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DAILY CURRENT AFFAIRS

FOR UPSC CIVIL SERVICE EXAMINATION

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1. Economic Stability and the '3F' Challenges: Fuel, Fertiliser, and Foreign Exchange

- **The '3F' Macroeconomic Challenge:** The Finance Ministry has flagged the simultaneous rise in fuel prices, fertiliser costs, and foreign exchange pressures as critical headwinds for the Indian economy. Driven heavily by geopolitical instabilities, such as conflicts in West Asia, these elements present immediate challenges to India's fiscal deficit management and external sector stability.
- **Fertiliser Subsidy and Import Vulnerability:** India relies heavily on external markets to meet its agricultural input requirements. In the fiscal year 2025-26, India imported 28.2 million tonnes of fertilisers valued at $14 billion; however, when accounting for crucial imported inputs like natural gas and ammonia, the total outflow exceeded $27 billion, straining the current account balance and escalating the domestic subsidy burden.

- **Fuel Pricing Dynamics and Fiscal Pressure:** Retail prices for petrol and diesel experienced sharp hikes (over ₹7/litre within an 11-day window) due to surging global crude oil benchmarks. While Oil Marketing Companies (OMCs) have passed on some costs to consumers to reduce daily under-recoveries—bringing daily losses down to approximately ₹600 crore—the persistent price volatility fuels domestic inflationary pressures.
- **Exchange Rate Management and Policy Dilemmas:** A key operational question facing monetary authorities is whether the Reserve Bank of India (RBI) should actively intervene to defend the domestic currency using its foreign exchange reserves or allow the Rupee to find its market-determined value. Defending the Rupee preserves import affordability but depletes reserves, while depreciation enhances export competitiveness at the cost of importing inflation (imported inflation).
- **Strategic Supply and Inventory Monitoring:** To prevent panic buying and artificial shortages, the Central government has established direct communication channels with state administrations to strictly monitor the supply chain and inventory levels at OMC retail outlets, ensuring retail energy security amid volatile market conditions.

Key Definitions

- **Under-recoveries:** The difference between the production/import cost of petroleum products and the actual regulated price at which Oil Marketing Companies sell them in the domestic market, which does not automatically equate to a direct fiscal loss but reflects cash-flow strains.
- **Imported Inflation:** A sustained increase in domestic prices attributed to an increase in the costs of imported commodities, particularly essential raw materials, crude oil, and intermediate goods that form the baseline of industrial and agricultural production.
- **Current Account Deficit (CAD):** A measurement of a country’s trade where the total value of goods, services, and transfers it imports exceeds the total value of goods, services, and transfers it exports.

Constitutional and Legal Provisions

- **Article 112 (Annual Financial Statement):** The volatile nature of fertiliser and fuel subsidies directly impacts the budgetary allocations and fiscal deficit targets mandated under the Union Budget framework.

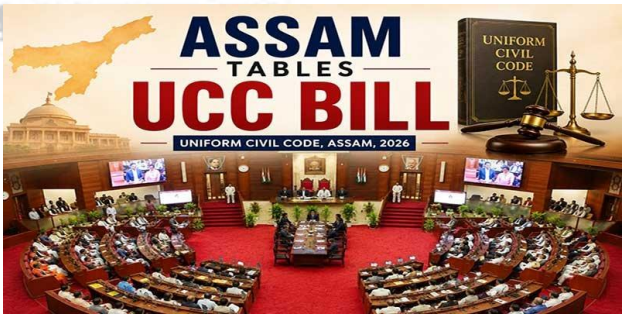
- **Essential Commodities Act, 1955:** Central and state coordination to monitor supply at OMC pumps leverages statutory powers under this Act to prevent hoarding, regulate distribution, and ensure the uninterrupted availability of petroleum products as essential commodities.
- **Reserve Bank of India Act, 1934:** Grants the statutory mandate to the RBI to manage the country's foreign exchange reserves under Section 40, balancing exchange rate stability with the primary objective of domestic price stability.

Conclusion and UPSC Relevance

The "3F" vulnerabilities highlight the structural linkages between global geopolitical disruptions and domestic macroeconomic health. For the UPSC Civil Services Examination, this issue is highly relevant under **GS Paper III (Indian Economy, Inflation, Fiscal Policy, and Infrastructure: Energy)** and **GS Paper II (Government Policies and Interventions)**. Mastery of these concepts is essential for analyzing questions on India's energy security, the fiscal implications of subsidy regimes, and the monetary policy trade-offs involved in managing external shocks.

2. Uniform Civil Code Bill in Assam: Marriage, Succession, and Live-in Regulations

- **Introduction of the UCC Bill:** The Assam government has tabled a 154-page Uniform Civil Code (UCC) Bill in the state assembly, following the legislative frameworks established by Uttarakhand and Gujarat. The Bill aims to govern and regulate personal laws relating to marriage, divorce, succession, and live-in relationships uniformly across communities within the state.
- **Exemption of Scheduled Tribes:** To protect indigenous cultural identities and autonomy, the proposed legislation explicitly exempts Scheduled Tribes (STs) from its purview. According to the 2011 Census, the ST population constitutes 12.44% of Assam's total demographic, making this exclusion structurally and politically significant for the region's tribal administration.
- **Prohibition of Polygamy and Legal Standardization:** The Bill institutionalizes strict legal conditions for marriage, mandating the minimum age as 21 years for men and 18 years for women. It explicitly bans polygamy by requiring that neither party have a living spouse at the time of marriage. It further introduces compulsory registration of all marriages and divorces within 60 days with designated sub-registrars.
- **Compulsory Registration of Live-in Relationships:** A distinctive feature of the Bill is the mandatory registration of live-in relationships for all residents of Assam, including those residing outside the state territory. Partners must submit a statement to the sub-registrar within one month of entering the relationship. Non-compliance attracts penal provisions, including imprisonment up to three months, a fine up to ₹10,000, or both, alongside enhanced penalties for ignoring official notices.



- **Gender-Equal Succession and Legitimacy Rights:** The legislation completely overhauls succession laws by introducing a uniform, gender-equal order of preference for intestate succession among Class-1 heirs, equitably distributing the estate among the spouse, children, and parents of the deceased. Additionally, it grants structural rights to women "deserted" by live-in partners to claim maintenance and ensures that any child born out of a live-in relationship is legally recognized as a legitimate child.

