the Strait of Hormuz.
- **Geopolitical Importance:** Its position reflects the strategic significance of Iran's islands around the Strait of Hormuz.

8.5 Lord Howe Island

Why in News?

A seabird chick found on Lord Howe Island with 894 pieces of plastic in its stomach has highlighted the growing threat of marine plastic pollution to remote island ecosystems.

Key Features

- **Location:** In the Tasman Sea, about 600 km east of mainland Australia.
- **Origin:** A volcanic island formed around 7 million years ago; it is a remnant of a shield volcano.
- **Major Peaks:** Mount Gower (875 m) and Mount Lidgbird (777 m) dominate the island and overlook its lagoon.
- **Biodiversity:** Known for its distinctive and highly endemic flora and fauna.
- **Coral Reef:** Supports the world's southernmost true coral reef.

- **UNESCO World Heritage Site:** Inscribed in 1982 for its exceptional natural values and unique biodiversity.

Environmental Significance

- **Marine Plastic Pollution:** The incident demonstrates how plastic waste transported through oceans can reach even remote island ecosystems.
- **Seabird Vulnerability:** Seabirds can mistake plastic debris for food, causing ingestion, starvation and internal injury.
- **Ecosystem Sensitivity:** Island ecosystems are often geographically isolated and contain species with restricted habitats and high endemism.

8.6 Mayun (Perim) Island

Why in News?

Mayun (Perim) Island, a Yemeni volcanic island in the Bab el-Mandeb Strait, is strategically important because it influences maritime movement between the Red Sea and the Gulf of Aden.

Key Features

- **Country:** Yemen
- **Location:** In the Bab el-Mandeb Strait, at the southern entrance to the Red Sea.
- **Nature:** Small, rocky volcanic island.
- **Strategic Location:** Lies between the Arabian Peninsula and the Horn of Africa.
- **Chokepoint Function:** The island divides the Bab el-Mandeb into two channels:

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- **Eastern Channel** – Alexander's Strait: Between Mayun and the Yemeni mainland.
- **Western Channel** – Dact-el-Mayun: Between Mayun and the African coast (Djibouti); it is wider and deeper and is important for international shipping.

Strategic Significance

- **Global Shipping:** Bab el-Mandeb is a major maritime chokepoint connecting the Red Sea with the Gulf of Aden and the Indian Ocean.
- **Energy & Trade:** Disruptions around the strait can affect shipping, energy flows and global supply chains.
- **Geopolitical Importance:** Mayun's position makes it significant for maritime security and regional geopolitics in the Red Sea–Horn of Africa region.

8.7 Sohar Port

Why in News?

Oman has highlighted Sohar Port as a potential gateway that could provide India with improved access to Gulf energy and regional markets.

Key Features

- **Location:** A major deep-sea port in northern Oman, on the Gulf of Oman.
- **Proximity:** Located about 160 km south of the Strait of Hormuz, between Muscat and Dubai.
- **Strategic Location:** Positioned outside the Persian Gulf, giving it direct access to

the Arabian Sea through the Gulf of Oman.

- **Commercial Hub:** Facilitates trade between the Gulf region, Indian subcontinent and East Africa.
- **Port Complex:** Functions as an important industrial, logistics and maritime hub in Oman.

Strategic Significance

- **Energy Security:** Its location near the Strait of Hormuz can provide an alternative logistics gateway for Gulf energy supplies.
- **India–Oman Connectivity:** Strengthens India's maritime and economic engagement with Oman.
- **Chokepoint Advantage:** Its location outside the Strait of Hormuz is strategically relevant amid concerns over disruptions at the chokepoint.
- **Regional Trade:** Enhances connectivity between West Asia, South Asia and East Africa.

8.8 Taklamakan Desert

Why in News?

China's large-scale tree-planting and desert-greening efforts in the Taklamakan Desert have renewed debate over the ecological limits and unintended consequences of greening extremely arid regions.

Key Features

- **Name Meaning:** In Uyghur, Taklamakan is commonly interpreted as “place of no return”.
- **Also Known As:** “Sea of Death.”

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- **Location:** Xinjiang Uyghur Autonomous Region, northwestern China.
- **Physiographic Setting:** Occupies the central part of the Tarim Basin.
- **Area:** Approximately 337,000–338,000 sq km, roughly comparable to the size of Germany.
- **Nature:** One of the world's largest sand deserts, characterised by extremely arid conditions and extensive shifting sand dunes.

China's Greening Experiment

- **Desertification Control:** Vegetation has been planted around the desert margins to reduce sand movement and desertification.
- **Water Constraint:** Large-scale afforestation in an extremely dry environment can increase water demand, creating concerns about groundwater and scarce water resources.
- **Ecological Balance:** Desert ecosystems are naturally adapted to aridity; replacing native desert vegetation with extensive plantations may alter soil, water and biodiversity dynamics.

8.9 Tso Kar Lake

Why in News?

Tso Kar Lake, a high-altitude saline lake in Ladakh's Rupshu Valley, is an important component of the region's unique high-altitude wetland ecosystem.

Key Features

- **Location:** Rupshu Valley, Ladakh, at a high altitude in the Trans-Himalayan region.
- **Meaning:** Tso Kar means "White Lake" in Ladakhi, referring to the white salt deposits along its shores.
- **Nature:** A hypersaline lake surrounded by an arid, high-altitude desert landscape.

Tso Kar Basin: Comprises two interconnected lakes:

- Tso Kar: Hypersaline main lake.
- Startsapuk Tso: Smaller freshwater lake located to its south.
- **Regional Lakes:** Tso Kar is one of the three major lakes of the region, alongside Pangong Tso and Tso Moriri.

