

Editorial of the Day – 19.05.2026

Index

- | | | |
|----|---|------------|
| 1. | Waiting For the Storm – On Weather Events, India's Vulnerability (TH) | -01 |
| 2. | In Federalism Challenges, Consensus Is the Solution (IE) | -04 |
| 3. | From Anai Mangalam to Leiden – Reclaiming A Civilisation's Memory (TP) | -07 |
| 4. | Bright Quantum Morning (TS) | -10 |

1. Waiting For the Storm – On Weather Events, India's Vulnerability (TH)

GS Paper III – Disaster Management / Geography

Topic – Important Geophysical phenomena (earthquakes, Tsunami, Volcanic activity, cyclone etc.); Disaster and disaster management.

Sub-Topic – Thunderstorms and Thundersqualls, Localized Extreme Weather Events, Early Warning Systems (EWS), and Last-Mile Disaster Risk Reduction (DRR).

1. Introduction

In May 2026, a deadly pre-monsoon weather system swept through Uttar Pradesh, impacting 26 districts and causing 111 deaths and 72 injuries. This extreme event—characterized by a destructive combination of thunderstorms, lightning, dust storms, heavy rain, and high-velocity thundersqualls—stands as one of the deadliest recent localized weather disasters in the region. The crisis highlights a widening gap in Indian disaster governance – while macro-meteorological forecasting has advanced significantly, local infrastructure vulnerability and last-mile communication failures continue to cause high casualties.

2. Meteorological Mechanics – Why Uttar Pradesh is a Storm Axis

The extreme intensity of the May 2026 pre-monsoon storms was driven by a volatile combination of thermal and atmospheric factors –

Collision of Contrasting Air Masses – Uttar Pradesh frequently acts as a geographic convergence zone. The collision of intense, dry, scorching heatwaves (Loo winds) originating from the Thar Desert with warm, highly moisture-laden winds blowing from the Bay of Bengal creates a highly unstable thermodynamic atmosphere.

Western Disturbance Instability – The convergence of these surface winds was heavily intensified by an active Western Disturbance moving over northwest India, creating strong convective triggers.

Orographic Amplification – Southern parts of the state, particularly the Vindhya hills region spanning Mirzapur and Sonbhadra districts, act as topographic elevations that rapidly force moist air upward, intensifying severe thunderstorm and squall activity.

A Predictable and Recurring Cycle – While the 2026 storms were unusually severe, similar deadly pre-monsoon convective systems have consistently formed during the May–June window every year since 2018.

3. The Early Warning System Paradox

The high death toll occurred despite active atmospheric tracking and widespread data transmission, revealing gaps in India's Early Warning Systems (EWS) –

Mass Notification Outlay – The India Meteorological Department (IMD) successfully generated timely thunderstorm and lightning alerts. In response, the Uttar Pradesh state administration dispatched over 34 crore red and orange alert messages via the centralized SACHET portal.

The Last-Mile Failure – Despite sending millions of automated SMS alerts, the system lacked precise target verification. It remains unclear whether these warnings reached the most marginalized, off-grid communities before the storms struck.

Lack of Actionable Intelligence – The disseminated alerts were mostly broad, text-based regional warnings. They lacked location-specific guidance and clear, actionable safety instructions on what vulnerable populations should do to protect themselves.

4. Infrastructure Vulnerabilities and Human Exposure

The high number of casualties was a direct consequence of weak structural resilience and long-standing vulnerabilities in rural and semi-urban infrastructure –

Fragile Housing Stocks – A significant percentage of casualties occurred in rural and peri-urban areas due to the collapse of structurally weak houses. Fragile thatch, mud, and unreinforced tin roofs turned into hazardous projectiles when the thundersqualls struck during evening and night hours.

Hazardous Commercial Infrastructure – Poorly installed commercial hoardings, weak public signboards, and uninsulated, hanging electrical wiring networks collapsed under high wind pressures, leading to electrocutions and crush injuries.

Agricultural and Economic Asset Loss – Beyond the human toll, the high winds caused widespread damage to standing horticulture crops, livestock, and local power infrastructure.