Key Definitions

- **Uniform Civil Code (UCC):** A common set of laws governing personal matters such as marriage, divorce, inheritance, adoption, and succession for all citizens of a jurisdiction, irrespective of their religion, caste, or community affiliation.
- **Intestate Succession:** The method of distribution and devolution of an individual's property, assets, and estate when they pass away without having executed a valid, legally enforceable last will and testament.
- **Degrees of Prohibited Relationship:** Specific categories of consanguinity or affinity defined by law within which individuals are legally barred from marrying each other (the Assam Bill explicitly lists 37 such relationships, including first cousins) unless sanctioned by deep-rooted custom.

Constitutional and Legal Provisions

- **Article 44 (Directive Principles of State Policy):** Mandates that the State shall endeavor to secure a Uniform Civil Code for the citizens throughout the territory of India, serving as the foundational constitutional basis for this legislation.
- **Article 21 (Right to Life and Personal Liberty):** The mandatory registration and criminalization aspects of live-in relationships intersect directly with the judicially expanded scope of Article 21, specifically regarding the right to privacy and autonomy established in the *K.S. Puttaswamy* judgment.
- **Article 246 and Concurrent List (Seventh Schedule):** Entry 5 of the Concurrent List vests legislative powers regarding marriage, divorce, infants, minors, adoption, and succession concurrently in both the Parliament and State Legislatures, providing Assam the jurisdiction to introduce this Bill.

Conclusion and UPSC Relevance

The tabling of the UCC Bill in Assam marks a significant shift from a national personal law framework toward localized state-level codes. While it advances gender equality in succession and standardizes civil rights, it raises critical legal debates surrounding state surveillance, the criminalization of personal choices, and federal consistency. For the UPSC Civil Services Examination, this topic holds critical relevance under **GS Paper II (Indian Constitution, Significant Provisions, Statutory/Regulatory Bodies, and Welfare Schemes for Vulnerable Sections)**. Candidates should analyze this from the perspectives of constitutional directives, tribal exemptions under the Sixth Schedule, and the evolving jurisprudence on the fundamental right to privacy.

3. Judicial Intervention in Defining the Aravalli Range: Balancing Development and Conservation

- **Mandate for Public and Stakeholder Consultation:** The Supreme Court of India, led by Chief Justice Surya Kant, has directed that the proposed expert committee tasked with defining the Aravalli hills and ranges must institutionalize broad-based public participation. The apex court emphasized that the committee must actively consult with domain experts, environmentalists, local communities, and industry stakeholders to ensure that grassroots and scientific perspectives inform environmental policy.
- **Structural Efficiency of the Expert Panel:** To prevent administrative delays, the Bench ruled that the core committee must remain lean and functional, proposing a compact composition of 5 to 7 members. Rather than expanding the committee into an unwieldy body of 30 or 40 representatives, it

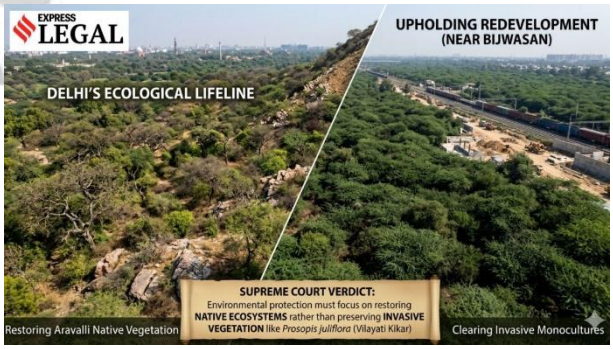
will operate as an agile administrative unit that collaborates extensively with external specialists, including foresters, geographers, and scientists, under the direct supervision and "umbrella" of the Supreme Court.

- **Formulating a Sustainable Operational Road Map:** Beyond a purely cartographic exercise, the expert team is mandated to draw up a comprehensive, regulated blueprint for permissible economic activities within the eco-sensitive zone. This includes assessing the viability, spatial boundaries, and regulatory frameworks for "regulated mining wherever the law permits," thereby attempting to balance industrial resource demands with ecological preservation.
- **Reversal of the Arbitrary Metric Framework:** The current judicial proceedings follow a significant *suo motu* review by the Supreme Court, which stayed its own November 2025 judgment. That previous order had upheld a Ministry of Environment, Forest and Climate Change (MoEFCC) definition reducing the protected "Aravalli" status exclusively to landforms with a minimum elevation threshold of 100 metres and hill clusters located within a 500-metre proximity of each other.
- **Addressing Critical Regulatory Lacunae:** The judiciary paused the implementation of the metric-based definition after discovering severe conservation gaps: out of 12,081 hills in Rajasthan alone, only 1,048 would have met the strict 100-metre threshold. Consequently, over 90% of the lower ranges, slopes, and low-altitude ecologies would have been stripped of legal protection, exposing a critical ecological continuum to rampant real estate expansion and unregulated mining.

Key Definitions

- **Suo Motu Cognizance:** A legal term meaning "on its own motion," describing a situation where a court takes up a case on its own initiative without any formal petition or complaint filed by an aggrieved party.
- **Amicus Curiae:** Literally translating to a "friend of the court," an independent legal professional or expert appointed by the judiciary to provide impartial assistance, insights, or specialized knowledge on complex matters of law or public interest.
- **Ecological Continuum:** A continuous, interconnected natural landscape where diverse elements like high peaks, low hills, slopes, and valleys function as an indivisible ecosystem, sustaining groundwater recharge tables, biodiversity, and regional climate moderation.

Constitutional and Legal Provisions



- **Article 48A (Directive Principles of State Policy):** Directs the State to endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country, serving as a guiding framework for ecological governance.
- **Article 51A(g) (Fundamental Duties):** Imposes a constitutional obligation on every citizen of India to protect and improve the natural environment, including forests, lakes, rivers, and wildlife, and to have compassion for living creatures.
- **Article 21 (Right to Life):** The Supreme Court has repeatedly expanded the scope of Article 21 to encompass the right to a clean, healthy, and pollution-free environment, directly linking the ecological survival of the Aravallis with the well-being of populations across Delhi-NCR, Haryana, Rajasthan, and Gujarat.