RIVERS IN NEWS

9.1 Devi Estuary

Why in News?

A new bivalve species has been discovered in the Devi Estuary of Odisha, highlighting the rich biodiversity of this important coastal ecosystem.

Key Features

- **River System:** The Devi River is one of the principal southern distributaries of the Mahanadi River.
- **Origin:** It branches from the Kathajodi River near Cuttack, Odisha.
- **Course:** Flows through Jagatsinghpur and Puri districts.

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- **Mouth:** Drains into the Bay of Bengal near Astaranga.
- **Estuarine System:** Characterised by tidal creeks, mudflats and dynamic sandbars.
- **Mangroves:** Dense mangrove vegetation provides coastal protection and supports diverse brackish-water fauna.

Ecological Significance

- **Olive Ridley Rookery:** The mouth of the Devi River is an important nesting site for Olive Ridley sea turtles.
- **Mass Nesting:** Large numbers of turtles arrive during the winter breeding season for mass nesting (arribada).
- **Biodiversity:** The combination of freshwater inflow, tidal influence, mangroves and mudflats creates a productive brackish-water ecosystem.
- **Coastal Protection:** Mangroves act as natural buffers against cyclones, storm surges and coastal erosion.

9.2 Hasdeo River

Why in News?

The Hasdeo River, an important tributary of the Mahanadi, is in focus for its role in the river system, irrigation and hydropower development in Chhattisgarh.

Key Features

- **River System:** Major tributary of the Mahanadi River.
- **State:** Flows entirely through Chhattisgarh.

- **Origin:** Rises from a small lake near Ambikapur in Surguja district.
- **Course:** Flows through Surguja, Korea and Bilaspur regions before joining the Mahanadi near Akaltara in Janjgir-Champa district.
- **Reservoir:** Hasdeo Bango Reservoir is constructed across the river.
- **Major Tributaries:** Gej and Ahiran.

Economic Significance

- **Irrigation:** Hasdeo Bango Reservoir supports irrigation in parts of Chhattisgarh.
- **Hydropower:** The reservoir and associated project contribute to hydroelectric power generation.
- **Water Resource Management:** The river-reservoir system is important for regulating water availability in the Mahanadi basin.

9.3 Lohit River

Why in News?

The Lohit River, a major tributary of the Brahmaputra, originates in Tibet and flows through Arunachal Pradesh before joining the Brahmaputra in Assam.

Key Features

- **River System:** Major eastern tributary of the Brahmaputra.
- **Origin:** Rises in eastern Tibet, in the Zayal Chu range.
- **Entry into India:** Enters India through Anjaw district of Arunachal Pradesh.

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- **Course:** Flows through the eastern Himalayas and travels for about 200 km in Arunachal Pradesh before entering Assam.
- **Confluence:** Joins the Brahmaputra in Assam.
- **Nickname:** Known as the “River of Blood” due to the reddish colour sometimes imparted by iron-rich lateritic sediments carried into the river during heavy rainfall.

Major Tributaries

Bank	Tributaries
Right Bank	Dau, Dalai, Tidding
Left Bank	Lang

9.4 Subansiri River: Hydropower

Development in the Eastern Himalayas

Why in News?

The Expert Appraisal Committee (EAC) of the Ministry of Environment, Forest and Climate Change has recommended environmental clearance for the 1,605 MW Subansiri Upper Hydroelectric Project in Arunachal Pradesh.

About the Suban siri River

Parameter	Key Fact
River System	Brahmaputra River System
Nature	Major right-bank tributary of the Brahmaputra
Origin	Tibet

States Traversed	Arunachal Pradesh and Assam
Physiographic Region	Eastern Himalayas and Trans-Himalayan region
Lower Course	Flows into Assam and joins the Brahmaputra
Nickname	“Gold River”, traditionally associated with gold-bearing sediments
Economic Importance	Hydropower, irrigation, fisheries and livelihoods
Strategic Importance	Important river system in the Eastern Himalayan and Northeast region

Left-Bank Tributaries	Right-Bank Tributaries
Laro	Tsari
Nye	Kamla
Yume	Jiyadhol
Ranganadi	Dikrong

Why is the Subansiri Basin Important?

- **Hydropower Potential:** The steep Himalayan gradient provides substantial potential for hydropower generation. The basin already hosts major projects, including the Subansiri Lower Hydroelectric Project.
- **Strategic Geography:** The upper basin lies in Arunachal Pradesh, a strategically

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important frontier region adjoining Tibet/China.

- **Ecological Sensitivity:** Himalayan river systems are highly sensitive to changes in river flow, sediment transport, forests and aquatic ecosystems.

SECURITY & DEFENCE

10.1 'RAKSHA' Framework

Why in News?

Defence Minister Rajnath Singh released the 'RAKSHA' Framework, a long-term strategic blueprint to guide India's defence diplomacy and global defence partnerships over the next decade.

What is the RAKSHA Framework?

- **Purpose:** Provides an actionable roadmap for aligning national security objectives with international defence cooperation.
- **Time Horizon:** Envisages India's defence-diplomacy priorities over the next 10 years.
- **Core Vision:** Strengthen strategic partnerships, promote regional stability and enhance India's role in the evolving global security architecture.