5. Gaps in Institutional Disaster Preparedness

Forecasting vs. Risk Reduction – State agencies knew the potential risks, as shown by pre-planned relief packages for different types of infrastructure and crop losses. However, institutional focus remains heavily biased toward post-disaster financial relief rather than pre-disaster vulnerability reduction.

Predictable Risk vs. Inadequate Resilience – The overall meteorological threat was entirely foreseeable. The continued high rate of casualties reflects a failure to translate weather forecasts into long-term, climate-resilient local infrastructure.

6. Strategic Way Forward

Transition to Impact-Based Forecasting – Moving past generic regional weather alerts to Impact-Based Forecasting (IBF), which clearly tells communities *what the weather will do* and provides step-by-step safety actions.

Upgrading the Last-Mile Communication Web – Utilizing local community networks, regional radio stations, and village-level sirens alongside the SACHET portal to ensure alerts reach non-smartphone users in time.

Structural Retrofitting & Cool/Resilient Roofs – Integrating mandatory wind-resistant structural codes into rural housing programs like the Pradhan Mantri Awas Yojana (PMAY) to replace fragile, unsafe roofs.

Enforcing Strict Public Safety Zoning – Auditing and regulating the installation of heavy commercial billboards and electrical poles along public highways and dense markets to prevent structural collapses during storms.

Decentralized Emergency Response Hubs – Setting up village-level disaster response teams equipped with basic rescue tools and medical kits to provide immediate aid during the golden hour, before state teams arrive.

Conclusion

The 2026 Uttar Pradesh storms show that predictable weather risks become deadly disasters when they meet weak local infrastructure and inadequate community preparedness. True climate resilience requires moving past sophisticated weather forecasting to fix the systemic vulnerabilities on the ground. By investing in wind-resilient housing, improving last-mile communication networks, and enforcing strict public safety codes, India can bridge the gap between advanced weather science and public safety, ensuring communities are prepared before the next storm hits.

Source – <https://www.thehindu.com/opinion/editorial/waiting-for-the-storm-on-weather-events-indias-vulnerability/article70994042.ece>

Question

"Despite significant advancements in meteorological forecasting and mass digital alerts, India's rural and peri-urban populations remain highly vulnerable to localized severe weather events. Examine the systemic bottlenecks in the 'last-mile' delivery of early warnings and suggest structural measures to build community-level climate resilience." (250 Words, 15 Marks)

1. Introduction

The occurrence of severe pre-monsoon storms in Uttar Pradesh in May 2026, which claimed 111 lives across 26 districts, highlights an institutional paradox in India's disaster management framework. While the India Meteorological Department (IMD) generated accurate alerts and the state sent over 34 crore warning messages via the SACHET portal, the high casualty count demonstrates that mass data transmission does not automatically translate into public safety if structural and communication bottlenecks persist.

2. Systemic Bottlenecks in 'Last-Mile' Delivery of Early Warnings

An examination of recent localized disasters reveals several critical gaps in the warning-to-action chain. **The Digital and Accessibility Divide** – Automated portals rely heavily on smartphone connectivity and literacy. The most vulnerable populations—such as agricultural labourers, migrant workers, and off-grid rural communities—often miss text-based alerts or lack the means to receive them in real time.

Lack of Actionable and Localized Intelligence – Most alerts are broad, regional meteorological statistics (e.g., predicting "thundersqualls at 60 km/h"). They do not practice Impact-Based Forecasting (IBF), which explains *what the weather will do* (e.g., warning that "fragile roofs may collapse") and provides clear, step-by-step safety guidelines.

Temporal and Situational Disconnect – Pre-monsoon convective storms develop rapidly and often strike during evening or night hours when families are asleep. Text alerts sent to switched-off or unmonitored phones fail to provide a proactive window for evacuation.

3. Structural Measures to Build Community-Level Resilience

To move beyond reactive relief, India must deploy targeted structural and institutional interventions –

Multi-Channel Decentralized Alert Systems – Supplementing digital portals with localized, low-tech alternatives such as village-level sirens, automated public address systems on religious or community buildings, and regional community radio broadcasts to ensure warnings cut across the digital divide.