Conclusion and UPSC Relevance

The Supreme Court's intervention underscores a transition toward evidence-based and democratic environmental adjudication, establishing that natural topographies cannot be managed through rigid mathematical formulas that disregard ecological continuity. For the UPSC Civil Services Examination, this development is highly relevant under **GS Paper III (Environment and Biodiversity: Conservation, Environmental Impact Assessment, Degradation)** and **GS Paper II (Judiciary, Statutory Bodies, and Executive Accountability)**.

4. 16th Finance Commission Devolution: Balancing Equity, Efficiency, and Fiscal Federalism

- **Retention of Vertical Devolution and Fiscal Constraints:** The 16th Finance Commission (FC) has maintained the vertical tax devolution share to the states at 41%, resisting demands from several states for an increase to 50%. This retention occurs amidst growing structural pressures, including a contraction of states' fiscal autonomy driven by the dominance of Centrally Sponsored Schemes—such as the revamped MGNREGA requiring a 40% state cost match—and the exclusion of cesses and surcharges (which exceed 15% of the Centre's gross tax revenues) from the divisible pool.
- **Persistent Horizontal Divergence between Regions:** Long-term devolution trends reveal a deepening gap between politically influential, financially dependent states and economically advanced states. Over consecutive award periods, the combined horizontal share of four major beneficiary states (Bihar, Madhya Pradesh, Uttar Pradesh, and West Bengal) climbed from 42.5% under the 6th FC to nearly 50% under the 16th FC, while the collective share of four major southern states (Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu) contracted sharply from 24.8% to approximately 17%, generating intense debates on performance penalties.
- **Methodological Alterations in Horizontal Criteria:** The 16th FC introduced marginal adjustments to its allocation formula by recalibrating the equity-efficiency balance from a 75:25 ratio to 70:30. Key criteria weights include Income Distance at 42.5%, Population at 17.5%, Area at 10%, Forest Cover at 10%, and a modified Demographic Criterion (substituting inverse fertility rates with population growth) at 10%. Crucially, the Commission replaced "tax effort" with a state's contribution to national GDP at a 10% weight.

- **The Square-Root Transformation and Efficiency Suppression:** To prevent economically dominant states from capturing an overwhelming share of the efficiency pool, the 16th FC applied a mathematical square-root transformation to Gross State Domestic Product (GSDP) shares. This compressed the calculated fiscal weight of top-tier economies; for instance, Maharashtra's actual GSDP share of 14.23% was scaled down to 8.31%, while Tamil Nadu's fell from 9.09% to 6.67%, reducing the fiscal gains that would have otherwise accrued under an untransformed data framework.
- **Fiscal Consolidation Directives and Abolition of Grants:** Seeking to institutionalize stricter fiscal discipline, the 16th FC recommended the absolute elimination of revenue deficit grants alongside sector-specific and state-specific grants. It has mandated that state governments completely dismantle off-budget borrowings, internalize all hidden liabilities directly into their primary budget statements, and strictly maintain their fiscal deficits below the statutory threshold of 3% of GSDP, escalating short-term liquidity stress for weaker states.

- **Absence of Public Expenditure Convergence:** Despite decades of unconditional equalization transfers designed to bridge regional disparities, stark inequalities in public service delivery persist. For instance, during 2022-23, Bihar's per capita health expenditure stood at ₹937 compared to Arunachal Pradesh's ₹10,148, while its elementary education spending per student was ₹20,282 against Sikkim's ₹1,30,498, demonstrating that unconditional fiscal transfers alone have not driven institutional convergence in essential social infrastructure.

Key Definitions

- **Vertical Devolution:** The statutory allocation of the net proceeds of shareable Central taxes between the Union government and the state governments as a collective unit.
- **Horizontal Devolution:** The criteria-based formula used to distribute the total states' share of Central taxes among the individual states based on attributes of equity, need, and efficiency.
- **Income Distance:** The gap between the per capita income of a specific state and the per capita income of the state with the highest income, used as a proxy for fiscal capacity; states with higher distance receive larger allocations to achieve fiscal equalization.
- **Divisible Pool:** The portion of gross tax revenues collected by the Central government that is constitutionally mandated to be distributed among the states, excluding specific cesses, surcharges, and administrative costs of collection.

Constitutional and Legal Provisions

- **Article 280:** Mandates the President of India to constitute a Finance Commission every five years (or earlier) to recommend the distribution of tax proceeds between the Centre and states.
- **Article 270:** Governs the distribution of net proceeds of taxes between the Union and the states, clarifying the composition of the divisible pool and explicitly permitting the exclusion of cesses levied for specific purposes.
- **Article 293:** Regulates the borrowing powers of states, providing the constitutional anchor for Central oversight regarding off-budget liabilities and state debt thresholds.
- **FRBM Act, 2003 (Fiscal Responsibility and Budget Management):** Sets the institutional roadmap for fiscal consolidation, setting the target deficit boundaries that the Finance Commission operationalizes via state-level borrowing ceilings.

Conclusion and UPSC Relevance

The 16th Finance Commission's award underscores a structural dilemma in cooperative federalism: balancing the equity requirements of socio-economically lagging regions against the efficiency incentives of high-performing, industrial states. As impending delimitation exercises threaten to alter parliamentary representation in favor of more populous states, the reliance on demographic and non-fiscal indicators in revenue sharing faces severe strain.

5. India-Australia CECA Negotiations: Bridging Trade Asymmetries and Agricultural Barriers

- **Transition from ECTA to CECA:** Amidst geopolitical instability and supply chain disruptions intensified by the West Asia crisis, India and Australia are actively negotiating a Comprehensive Economic Cooperation Agreement (CECA). This proposed pact aims to upgrade the 2022 Economic Cooperation and Trade Agreement (ECTA)—which granted India 100% duty-free access to the

Australian market while India provided roughly 70% market access covering 91% of its trade value—with Canberra now strongly advocating for full market parity.

- **Persistent Merchandise and Service Trade Imbalances:** While bilateral merchandise trade doubled from $12.2 billion in fiscal year 2020-21 to $24.1 billion in fiscal year 2024-25, the gains remain structurally skewed. Australian exports constitute nearly two-thirds of this total; similarly, in the services sector, which has breached the $10 billion mark, Australia's higher education sector alone accounts for nearly 60% of the trade volume, presenting a stark bilateral deficit for India.
- **Inverted Investment Dynamics:** In contrast to the merchandise trade deficit, the bilateral investment narrative tells the opposite story. As of 2024, cumulative Indian investments into the Australian economy reached nearly $32 billion, significantly outpacing Australia's total foreign direct investment (FDI) inflows into India, which hovered at approximately $18 billion, highlighting the need to leverage Indian market access for increased Australian capital injection.