Four Strategic Pillars

Pillar	Focus
Strategic Partnerships	Deepen bilateral and multilateral security cooperation with key partners.
Defence Cooperation	Expand cooperation in areas such as defence

	engagement, training and capability development.
Regional Security	Contribute to peace, stability and security in India's neighbourhood and wider strategic regions.
Global Defence Engagement	Strengthen India's role in international security cooperation and promote a rules-based global order.

10.2 Exercise Tarang Shakti 2026

Why in News?

The Indian Air Force (IAF) is set to host the second edition of Exercise Tarang Shakti 2026, a major multinational air exercise aimed at strengthening interoperability and operational cooperation among participating air forces.

Key Features

- **Host:** Indian Air Force (IAF)
- **Edition:** Second edition
- **Inaugural Edition:** Held in 2024 in two phases at Sullur, Tamil Nadu, and Jodhpur, Rajasthan.
- **Nature:** Multinational air exercise involving friendly foreign air forces.
- **Primary Aim:** Enhance interoperability, operational coordination and exchange of combat experiences among participating air forces.

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- **Capability Showcase:** Provides India an opportunity to showcase its indigenous air-combat capabilities.

Participating Countries

Category	Countries
Active Participants – 8	Australia, Bangladesh, France, Germany, Greece, Sri Lanka, UAE and USA
Observer Nations – 32	Attend to observe and study the exercise and tactical deployments

10.3 Exercise KAZIND-2026

Why in News?

A 60-member Indian Armed Forces contingent departed for Oskemen, Kazakhstan, for the 9th edition of Exercise KAZIND-2026.

Key Facts

Parameter	Details
Exercise	KAZIND-2026
Participants	India and Kazakhstan
Host Country	Kazakhstan
Location	Oskemen, Kazakhstan
Edition	9th edition
Nature	Joint military exercise
Primary Focus	Counter-terrorism and interoperability
Terrain	Semi-urban and mountainous terrain
Indian Contingent	60 personnel
Key Training Areas	Joint operations, counter-terrorism tactics and

coordination in challenging terrain

10.4 INS Kulish

Why in News?

INS Kulish, a Kora-class corvette of the Indian Navy, was in focus for its role as a missile-capable surface combatant.

Key Features

- **Class:** Kora-class corvette.
- **Name:** Kulish means “Thunderbolt” in Sanskrit.
- **Construction:** Built in India through the indigenous naval shipbuilding programme, with GRSE involved in its construction.
- **Commissioned:** 2001.
- **Primary Role:** Designed primarily for anti-surface warfare.
- **Main Armament:** Equipped with Kh-35 anti-ship cruise missiles of Russian origin.

What is a Corvette?

A corvette is a relatively small, fast and manoeuvrable warship designed primarily for coastal and near-sea operations, although modern corvettes can undertake a range of missions.

Category	General Characteristics
Patrol Craft / Fast Attack Craft	Small, fast vessels mainly for coastal patrol, surveillance and short-range combat

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Corvette	Small, agile warship; mainly for coastal and near-sea operations
Frigate	Larger multi-role warship; escort, anti-submarine and air-defence roles
Destroyer	Large, heavily armed multi-role warship; air defence, anti-surface and anti-submarine warfare
Cruiser	Very large surface combatant with long-range weapons and command capabilities

10.5 Jhiram Ghati : The Security–Development Challenge of Left-Wing Extremism

Why in News?

A Special NIA Court at Jagdalpur convicted 10 CPI (Maoist) cadres in the 2013 Jhiram Ghati attack. The court subsequently awarded the death penalty to all 10 on 16 September 2026, bringing renewed attention to Left-Wing Extremism (LWE) and the challenges of security, governance and development in affected regions.

Jhiram Ghati Attack – Background

- **Date:** 25 May 2013.
- **Location:** Jhiram Ghati, Bastar district, Chhattisgarh.
- **Nature:** CPI (Maoist) ambushed a Congress Parivartan Yatra convoy.

➤ **Casualties:** 27 people were killed, including senior political leaders and security personnel; 38 were injured.

➤ **Investigation:** The NIA took over the case on 27 May 2013 and filed chargesheets in the NIA Special Court, Jagdalpur.

What is an NIA Special Court?

- Special Courts are designated by the Central Government under the National Investigation Agency Act, 2008 for the trial of offences investigated by the NIA.
- Legal Basis: Section 11 empowers the Central Government to constitute Special Courts for the trial of scheduled offences.

10.6 Khagantak-243

Why in News?

The Indian Air Force (IAF) successfully conducted trials of Khagantak-243, an indigenous long-range stand-off precision-guided glide bomb, in September 2026.

Key Features

- **Type:** Air-launched, long-range stand-off precision-guided glide bomb.
- **Weight Class:** 300-kg class.
- **Developers:** Jointly developed by Nagpur-based JSR Dynamics and Bharat Electronics Limited (BEL).
- **Design:** Cylindrical body with swivel-type mid-body glide wings and five aft control surfaces.
- **Guidance:** After release from an aircraft, the deployable aerodynamic surfaces

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enable controlled gliding towards the target.

- **Warhead:** Mk-81 general-purpose blast-fragmentation warhead.

Why is a Glide Bomb Significant?

- **Stand-off Capability:** Allows an aircraft to engage targets from a distance without directly flying over the target area.
- **Precision Strike:** Guidance and aerodynamic control improve targeting accuracy.
- **Reduced Aircraft Exposure:** Stand-off employment can reduce exposure of aircraft to enemy air-defence systems.