Climate-Resilient Housing Infrastructure – Integrating mandatory wind- and lightning-resistant construction guidelines into rural housing programs like the Pradhan Mantri Awas Yojana (PMAY). Replacing fragile thatch, mud, and unreinforced tin roofs with stable structures removes the primary hazard during high-velocity thundersqualls.

Public Safety Zoning and Engineering Codes – Enforcing rigid structural audits for commercial hoardings, highway billboards, and public signboards. Power distribution networks must transition to underground or heavily insulated overhead cables to eliminate the risk of electrocution during storms.

Institutionalization of First Responders – Training and equipping village-level disaster management committees (Aapda Mitras) with basic rescue tools and first-aid kits. Localized management ensures immediate rescue operations during the "golden hour" before district administrative machinery can reach the site.

Conclusion

Examining India's extreme weather vulnerabilities shows that advanced meteorology is only half the solution. True disaster risk reduction (DRR) occurs when scientific data is matched by secure local infrastructure and accessible public communication. By shifting the policy focus from massive digital data outlays to localized, impact-based communication and climate-proof housing, India can protect its most vulnerable populations and turn advanced weather forecasting into saved lives.

Source – <https://www.thehindu.com/opinion/editorial/waiting-for-the-storm-on-weather-events-indias-vulnerability/article70994042.ece>

2. In Federalism Challenges, Consensus Is the Solution (IE)

GS Paper II – Indian Polity and Governance

Topic – Functions and responsibilities of the Union and the States, issues and challenges pertaining to the federal structure, devolution of powers and finances up to local levels and challenges therein.

Sub-Topic – Fiscal Federalism, Asymmetric Demography, Delimitation Dilemma, Cooperative vs. Combative Federalism, and Article 356.

1. Introduction

Indian federalism has been a dynamic, evolving architecture that serves as a vital instrument for nation-building. Historically shaped by the tension between the centralizing tendencies of the post-Partition era and the localized demands of diverse states, federalism has routinely grappled with challenges regarding vertical and horizontal equity. The authors look back on 75 years of India's constitutional journey, utilizing data from their recent book, *A Sixty-Year Humanity* (specifically chapters XIV and XV), to identify two proximate challenges and two deep-seated structural causes that are converting cooperative federalism into a contentious, combative system.

2. Proximate Challenge 1 – The Rising Democratic Deficit

The Democratic Principle – In a true democracy, equal citizenship demands that every individual citizen's vote carries equivalent weight (1 person = 1 vote = 1 value). This requires regular, periodic adjustments in electoral seat allocations to mirror shifting population dynamics.

The 1971 Freeze Policy – To encourage population control, constitutional amendments in 1976 (and again in 2002) froze political representation in the Parliament based on the 1971 Census until the first census after 2026.

The Representation Gap – This freeze created a structural divergence between a state's actual population share and its corresponding seat share in Parliament (as shown in Figure 1 – Over/Under-Representation) –

1. **The Southern Deficit** – By the 2024 general elections, the four southern states (Andhra Pradesh, Kerala, Tamil Nadu, and Telangana) would have collectively held 23 more seats if representation tracked current population realities.
2. **The Northern Surplus** – Conversely, four northern states (Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh) would have held 31 fewer seats under the same demographic parameters.

The Delimitation Dilemma – This widening gap means that states that successfully implemented national population stabilization goals are being penalized with diminishing political relevance, while states with higher fertility rates are gaining legislative dominance.

3. Proximate Challenge 2 – Rising Fiscal Transfers

The Theoretical Objective – In an ideal federal framework, financial resources generated across states are partially redistributed. Transfers from wealthier, high-performing states to economically weaker ones ensure that all citizens have access to a comparable baseline of public goods and services.