- **Divergent Agricultural Realities and Livelihood Shields:** The primary friction point in CECA negotiations is the agribusiness sector due to vast structural asymmetries. The average Indian farm size is just 0.73 hectares, supporting over half the national population and contributing 16% to GDP as a vital livelihood and food security anchor; conversely, the average Australian farm exceeds 1,400 hectares, contributing 2.5% to its GDP as a highly mechanized, export-oriented industry, making the total removal of Indian tariffs on sensitive commodities like wheat, dairy, and pulses politically unviable.
- **Shifting the Trade Paradigm from Tariffs to Technology:** To prevent negotiations from becoming a zero-sum bottleneck, the bilateral focus is shifting toward mutual recognition of biosecurity and phytosanitary standards alongside digital certifications. India aims to leverage Australia's domestic demand for market access to secure institutional investments in precision farming, advanced water management, climate adaptation, and cold-chain logistics to mitigate India's annual 15% to 35% post-harvest losses.

Key Definitions

- **Free Trade Agreement (FTA):** A treaty between two or more countries designed to reduce or eliminate barriers to trade, such as tariffs and quotas, on goods and services to facilitate deeper economic integration.
- **Phytosanitary Measures:** Globally recognized sanitary and phytosanitary (SPS) regulations applied to protect human, animal, or plant life and health from risks arising from additives, contaminants, toxins, or disease-causing organisms in traded agricultural commodities.
- **Post-Harvest Losses:** The measurable qualitative and quantitative degradation of agricultural produce occurring along the supply chain from the time of harvest to the point of final consumption, driven by infrastructure gaps.

Constitutional and Legal Provisions

- **Article 253 of the Constitution:** Grants Parliament the exclusive power to make any law for the whole or any part of the territory of India for implementing any treaty, agreement, or convention with any other country or international body.

- **Seventh Schedule (Union List - Entries 10 and 14):** Explicitly vests the legislative domains of "Foreign Affairs" and "Entering into treaties and agreements with foreign countries and implementing of treaties, agreements and conventions with foreign countries" under the exclusive jurisdiction of the Central government.
- **Foreign Trade (Development and Regulation) Act, 1992:** Provides the statutory architecture for the development and regulation of foreign trade by facilitating imports into and augmenting exports from India, forming the legal baseline for executing agreements like ECTA and CECA.

Conclusion and UPSC Relevance

The evolving India-Australia CECA highlights the delicate diplomatic balancing act required to navigate international trade parity while defending domestic livelihood security. It underscores that modern trade agreements must prioritize economic complementarity, technological transfers, and mutual regulatory recognition over absolute tariff symmetries.

6. Water Governance in Peri-Urban Areas: Challenges and Action Plan for Sustainable Urbanization

- **The Rise of the Peri-Urban 'Missing Middle':** India's water landscape is experiencing an institutional vacuum within its rapidly expanding peri-urban zones—transitional areas where rural agricultural land and industrial clusters intersect. Over the last two decades, the number of Census towns has grown by 178%, rising from 1,362 to 3,784; however, because these settlements lack official administrative recognition as urban bodies, they remain trapped in a regulatory limbo that severely compromises basic water and sanitation delivery.
- **Resource Appropriation and Environmental Degradation:** Rapidly growing urban centers are reaching outward to exploit peripheral resources, often creating ecological sacrifice zones. This is exemplified by the diversion of the Bisalpur dam's reservoir capacity from downstream agricultural irrigation in Tonk to meet municipal demands in Jaipur, alongside severe groundwater contamination from toxic landfill leachate in peripheral Hyderabad, forcing communities to rely on unregulated, high-priced private water tankers.
- **Sanitation Failure and Fecal Sludge Malpractice:** While the Swachh Bharat Mission significantly expanded toilet construction, peri-urban sanitation infrastructure remains fundamentally broken. Nearly 40 million urban and semi-urban households depend on decentralized, on-site septic tanks; irregular desludging and the illegal dumping of untreated septage into open fields and natural rivers by commercial vacuum trucks systematically reverse the gains of centralized waste treatment frameworks.
- **Administrative and Democratic Decentralization Gaps:** The transition of peri-urban governance frequently results in administrative inefficiencies, as seen in Gurugram where the sudden abolition of rural panchayats left residents facing urban tax rates without receiving corresponding civic services. To resolve this structural gap, state administrations must actively establish functional Nagar Panchayats for all designated Census towns, thereby operationalizing the statutory transitions envisioned under the 74th Constitutional Amendment Act.
- **Strategic Roadmap for Sustainable Infrastructure:** Addressing the upcoming demographic pressure of 230 million new housing units by 2047 requires five structural interventions: formalizing local governance mechanisms, ensuring water source sustainability through community-led catchment protection, launching a septage-focused Swachh Bharat Mission 3.0, legalizing public procurement models for decentralized plug-and-play wastewater treatment startups, and structuring blended finance mechanisms backed by multilateral concessional loans.

Key Definitions

- **Peri-Urban Interface:** A dynamic, transitional zone where urban and rural characteristics, functions, and biophysical features coexist and interact, typically characterized by rapid land-use changes, administrative ambiguity, and fragmented infrastructure.
- **Census Town:** A settlement that is not statutorily notified as an urban local body but possesses urban demographic features, specifically a population exceeding 5,000, at least 75% of the male main working population engaged in non-agricultural pursuits, and a population density of at least 400 persons per square kilometer.
- **Fecal Sludge and Septage Management (FSSM):** The structured, safe operational ecosystem of containment, collection, transport, treatment, and safe reuse or disposal of the liquid-solid mixture accumulated in pit latrines and septic tanks, distinct from centralized underground sewerage systems.

Constitutional and Legal Provisions

- **74th Constitutional Amendment Act, 1992:** Inserted Part IXA into the Constitution, mandates the creation of Nagar Panchayats for areas in transition from a rural to an urban character, and outlines the devolution of water supply and sanitation responsibilities via the Twelfth Schedule.
- **Article 243W and Article 243G:** Govern the powers, authority, and responsibilities of Municipalities and Panchayats respectively, establishing the legal basis for local bodies to manage public health, sanitation, and solid waste management.
- **Water (Prevention and Control of Pollution) Act, 1974:** Provides the primary statutory framework to maintain or restore the wholesomeness of water, rendering the illegal discharging of commercial septage tankers into open water bodies a punishable environmental offense.