Glide Bomb vs Conventional Bomb

Feature	Conventional Bomb	Glide Bomb
Propulsion	No powered propulsion	Generally unpowered after release
Range	Primarily dependent on release conditions	Extended through aerodynamic glide
Wings	Usually absent	Deployable wings/control surfaces
Accuracy	Relatively lower	Higher with precision guidance
Stand-off capability	Limited	Greater

10.7 RVV-BD Missile

Why in News?

The RVV-BD, Russia's very-long-range Beyond-Visual-Range (BVR) air-to-air missile, has attracted attention for its potential to engage high-value aerial targets such as AEW&C aircraft, aerial refuellers and surveillance platforms.

Key Features

- **Full Name:** Raketa Vozduh-Vozduh Bolshoy Dalnosti — meaning very-long-range air-to-air missile.
- **Origin:** Russia.
- **Variant:** Export version of the R-37M missile.
- **Type:** BVR air-to-air missile.
- **Range:** Reported up to 200 km for the export version in the forward hemisphere; longer ranges have been reported in connection with proposed integrations.
- **Speed:** Approximately Mach 6.
- **Targets:** Designed particularly for high-value and relatively less manoeuvrable aerial platforms.

What is BVR Air-to-Air Missile?

A Beyond-Visual-Range (BVR) missile enables an aircraft to engage an enemy aircraft without requiring visual identification of the target at close range.

Strategic Significance

- **Counter-Force Multiplier:** Threatens high-value enablers such as AEW&C and aerial-refuelling aircraft.

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- **Extended Engagement Range:** Allows fighter aircraft to engage targets from considerable distances.
- **Air-Superiority Operations:** Can disrupt an adversary's surveillance, command-and-control and air-refuelling architecture.
- **Network-Centric Warfare:** Effectiveness increases when combined with long-range sensors and external targeting data.

10.8 Table Top Exercise (TTX) under Colombo Security Conclave

Why in News?

A three-day Table Top Exercise (TTX) under the Colombo Security Conclave (CSC) was conducted at the Eastern Naval Command, Visakhapatnam, focusing on coordinated responses to maritime security challenges.

What is a Table Top Exercise (TTX)?

A TTX is a simulation-based exercise in which commanders, officials and relevant agencies discuss and rehearse responses to hypothetical crisis situations without physically deploying troops, ships or other operational assets.

Key Focus Areas

- **Maritime Terrorism:** Coordinated response to terrorist threats and attacks at sea.
- **Drug Trafficking:** Strengthening information-sharing and mechanisms to detect and disrupt maritime drug networks.

- **Human Trafficking:** Improving cooperation against trafficking conducted through maritime routes.
- **Piracy:** Developing coordinated responses to piracy and maritime security incidents.

SCHEMES & INITIATIVES

11.1 National Single Window System: Transforming Business Approvals in India

Why in News?

The National Single Window System (NSWS) completed five years in September 2026. Launched on 22 September 2021, it has emerged as an important digital platform for simplifying and integrating business approvals across the Centre and States.

What is NSWS?

The National Single Window System is a digital platform that enables investors and businesses to identify and apply for various government approvals through a single interface.

- **Launched:** 22 September 2021
- **Nodal Ministry:** Ministry of Commerce & Industry
- **Implementing Agency:** Department for Promotion of Industry and Internal Trade (DPIIT)
- **Coverage:** Approvals integrated from 32 Central Ministries/Departments and 34 States/UTs.

Key Objectives

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- **Single Interface:** Provides businesses with a common digital platform for regulatory approvals.
- **Regulatory Simplification:** Reduces the need to approach multiple government departments separately.
- **Transparency:** Enables applicants to track approval processes digitally.
- **Ease of Doing Business:** Reduces procedural complexity and transaction costs.
- **Investment Facilitation:** Helps investors identify approvals required for establishing and operating businesses.

11.2 e-FAST India Initiative

Why in News?

e-FAST India, an initiative of NITI Aayog, launched PACT to support the accelerated deployment of zero-emission freight vehicles in India.

What is e-FAST India?

- e-FAST stands for Electric Freight Accelerator for Sustainable Transport – India.
- It is a collaborative platform aimed at accelerating the transition of India's freight sector towards electric and other zero-emission mobility solutions.
- **Launched:** 2022
- **Initiated by:** NITI Aayog
- **Collaboration:** World Resources Institute (WRI)
- **Approach:** Brings together government and private-sector stakeholders.

Key Stakeholders

- Original Equipment Manufacturers (OEMs)
- Logistics Service Providers
- Financiers
- Shippers/Freight Users
- Charge Point Operators
- Government agencies

Key Focus

- The initiative particularly focuses on the electrification of Medium and Heavy-Duty Vehicles (e-MHDVs).
- These vehicles are important because freight transport is a significant source of fuel consumption and transport-sector emissions, while electrifying heavy vehicles presents greater infrastructure and cost challenges than passenger vehicles.

11.3 Integrated Fertilizer Management System (iFMS)

The Department of Fertilizers has upgraded the Integrated Fertilizer Management System (iFMS), transforming it from a primarily transactional database into a data-driven decision-support platform for managing India's fertiliser ecosystem.

What is iFMS?

- The Integrated Fertilizer Management System (iFMS) is a national end-to-end digital tracking and enterprise resource platform developed by the National Informatics Centre (NIC) for the

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Department of Fertilizers, Ministry of Chemicals & Fertilizers.

- It tracks the fertiliser supply chain from production and imports to distribution, stock availability and retail sales.