Conclusion and UPSC Relevance

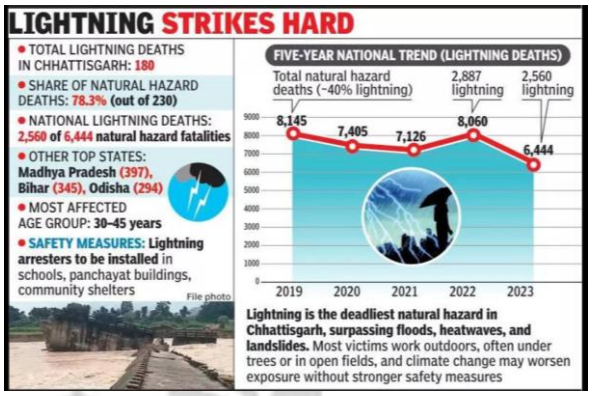
The governance of India's peri-urban interface represents a critical determinant of the nation's long-term environmental sustainability and urban resilience. Developing these transitional spaces systematically is vital to preventing future cities from inheriting structural vulnerabilities, resource scarcity, and public health crises.

7. Rising Fatalities from Lightning: India's Deadliest Natural Hazard and the Climate Link

- **Emergence as the Deadliest Natural Hazard:** Long-term statistical analysis from the National Crime Records Bureau (NCRB) reveals that lightning has surpassed floods and cyclones to become India's most lethal natural hazard. Between 1975 and 2024, the country recorded 1,02,263 lightning fatalities, with more than half of these deaths concentrated in the last two decades (2005-2024), demonstrating a stark upward trajectory despite overall improvements in national disaster preparedness.
- **Escalating Decennial Mortality Trends:** The decennial average of lightning-related deaths has risen systematically, jumping from 1,683 (1995-2004) to 2,476 (2005-2014), and reaching 2,809 during the 2015-2024 block. Since 2016, lightning has consistently accounted for at least 50% of all annual fatalities attributed to natural causes, reaching a proportional peak in 2021 when it caused 70.4% of all natural disaster deaths (2,880 out of 4,091).
- **Geographical Concentration in Non-Peninsular States:** Mortality distribution exhibits a distinct geographical bias toward non-peninsular and central-eastern states. In 2024, just five states—Madhya Pradesh (577), Bihar (360), Uttar Pradesh (275), Odisha (249), and Chhattisgarh (241)—

accounted for roughly 60% of the total 2,825 recorded fatalities, a high concentration pattern that mirrors historical datasets and recent unseasonal spikes in 2026.

- **Atmospheric Drivers and Land-Use Triggers:** Studies by the Indian Institute of Tropical Meteorology (IITM) link the surge in lightning activity to an increase in Convective Available Potential Energy (CAPE), elevated low-level moisture levels, and rising surface temperatures. These atmospheric changes are directly driven by global warming and rapid regional changes in Land Use and Land Cover (LULC), which modify heat absorption and moisture flux.



- **Technological Interventions and Awareness Gaps:** While the India Meteorological Department (IMD) issues regular localized thunderstorm forecasts, the IITM utilizes satellite inputs and the "Damini" mobile application to provide real-time lightning alerts and safety protocols in 23 regional languages. However, the persistent rise in rural casualties underscores a critical gap between real-time data generation and grassroots community awareness and response infrastructure.

Key Definitions

- **Convective Available Potential Energy (CAPE):** A meteorological indicator that measures the amount of atmospheric instability and indicates the amount of energy available to accelerate a parcel of air vertically upward; higher CAPE values directly correlate with severe thunderstorm and lightning development.
- **Land Use and Land Cover (LULC):** A classification framework that monitors human modifications of the Earth's surface (land use, such as urbanization or agriculture) and the physical material present on the surface (land cover, such as forests or water bodies), which alters regional microclimates.
- **Non-Peninsular States:** The continental landmass regions of India located north of the Vindhya and Satpura ranges, characterized by specific thermal and topographical attributes that contrast with the maritime-influenced peninsular block.

Constitutional and Legal Provisions

- **Disaster Management Act, 2005:** Provides the institutional, legal, and financial framework for disaster management in India. Currently, state governments have repeatedly requested the Centre to officially declare lightning a "Notified National Disaster" to unlock financial deployment from the National Disaster Response Fund (NDRF).
- **Article 21 (Right to Life):** The judiciary interprets the state's failure to mitigate predictable environmental hazards or provide accessible early warning systems as an infringement on the constitutional guarantee to protection of life and personal safety.
- **State Disaster Response Fund (SDRF) Guidelines:** Under existing norms established via Article 280 allocations, states are permitted to utilize up to 10% of their annual SDRF allocations for localized "state-specific disasters" like lightning, though this remains fiscally restrictive.

Conclusion and UPSC Relevance

The structural escalation of lightning-related mortality represents a major public health and climate adaptation challenge that highlights the limitations of standard disaster mitigation policies. It demonstrates

that as global temperatures rise, conventional tracking mechanisms must be integrated with local building codes, lightning conductor networks, and community-level warning systems.

8. Depreciating Indian Rupee: Balance of Payments Dynamics and Central Bank Interventions

- **The Trajectory of Rupee Depreciation:** The Indian Rupee (INR) experienced a sharp downward trajectory, crossing the threshold of 96 against the U.S. Dollar (USD) in May 2026, compared to a level of approximately 85 a year prior. The external value of the domestic currency is determined by market-driven forces of demand and supply, which are deeply linked to the country's macroeconomic fundamentals, trade balance, and capital flows.
- **Balance of Payments and Twin Deficit Pressures:** India historically runs a persistent merchandise trade deficit due to its high structural dependence on crude oil imports. While this deficit is partially mitigated by a surplus in the "invisibles" account—driven by robust software service exports and strong remittance inflows from migrant workers in West Asia—the overall Current Account Deficit (CAD) remains vulnerable to external shocks and fluctuating global commodity pricing.
- **Volatility of Capital Accounts and FPI Flight:** The gap created by the CAD is bridged through inflows in the Capital Account, primarily via Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI). Unlike stable, long-term FDI, FPI is highly volatile and speculative; recent global developments—including elevated U.S. interest rates and escalating geopolitical tensions—have triggered rapid FPI outflows as global investors liquidate rupee assets for safe-haven dollar assets, depressing the domestic currency.
- **Macroeconomic Implications and Imported Inflation:** A depreciating currency acts as a double-edged sword for the domestic economy. It escalates the landing cost of critical imports, leading to imported inflation; for instance, a fixed $100 barrel of crude oil costs ₹9,600 at an exchange rate of 96 per dollar compared to ₹8,500 at an exchange rate of 85. Conversely, while depreciation lowers the dollar pricing of Indian exports to enhance global competitiveness, structural supply-side bottlenecks in Indian manufacturing limit the realization of these trade benefits.
- **Strategic Intervention and Forex Defence by the RBI:** To prevent excessive, disorderly volatility and speculative attacks on the currency, the Reserve Bank of India (RBI) actively intervenes in the foreign exchange market. The RBI supports the Rupee by absorbing excess local currency and selling dollars from its foreign exchange reserves; as of March 2026, India's forex reserves stood at a robust USD 691.11 billion, providing an import cover of approximately 10.8 months to cushion the economy against external vulnerabilities.

Key Definitions

- **Exchange Rate:** The price of one country's currency expressed in terms of another currency, serving as the relative measure of purchasing power between two economic jurisdictions.
- **Current Account:** A component of the Balance of Payments that records a nation's net income from visible merchandise trade, invisible services trade, and unilateral factor transfers like remittances over a specific period.
- **Foreign Portfolio Investment (FPI):** Investments consisting of securities and other financial assets held passively by foreign investors, characterized

by high liquidity and susceptibility to sudden flight ("hot money") in response to changing global risk perceptions.

- **Import Cover:** A critical indicator of external stability that measures the number of months of imports a country can sustain using its existing stock of foreign exchange reserves in the absence of fresh export earnings or capital inflows.

Constitutional and Legal Provisions

- **Foreign Exchange Management Act (FEMA), 1992:** The primary legislative framework that consolidates and amends the law relating to foreign exchange, empowering the Central Government and the RBI to regulate capital account transactions and maintain external trade operations.
- **Reserve Bank of India Act, 1934 (Section 40):** Mandates that the Central Bank shall buy and sell foreign exchange at specified rates to fulfill the country's international obligations and maintain the external stability of the domestic currency.
- **Seventh Schedule (Union List - Entry 36):** Vests the exclusive constitutional authority over "Currency, coinage and legal tender; foreign exchange" with the Parliament of India, ensuring a centralized macro-monetary governance structure.

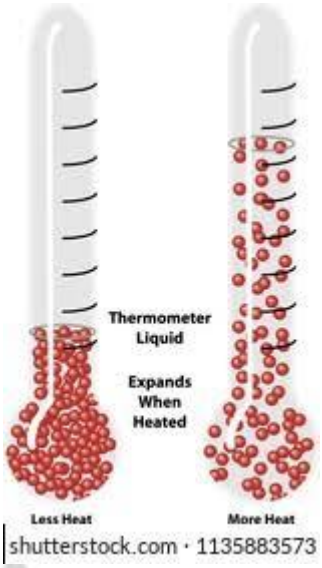
Conclusion and UPSC Relevance

The sustained depreciation of the Indian Rupee highlights the structural vulnerability of India's external sector to global macroeconomic shifts, tightening U.S. monetary policy, and volatile commodity lines. Managing this exposure requires a policy transition from short-term reserve interventions toward long-term structural reforms, including import substitution in energy through green transitions and deep-rooted manufacturing reforms to enhance real export elasticity.

9. The Science of Thermometry: From Liquid Expansion to Quantum Condensates

- **Microscopic Definition of Temperature:** Temperature fundamentally quantifies the average kinetic energy of the constituent atoms or molecules within a substance. Heating a material infuses energy, inducing intense microscopic agitation, whereas cooling extracts thermal energy, causing the atoms to become increasingly sluggish until a critical threshold forces a structural rearrangement known as a phase transition.
- **Evolution of Standardized Temperature Scales:** Early thermometry established operational reference points based on the phase transitions of water. Anders Celsius defined 0°C as the freezing point of water and 100°C as its boiling point, dividing the interval into 100 equal segments; the Fahrenheit scale utilizes an alternative calibration matrix. In 1948, the international scientific community standardized the Celsius scale for global metrological consistency.
- **Physics of Mercury-in-Glass Thermometers:** Traditional liquid thermometers operate on the thermodynamic principle of predictable thermal expansion in metals. Mercury remains uniquely liquid at room temperature and exhibits linear volumetric expansion across a wide thermal range; by confining mercury within a glass bulb attached to a narrow capillary tube, its precise physical displacement can be calibrated against known phase transitions to gauge environmental heat.
- **Semiconductors and Digital Metrology:** Modern digital thermometers utilize condensed matter physics, replacing expanding liquids with temperature-dependent electronic components. In semiconductors, electrons are loosely bound to atomic structures; as temperature rises, thermal agitation releases these electrons into the conduction band, increasing electrical conductivity and

allowing sensitive internal microcircuits to translate the altered current or voltage into a digital temperature reading.



- **The Limit of Absolute Zero:** While atoms continue to vibrate at 0°C, further energy extraction brings the system toward Absolute Zero (0 K or -273.15°C), the fundamental thermodynamic limit where classical molecular motion ceases entirely. At these ultra-low thresholds, standard liquid or semiconductor instruments fail as their own physical properties distort, requiring alternative optical or quantum sensing techniques.
- **Quantum Manifestations and Bose-Einstein Condensation:** At ultra-cold temperatures, atomic behavior shifts from classical mechanics to quantum mechanics, forming the core of cold-atomic physics. Bosonic atoms—named after Indian physicist Satyendra Nath Bose following his 1924 formulation of Bose statistics—tend to occupy identical quantum states; when cooled to near-absolute zero (such as 20 nanoKelvin), they collapse into a unified quantum state known as a Bose-Einstein Condensate (BEC), effectively acting as a single "super-atom."