Key Features

- **End-to-End Tracking:** Monitors fertiliser movement from domestic production and imported consignments to final retail sale.
- **Logistics Monitoring:** Tracks movement through railways and roads.
- **Stock Management:** Provides information on fertiliser availability at the district level.
- **Retail Network:** Covers more than 2.5 lakh retail outlets.
- **Large-Scale Transactions:** Tracks around 7 crore metric tonnes of fertiliser transactions annually.
- **Subsidy Management:** Supports administration of nearly ₹2 lakh crore in annual Central fertiliser subsidies.

AgriStack Integration

- A major upgrade involves integrating iFMS with State land records and the central AgriStack.
- For example, integration with Haryana's Meri Fasal Mera Byora links fertiliser purchases with: Verified Farmer ID → Landholding → Crop/Input Requirement → Fertiliser Purchase.

Significance

- **Preventing Hoarding:** Farmer- and land-linked purchase data can help

identify abnormal demand and stock accumulation.

- **Better Subsidy Management:** Improves monitoring of subsidised fertiliser distribution.
- **Demand Forecasting:** Real-time data can support more accurate assessment of regional fertiliser requirements.
- **Supply-Chain Efficiency:** Helps identify bottlenecks in production, transportation and retail availability.
- **Data-Driven Agriculture: Moves fertiliser governance** from transaction recording towards predictive and evidence-based management.

11.4 Mission Rangeen Machhli 2031

Why in news ?

Vice President C. P. Radhakrishnan launched Mission Rangeen Machhli 2031 on 31 August 2026 during a Fisheries Outreach Programme at Agatti, Lakshadweep, to promote sustainable ornamental fisheries and strengthen the islands' Blue Economy.

About the Mission

- Mission Rangeen Machhli 2031 is a Strategic Action Plan for Ornamental Fisheries Development.
- **Launch:** 31 August 2026
- **Venue:** Agatti, Lakshadweep
- **Launched by:** Vice President C. P. Radhakrishnan
- **Nodal Ministry:** Ministry of Fisheries, Animal Husbandry & Dairying

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- **Primary Focus:** Development of ornamental fisheries
- **Broader Goal:** Sustainable fisheries-led Blue Economy

What are Ornamental Fisheries?

Ornamental fisheries involve the breeding, rearing, conservation and trade of attractive aquarium fish and other aquatic organisms for ornamental and recreational purposes.

Significance

- **Livelihood Diversification:** Creates additional income opportunities for coastal and island communities.
- **Blue Economy:** Converts marine and aquatic biodiversity into sustainable economic opportunities.
- **Lakshadweep Potential:** The islands' rich marine biodiversity provides opportunities for developing sustainable ornamental-fish activities.

11.5 Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY)

Why in News?

The Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY), launched in 2015, aims to ensure that mining-affected communities benefit from mineral development.

Key Features

- **Launch:** 2015 by the Ministry of Mines.
- **Objective:** Welfare and socio-economic development of people and areas affected by mining, addressing the “resource curse”.

- **Implementation:** Implemented through District Mineral Foundations (DMFs), which are non-profit trusts established in mining-affected districts.
- **Legal Basis:** The scheme operates within the framework of the Mines and Minerals (Development and Regulation) Act, 1957 (MMDR Act).
- **State Role:** State Governments incorporate PMKKKY guidelines into their DMF rules.
- **Convergence:** Complements existing Central and State Government development schemes.

11.6 National Commission for Safai

Karamcharis (NCSK)

Why in News?

The Government appointed a new Chairperson, Vice-Chairperson and Members to the National Commission for Safai Karamcharis (NCSK), with the present Commission's tenure extending up to 31 March 2028.

Position	Name
Chairperson	Bhagwat Prasad Makwana
Vice-Chairperson	Kaishab Bihari
Members	Manoj Kumar Balmiki; Sushma Gaudiyal; Ravi Ramu Kalose

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About NCSK

The National Commission for Safai Karamcharis (NCSK) works for the welfare, rights, dignity and rehabilitation of Safai Karamcharis and monitors measures aimed at eliminating manual scavenging.

Feature	Details
Established	1994
Original Statutory Basis	National Commission for Safai Karamcharis Act, 1993
Current Status	Non-statutory body
Administrative Ministry	Ministry of Social Justice & Empowerment
Present Tenure	Up to 31 March 2028
Key Legislation	Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013

Key Functions

- **Rights & Dignity:** Protect the rights, dignity and welfare of Safai Karamcharis.
- **Manual Scavenging:** Work towards elimination of manual scavenging.
- **Rehabilitation:** Monitor rehabilitation and alternative livelihood measures for affected workers.
- **Institutional Monitoring:** Review implementation of welfare programmes and safeguards.
- **Legal Protection:** Support implementation of the 2013 Act.

11.7 Rashtriya Poshan Maah 2026

Why in News?

The 9th Rashtriya Poshan Maah was launched with the theme “Hamari Anganwadi Hamari Jimmedari”, emphasising community participation and strengthening Anganwadi Centres for better nutrition outcomes.

About Rashtriya Poshan Maah

- **Observed:** Every year in September.
- **Nodal Ministry:** Ministry of Women and Child Development.
- **Associated Mission:** POSHAN Abhiyaan.
- **Core Approach:** Convergence of multiple departments, behavioural change and community participation.
- **Objective:** Improve nutrition outcomes and address undernutrition, anaemia and other forms of malnutrition.

Key Focus Areas

- **Anganwadi Centres:** Strengthen Anganwadis as communitylevel platforms for nutrition and early childhood development.
- **Maternal & Child Nutrition:** Improve nutrition among pregnant women, lactating mothers and children.
- **Anaemia Reduction:** Promote awareness, dietary diversity and preventive interventions.
- **Behavioural Change:** Encourage healthy dietary and childcare practices.