Key Definitions

- **Metrology:** The rigorous scientific study of measurement, encompassing both experimental and theoretical determinations at any level of uncertainty in any field of science and technology.
- **Phase Transition:** A transformation of a thermodynamic system from one state of matter or phase to another—such as solid to liquid or gas to plasma—characterized by abrupt changes in physical properties resulting from energy transfer.
- **Bosons:** A class of subatomic particles or atomic systems that possess integer spin and obey Bose-Einstein statistics, allowing an unlimited number of them to coexist in the exact same quantum energy state simultaneously.
- **Fermions:** Particles with half-integer spin (such as electrons or protons) that obey Fermi-Dirac statistics and conform to the Pauli Exclusion Principle, which strictly prevents two identical fermions from occupying the same quantum state.

Constitutional and Legal Provisions

- **Seventh Schedule (Union List - Entry 51):** Vests the exclusive constitutional authority over the "Establishment of standards of weight and measure" with the Parliament of India, ensuring absolute uniformity in industrial and scientific metrology.
- **Legal Metrology Act, 2009:** Provides the statutory architecture to establish and enforce standards of weights, measures, and instruments, regulating commercial production and ensuring that medical and industrial thermometers conform to uniform global criteria.

Conclusion and UPSC Relevance

The transition from basic thermal expansion to quantum cold-atomic physics reflects the deep connections between core scientific theories and practical measurement technologies. Satyendra Nath Bose's foundational contributions emphasize India's historic role in quantum mechanics, a field that now drives modern innovations from advanced semiconductors to quantum computing and precision atomic clocks.

10. Civil Investiture Ceremony 2026: National Honours and Cultural Traditions

- **Presidential Conferment of Honours:** President Droupadi Murmu presented the Padma Vibhushan, Padma Bhushan, and Padma Shri awards for 2026 at the Civil Investiture Ceremony-I at Rashtrapati Bhavan. Annually announced on the eve of Republic Day, a total of 131 civilian honours were approved for 2026, comprising 5 Padma Vibhushan, 13 Padma Bhushan, and 113 Padma Shri awards.
- **Recognition of Exceptional Merit:** The 2026 decorations span diverse professional fields, acknowledging monumental contributions across public administration, industry, medicine, literature, and the arts. High-profile honors included the Padma Vibhushan conferred on cinematic icon Dharmendra (posthumously) and violin virtuoso N. Rajam, alongside the Padma Bhushan presented to corporate leader Uday Kotak.
- **Preservation of Classical Art Forms:** The selections highlight deep artistic innovation within classical Indian music and literature. Violinist N. Rajam was recognized for pioneering "Gayaki Ang"—a technique that replicates human vocal modulations on the violin—while Sanskrit scholar Shatavadhani R. Ganesh was honored for reviving "Avadhana," an ancient performance art testing parallel cognitive multitasking and spontaneous poetic composition.
- **Grassroots and Indigenist Social Impact:** The 2026 Padma Shri appointments strongly emphasized safeguarding regional folk heritage and community service. Notable recipients included Silambam martial arts master K. Pajanivel, Kantha embroidery textile artist Tripti Mukherjee, and the medical duo Dr. Ramchandra and Suneeta Godbole for their decades of decentralized healthcare interventions within tribal communities.
- **The Institutional Selection Framework:** The awards are administered via a structured, bottom-up regulatory process. Recommendations are evaluated by the dedicated Padma Awards Committee, an annual body chaired by the Cabinet Secretary. The panel includes the Home Secretary, the Secretary to the President, and selected eminent public figures, with final approval granted by the Prime Minister and the President.

Key Definitions

- **Gayaki Ang:** A specialized instrumental technique in Indian classical music where the performer replicates the phrasing, microtones, and structural ornamentation characteristic of human vocal singing.
- **Avadhana:** An ancient classical Indian literary performing art that tests extreme concentration, memory recall, and parallel multitasking across several complex scholarly subjects simultaneously.

Constitutional and Legal Provisions

- **Article 18(1) of the Constitution:** Mandates the complete abolition of state-conferred titles of nobility to preserve the core democratic tenet of absolute social equality.
- **Balaji Raghavan v. Union of India (1996):** The landmark Supreme Court ruling that upheld the validity of Padma awards, declaring they constitute state recognitions of merit rather than prohibited aristocratic titles. Recipients cannot legally use them as prefixes or suffixes.

Conclusion and UPSC Relevance

The annual conferment of the Padma Awards highlights the state's constitutional effort to foster an architecture of citizen excellence without introducing artificial social hierarchies.

11. Quantum Materials and the Fractional Quantum Hall Effect: Advancements in Condensed Matter Physics

- **Evolution of the Hall Effect Phenomenon:** The foundational Hall effect, discovered in 1879, describes how a perpendicular magnetic field exerts a sideways force on moving electrical charges within a metal plate, causing a voltage build-up along the edges. In the early 1980s, studies at temperatures near absolute zero revealed that Hall resistance does not change smoothly but in discrete, whole-number steps, a phenomenon termed the Integer Quantum Hall Effect.
- **The Physics of the Fractional Quantum Hall Effect (FQHE):** In 1982, physicists discovered that under intense magnetic fields, Hall resistance could also stabilize at fractional values like 1/3, 2/5, or 3/7. Because electrons are indivisible, this fractional behavior occurs because strongly interacting electrons merge into a collective quantum fluid where distinct particles disappear, giving rise to "quasiparticles" that carry a fraction of an electron's charge.
- **The Breakthrough of the Fractional Quantum Anomalous Hall Effect (FQAHE):** Historically, observing the FQHE required powerful, energy-intensive magnetic fields alongside extreme sub-zero cooling. In a major advancement, researchers successfully replicated this behavior in 2024 without using an external magnetic field, defining the phenomenon as the Fractional Quantum Anomalous Hall Effect (FQAHE), where the structural features of the material itself mimic a magnetic field.
- **Engineering Moiré Superlattices with Pentalayer Graphene:** To simulate a magnetic field from within, scientists stacked five layers of graphene, with each layer twisted at a precise angle relative to the one below, atop a hexagonal boron nitride substrate. This alignment creates a moiré superlattice that slows down the moving electrons, allowing their mutual electrical repulsion to dominate over kinetic energy and forcing them into the collective quantum state required for FQAHE.
- **Strategic Value of Anyons for Quantum Computing:** The collective states generated by the FQAHE give rise to a unique class of quasiparticles known as anyons. Anyons possess an inherent structural stability that makes them highly resilient to external environmental noise and decoherence, offering a potential breakthrough for creating fault-tolerant topological quantum computers capable of processing complex calculations without data corruption.

Key Definitions

- **Quasiparticle:** A microscopic, predictable disturbance or collective excitation within a strongly interacting quantum system that behaves dynamically like an independent, real physical particle.
- **Moiré Superlattice:** A complex geometric interference pattern generated when two or more periodic atomic grids or crystalline sheets are overlaid with a slight relative angular twist, altering the material's electronic structure.
- **Topological Quantum Computing:** An advanced computing paradigm that utilizes localized quasiparticles like anyons to execute logic gates, protecting quantum information from environmental disturbance by storing data globally rather than locally.

Constitutional and Legal Provisions

- **Article 51A(h) of the Constitution:** Establishes the Fundamental Duty of every Indian citizen to develop the scientific temper, humanism, and the spirit of inquiry and reform, encouraging engagement with foundational sciences.
- **National Quantum Mission (NQM):** Approved by the Union Cabinet to seed, nurture, and scale up scientific R&D in quantum technologies. The study of quantum materials and exotic states directly aligns with the mission's thematic hubs on quantum materials and devices.

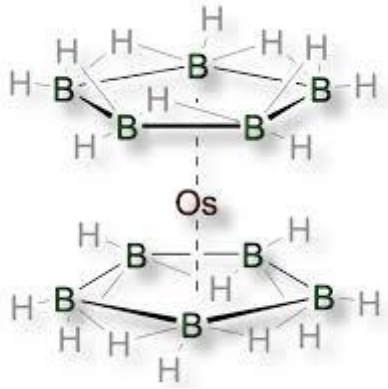
Conclusion and UPSC Relevance

The transition from classical electronics to quantum materials represents a major shift in modern technology, moving away from relying on powerful magnets toward engineering materials at the atomic level. Mastering these quantum states is vital for achieving technological self-reliance in next-generation computing, advanced sensors, and deep-tech manufacturing.

12. Synthesis of First Carbon-Free Ferrocene Analogue by Indian Researchers

Key Summary Points

- **The Breakthrough:** Indian researchers from IIT Madras and the Indian Institute of Science (IISc), Bengaluru, have synthesized the world's first completely carbon-free analogue of **ferrocene**, resolving a fundamental puzzle that challenged inorganic chemists for over seven decades.
- **Structural Composition:** The traditional ferrocene molecule consists of an iron atom sandwiched between two organic, flat carbon rings. The newly synthesized molecule mimics this exact architectural layout but replaces the iron atom with **osmium** at the center, sandwiched between two **boron-based rings**.
- **Enhanced Stability and Bonding:** Initial crystallographic investigations show that the new molecule is structurally stable. The metal-ring bonding between osmium and the boron rings is significantly stronger than the iron-carbon bonds in ferrocene, making it potentially more robust and thermally resilient.
- **Methodology of Synthesis:** The research team utilized computer modeling to determine that osmium was the ideal transition metal to stabilize the boron rings. The physical synthesis was achieved via **thermolysis** at 100°C by reacting an osmium precursor with a boron-hydrogen source.



- **Scientific Publication:** The landmark discovery has been published in the prestigious global journal *Science*, marking an indigenous milestone for India in fundamental chemical research and advanced molecular design.

Core Scientific Concepts & Definitions

- **Ferrocene:** Discovered accidentally in the early 1950s, ferrocene ($Fe(C_{5}H_{5})_{2}$) is a landmark organometallic "sandwich compound" where a central transition metal (iron) is bound by covalent bonds between two parallel, electron-rich cyclopentadienyl (carbon) rings. It revolutionized transition metal chemistry and is heavily utilized in sensors, batteries, catalysis, and pharmaceuticals.

- **Sandwich Compounds:** Chemical complexes featuring a central transition metal atom bound by haptic covalent interactions to two parallel peripheral ring systems (ligands).
- **Organometallic vs. Inorganometallic Chemistry:** Organometallic chemistry studies compounds containing at least one chemical bond between a carbon atom of an organic molecule and a metal. This new breakthrough opens up the era of "inorganometallics," where the carbon-free, inorganic rings (like boron) mimic organic structures.
- **Thermolysis:** A chemical decomposition or synthesis process caused by heat energy.

Comparison Matrix: Ferrocene vs. New Boron Analogue

Parameter	Traditional Ferrocene	Newly Synthesized Analogue
Central Metal Atom	Iron	Osmium
Ring Composition	Cyclopentadienyl Rings	Boron-Hydrogen Rings
Chemical Nature	Organic / Organometallic	Inorganic / Inorganometallic
Bond Strength	Standard stability	Significantly stronger due to bridging hydrogens
Structural Alignment	Eclipsed / Staggered conformation	Highly compressed, staggered conformation

Potential Applications and Significance

- **Textbook Paradigm Shift:** The discovery proves that the highly stable sandwich molecular architecture is not an exclusive property of carbon chemistry. It expands the structural possibilities of the periodic table, specifically for boron.
- **Advanced Material Science:** Boron-based 2D chemistry is expanding into borophenes and multilayer structures. This breakthrough opens up pathways to create metal-sandwiched or intercalated boron bilayers that could rival or surpass graphene in thermal and electronic properties.
- **Industrial Catalysis:** Due to the higher thermal stability of the osmium-boron bonds, this molecule can pave the way for high-temperature catalysts in petrochemical and industrial operations.

Constitutional & Institutional Framework for Research in India

- **Article 51A(h) of the Constitution:** Mandates that it shall be the duty of every citizen of India to develop the **scientific temper, humanism, and the spirit of inquiry and reform**. Indigenous fundamental research breakthroughs directly embody this fundamental duty.
- **Anusandhan National Research Foundation (ANRF):** Established under the ANRF Act, 2023, it aims to seed, grow, and promote Research and Development (R&D) and foster a culture of research across India's universities and institutions. The senior leadership involved in this discovery holds research chairs supported by the ANRF.

- **Science, Technology, and Innovation Policy (STIP):** Governs India's overarching ecosystem to position the nation among the top scientific powers globally by prioritizing core fundamental research alongside applied technologies.

Conclusion

The synthesis of a carbon-free ferrocene analogue by Indian scientists represents a monumental leap in foundational chemistry. By breaking the long-standing scientific assumption that stable sandwich structures require carbon rings, this discovery unlocks a completely new domain of inorganometallic materials. It underscores the growing prowess of Indian premier institutions like IITs and IISc in conducting cutting-edge, high-impact basic science research that commands global recognition.