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11.8 India's First LNG-Powered Train: Exploring Alternative Railway Fuels

Why in News?

- Indian Railways has introduced India's first LNG-powered train, marking an experiment with alternative fuels for railway transportation.
- The initiative explores the potential of LNG-diesel dual-fuel technology as an alternative to conventional diesel traction.

Key Features

- **LNG-Diesel Dual-Fuel System:** The train uses LNG along with diesel, with LNG intended to replace a significant portion of conventional diesel consumption.
- **Launch:** The initiative was launched from Sabarmati, Gujarat.
- **LNG:** Liquefied Natural Gas is natural gas cooled to approximately -162°C , causing it to become liquid.
- **Reduced Volume:** Liquefaction substantially reduces the volume of natural gas, making it easier to store and transport.
- **Lower Emissions:** Natural gas generally produces lower emissions of certain pollutants and CO_2 per unit of energy compared with conventional diesel, although LNG remains a fossil fuel.

LNG vs Hydrogen Trains

Feature	LNG Train	Hydrogen Train
Fuel	LNG + Diesel	Hydrogen

Core Technology	Dual-fuel internal combustion engine	Hydrogen fuel-cell system
Energy Conversion	Chemical energy → combustion → mechanical energy	Chemical energy → electrochemical reaction → electricity
Main Exhaust Product	CO_2 , water vapour and other combustion emissions	Mainly water vapour
Nature of Fuel	Fossil fuel	Can be low-carbon when produced using renewable electricity
Infrastructure Requirement	LNG storage, handling and bunkering facilities	Hydrogen production, storage and specialised refuelling infrastructure
Environmental Profile	Lower emissions than convention	Potentially very low operational emissions,

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	al diesel in some applications, but remains fossil-fuel based	depending on hydrogen production method
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HEALTH

12.1 Dili Declaration on Human Resources for Health

Why in News?

The WHO South-East Asia Regional Committee adopted the Dili Declaration on Human Resources for Health: Equity in Specialized Care, focusing on shortages and unequal distribution of specialist health workers.

What is the WHO South-East Asia Regional Committee?

- **Nature:** Governing body of the WHO South-East Asia Region (SEAR).
- **Members:** 11 Member States.
- **Headquarters of SEARO:** New Delhi, India.
- **Role:** Meets annually to formulate regional health policies, adopt resolutions and declarations, review health programmes and address regional health challenges.

WHO South-East Asia Region – Member States

- **11 Member States:** Bangladesh, Bhutan, Democratic People's Republic of Korea (North Korea), India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste.

12.2 Lumpy Skin Disease (LSD)

Why in News?

The Department of Animal Husbandry & Dairying (DAHD) has strengthened surveillance, vaccination and disease-control measures to contain Lumpy Skin Disease (LSD) among livestock.

What is Lumpy Skin Disease?

- **Nature:** A viral disease primarily affecting cattle and buffaloes.
- **Causative Agent:** Lumpy Skin Disease Virus (LSDV), belonging to the genus Capripoxvirus of the family Poxviridae.
- **Zoonotic Status:** Not zoonotic; LSDV does not infect humans.

Transmission & Geographical Spread

- **Vector-Borne:** Mainly transmitted through blood-feeding insects such as mosquitoes, biting flies and ticks.
- **Animal-to-Animal Spread:** Can also occur through contact with infected animals, contaminated equipment and certain bodily secretions.
- **Spread:** Originally reported in Africa, LSD has subsequently spread to parts of the Middle East, Asia and Europe, including India.

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- **India:** First reported in 2019 and subsequently spread across several cattle-rearing regions.

Key Symptoms

- Fever and characteristic skin nodules.
- Swelling of lymph nodes.
- Reduced milk production.
- Oedema of limbs and difficulty in movement.
- Severe cases may result in emaciation, secondary infections and death.

12.3 Scrub Typhus: The Neglected Vector-Borne Disease Beyond Mosquitoes

Why in News?

A recent death in Tamil Nadu has brought attention to scrub typhus, an important but often under-recognised febrile illness.

What is Scrub Typhus?

- **Causative Agent:** Orientia tsutsugamushi, an intracellular bacterium.
- **Vector:** Infected larval mites called chiggers.
- **Transmission:** Humans acquire infection through the bite of infected chiggers; it is not transmitted by mosquitoes.
- **Habitat:** Commonly associated with scrub vegetation, grasslands, rural areas and mite-infested environments.
- **Geographical Distribution:** Predominantly found in parts of Asia-Pacific, including India.

Symptoms

- **Fever:** Often acute and persistent.
- **Headache and Body Pain:** Common systemic symptoms.
- **Rash:** May occur during the illness.
- **Lymphadenopathy:** Enlarged lymph nodes may develop.
- **Eschar:** A characteristic dark, scab-like lesion at the site of the mite bite; however, it may not be present in every patient.

Prevention & Control

- **Avoid Exposure:** Minimise direct contact with mite-infested scrub and grassland areas.
- **Protective Clothing:** Wear covered clothing when working in vegetation-rich environments.
- **Personal Protection:** Use appropriate insect/mite repellents.
- **Early Diagnosis:** Maintain clinical suspicion in patients with unexplained fever and relevant environmental exposure.
- **Surveillance:** Strengthen detection and reporting of scrub typhus in endemic regions.

12.4 Hepatitis B and C: The Silent Burden of Viral Liver Disease

Why in News?

India reiterated its commitment to eliminate Hepatitis B and C as public-health threats by 2030.

What is Viral Hepatitis?

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- **Viral Hepatitis:** An infection causing inflammation of the liver, with Hepatitis B and C being major causes of chronic liver disease.
- **Silent Progression:** Infections may remain asymptomatic for years while gradually causing liver damage.

Feature	Hepatitis B (HBV)	Hepatitis C (HCV)
Virus	DNA virus	RNA virus
Family	Hepadnaviridae	Flaviviridae
Vaccine	Available	No preventive vaccine currently available
Major Transmission	Blood, sexual contact, mother-to-child	Primarily blood exposure
Chronic Infection	Can become chronic	Frequently becomes chronic
Special Feature	cccDNA can persist in infected liver cells	High genetic variability and mutation
Key Point	Prevention is strongly supported by vaccination	Curative antiviral treatment

		is available
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REPORTS & INDICES

13.1 Global Gender Gap Index 2026

Why in News?

- India's rank on Global Gender Gap Index unchanged at 131; Iceland retains top spot

➤ India's rank remained unchanged at 131st out of 145 economies in the Global Gender Gap Index 2026, while Iceland retained the top position for the 17th consecutive year.

About the Index

- **Released by:** World Economic Forum (WEF).
- **Published:** Annually since 2006.
- **Objective:** Measures the current state and evolution of gender parity across economies.
- **Approach:** Assesses the relative gap between women and men across four dimensions.

Four Key Sub-Indexes

- Economic Participation and Opportunity
- Educational Attainment
- Health and Survival
- Political Empowerment

Global Highlights – 2026

- **Global Average:** 69.2% of the gender gap has been closed, an improvement of 0.4 percentage points over the previous year.

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- **Iceland:** Ranked 1st for the 17th consecutive year, with 93% of its gender gap closed; it is the only country to cross the 90% mark.
- **Top Performers:** Finland (2nd), Norway (3rd) and Namibia (4th).
- **Australia:** Entered the top 10 for the first time.
- **Lowest Ranked:** Chad (145th), with Iran and Pakistan also among the bottom three.
- **Sectoral Trend:** Educational Attainment recorded the largest global improvement, while Political Empowerment experienced a reversal in progress.

India's Performance – 2026

- **Overall Rank:** 131st out of 145 economies.
- **Overall Score:** 64.5% gender parity.
- **Long-Term Progress:** India's parity score has increased by 4.3 percentage points since 2006, driven largely by improvements in education.
- **Bottom Tier:** Only 14 economies rank below India.

Sub-Index Performance

Educational Attainment

- India's strongest dimension.
- Near-universal parity has been achieved in secondary and tertiary enrolment.

Economic Participation and Opportunity

- Remains a major weakness.
- India recorded 41.2% parity.

- Improved by 0.5 percentage points from the previous edition.
- However, it remains 3.5 percentage points below its 2013 peak.

What Does India's Performance Indicate?

India demonstrates a significant education-to-employment gap: improvements in girls' and women's educational participation have not translated proportionately into economic opportunities.

Key concerns include:

- Low female labour-force participation.
- Gender disparities in employment and income.
- Unequal distribution of unpaid care work.
- Occupational segregation and limited access to productive assets.

Under-representation of women in economic decision-making.

Significance

- **Human Capital:** Gender equality enables fuller utilisation of the country's human resources.
- **Economic Growth:** Greater female workforce participation can strengthen productivity and household incomes.
- **Social Justice:** Gender parity is central to equality of opportunity and substantive equality.
- **Policy Benchmarking:** Provides a comparative framework for identifying persistent gender gaps.

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- **SDG 5:** Supports the achievement of Gender Equality under the Sustainable Development Goals.

Way Forward

- **From Education to Employment:** Convert educational gains into greater workforce participation.
- **Care Economy:** Expand affordable childcare, maternity support and care infrastructure.
- **Workplace Reform:** Ensure equal pay, safe workplaces and flexible employment opportunities.
- **Economic Empowerment:** Improve women's access to credit, property, technology, markets and entrepreneurship.
- **Political Participation:** Strengthen women's representation in decision-making.
- **Skill Development:** Align women's skills with emerging sectors and higher-productivity employment.

13.2 Limiting Overshoot Report

Why in News?

The United Nations Environment Programme (UNEP) released its first dedicated report on climate overshoot, titled "Limiting Overshoot: Navigating Exceedance of 1.5°C and Pathways Towards Return", on 2 September 2026.

What is Climate Overshoot?

Climate overshoot refers to a period in which global warming temporarily exceeds a

specified temperature threshold, such as 1.5°C above the pre-industrial level, followed by efforts to bring temperatures back below that threshold.

Why is 1.5°C Overshoot Becoming Likely?

- **Current Warming:** Human-induced warming is approaching 1.4°C.
- **Rate of Warming:** Human-induced warming is increasing at approximately 0.25°C per decade.
- **Emissions Gap:** Current global mitigation efforts remain insufficient to rapidly reduce greenhouse-gas emissions.
- **Climate Inertia:** Existing atmospheric greenhouse gases and slow-responding components of the climate system continue to influence warming even after emissions reductions begin.

Why Does Overshoot Matter?

- **Irreversible Risks:** Some impacts may become irreversible or substantially harder to reverse.
- **Tipping Points:** Prolonged warming can increase risks of crossing climate-system tipping points.
- **Extreme Events:** Higher temperatures can intensify heatwaves, heavy rainfall, droughts and other climate extremes.
- **Ecosystems:** Coral reefs, glaciers, polar systems and biodiversity face increasing stress.
- **Loss and Damage:** Climate impacts and associated economic losses can increase with every additional fraction of warming.

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Pathways to Return Below 1.5°C

- **Deep Emission Cuts:** Rapidly reduce CO₂ and other greenhouse-gas emissions.
- **Net-Zero Transition:** Accelerate decarbonisation of energy, transport, industry and buildings.
- **Carbon Dioxide Removal (CDR):** Remove atmospheric CO₂ through approaches such as ecosystem restoration and engineered carbon removal.
- **Nature-Based Solutions:** Protect and restore forests, wetlands, mangroves and other carbon-rich ecosystems.
- **Climate Adaptation:** Strengthen resilience even during the overshoot period.

13.3 Global Water Cycle Under Stress: Groundwater, Glaciers and Freshwater Storage Decline

Why in News?

The World Meteorological Organization (WMO) released the State of Global Water Resources 2025 report on 17 September 2026, highlighting increasing stress on the global water cycle, including declining river discharge, groundwater depletion and changes in glaciers and freshwater storage.

What is the Report?

- **Publisher:** World Meteorological Organization (WMO).
- **Nature:** Annual assessment of the world's freshwater resources and hydrological variability.

- **Coverage:** River discharge, groundwater, terrestrial water storage, soil moisture, snow, glaciers and water-related extremes.
- **Methodology:** Combines ground observations, satellite observations and hydrological models.
- **Monitoring Network:** Draws on data from 68 countries and more than 3,000 stations, reflecting expanding global hydrological monitoring.

Key Findings

River Discharge

- 2025 was among the driest years for global river discharge in 35 years, indicating widespread stress in surface-water systems.
- However, hydrological conditions remained highly uneven, with some regions experiencing floods and excess water.

Groundwater

- Groundwater is under increasing pressure from over-extraction, drought and changing recharge patterns.
- Depletion threatens long-term water security because groundwater systems often recover slowly.

Glaciers

- Continued glacier mass loss is affecting long-term freshwater storage.
- Glacier-fed rivers may initially experience increased meltwater, but prolonged

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glacier loss can reduce future dry-season water availability.

Terrestrial Water Storage

- Changes in soil moisture, groundwater, snow and surface water are altering the amount of freshwater stored on land.
- These changes affect agriculture, ecosystems and human water security.

Why Does it Matter?

- **Agriculture:** Water availability directly affects irrigation and crop productivity.
- **Food Security:** Hydrological variability can cause both drought-related crop losses and flood damage.
- **Groundwater Security:** Excessive extraction can reduce aquifer availability and increase water stress.
- **Ecosystems:** Altered river flows and freshwater availability affect wetlands, biodiversity and aquatic ecosystems.
- **Disaster Management:** Changing hydrological patterns increase the need for integrated drought and flood management.

13.4 India's Higher Education

Transformation

Why in News?

The Ministry of Education released a decadal review of India's higher education sector based on AISHE data, highlighting significant expansion between 2014–15 and 2023–24.

Indicator	2014–15	2023–24
Universities	760	1,289
Colleges	38,498	48,246
Total Enrolment	3.42 crore	4.50 crore
Gross Enrolment Ratio (GER)	23.7%	30%
PhD Enrolment	1.17 lakh	3.43 lakh
Female Enrolment	1.57 crore	2.24 crore
International Students	42,293	58,134

Major Gains

- **Access:** GER increased to 30%, moving towards the NEP 2020 target of 50% by 2035.
- **Research:** PhD enrolment increased by nearly 193%, strengthening India's research and innovation potential.
- **Gender Inclusion:** Female GER (31.2%) surpassed male GER (28.9%); GPI improved from 0.92 to 1.08.
- **Social Inclusion:** SC GER rose from 18.9% to 27.8%, while ST GER increased from 13.5% to 22.8%.
- **Infrastructure:** Over 98% of HEIs have libraries, while more than 85% have specialised laboratories.

What Drove the Expansion?

- **NEP 2020:** Multiple entry–exit, Academic Bank of Credits, multidisciplinary education, flexible curricula and greater research orientation.

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- **Welfare Support:** Scholarships, fee waivers, postmatric assistance and reservation have widened participation.
- **Digitalisation:** Digital learning infrastructure has expanded access beyond conventional campuses.
- **Institutional Expansion:** Growth of universities and colleges has improved geographical availability.

Persistent Challenges

- **Quality–Quantity Gap:** Rapid expansion in enrolment has not necessarily translated into better learning outcomes or employability.
- **Skill Mismatch:** Weak industry–academia linkages and limited practical exposure constrain graduate employability.
- **Faculty Shortages:** Vacancies remain a major concern, particularly in State universities and rural colleges.
- **Unequal Research Capacity:** Research funding and advanced infrastructure remain concentrated in premier institutions, creating a gap with State universities and colleges.
- **Inclusivity Gaps:** Persons with disabilities and disadvantaged students continue to face accessibility, financial and digital barriers.

Way Forward

- **Outcomebased education:** Shift focus from institutional expansion to learning

outcomes, employability and research quality.

- **Strengthen State universities:** Improve research infrastructure, funding and capacitybuilding, including through the ANRF.
- **Faculty reform:** Ensure timely recruitment, continuous training and research incentives.
- **Inclusive infrastructure:** Promote accessible campuses, assistive technologies and affordable digital learning.
- **Targeted support:** Strengthen scholarships and retention measures for disadvantaged students.