The Divergence Index – Figure 2 plots the ratio between what a state receives via Finance Commission transfers versus its underlying tax base/contribution –

1. An Index > 1 denotes a Beneficiary state (transfers exceed contributions).
2. An Index < 1 denotes a Donor state (contributions exceed transfers).

The Widening Tax-to-Transfer Wedge – While the spread between donor and beneficiary states was tight in the 1960s, it has widened significantly over the last three decades –

3. In the early 1960s, the Hindi Heartland received roughly 20% more resources relative to its economic size, while the South and West received 20% less.
4. By 2023, the Hindi Heartland received 90% more resources relative to its tax base.
5. Concurrently, the South and West received 44% and 58% less, respectively, relative to their financial contributions.

The Non-Southern Contributors – The authors note that the largest net financial contributors are not solely southern states; western industrialized states like Gujarat and Maharashtra serve as primary engines of tax contribution, while eastern states like Odisha and West Bengal remain net fiscal beneficiaries.

4. Deeper Cause 1 – Divergent Economic Performance

The Divergence Phenomenon – The underlying driver of fiscal friction is the sharply uneven performance of states across health, education, fertility, and economic indicators.

The "China-Scale" Growth – Since 1980, per capita Gross State Domestic Product (GSDP) in the Southern and Western states has expanded at rates comparable to China's historic growth surge.

The Hindi Heartland Stagnation – These high-performing regions have rapidly pulled away from the Hindi heartland and West Bengal.

The Penalization Perception – This economic divergence creates a political narrative where economically disciplined states feel they are being financially penalized for their success (in demography and productivity), while lagging states are seen as receiving open-ended financial rewards for underperformance.

5. Deeper Cause 2 – Erosion of Democratic Sensibility

The Trust Deficit – The core issue undermining fiscal and political federalism is a growing distrust within Indian politics, impacting relationships between the Centre and states, among states themselves, and across religious minorities.

Unilateral Centralization – The authors point to a series of major policy measures—ranging from demonetization and the farm laws to the Citizenship Amendment Act (CAA) 2019, the overhaul of the Indian Penal Code (via the Bharatiya Nyaya Sanhita), and sudden electoral roll revisions—as examples of top-down actions executed with minimal consultation with state governments.

The Partisan Imbalance – The persistent misuse of Article 356 to dismiss state governments, mounting grievances in regions like Kashmir, Ladakh, and Manipur, and the partisan role played by Governors have weakened institutional guardrails, replacing cooperative federalism with a combative variant.

6. The Way Forward – Reviving Democratic Sensibility

Beyond Technical Fixes – Standard policy remedies—such as new fiscal compacts, grand structural bargains, complex voter weighting matrices, or revised financial allocation formulas—will fail if the underlying political culture remains uncooperative.

The Core Solution – Resolving these systemic challenges requires the Central government, which holds a preponderance of constitutional power, to practice wide consultation, accommodation, compromise, and self-restraint.

The Historic Lesson of Unanimity – The authors cite an instructive historic precedent from a 2018 GST Council meeting –

When the then Finance Minister of Kerala, T.M. Thomas Isaac, walked out of a GST Council session because his state was in a minority regarding a tax proposal, the Union Finance Minister, Arun Jaitley, chose not to override him using the Centre's dominant voting bloc. Instead, Jaitley halted proceedings, engaged in direct consultation, and accommodated Kerala's concerns to preserve complete unanimity among all 28 states.

Preserving Strategic Space – The Centre must treat state governments as essential partners in nation-building rather than political adversaries, ensuring that major policy transitions are rooted in consensus.

Conclusion

Indian federalism stands at a critical juncture where demographic divergence and economic polarization are testing the limits of constitutional integration. While technical adjustments to finance formulas and delimitation parameters are necessary, they are secondary to the preservation of democratic sensibility. The future stability of the Indian Union relies on the Centre's ability to engage with

states through institutional self-restraint and consensus-building, ensuring that economic productivity and population control are rewarded rather than marginalized.

Source – **Indian express**

<https://indianexpress.com/article/explained/explained-politics/india-federalism-debate-democracy-fiscal-transfers-expert-explains-10695802/>

Question

"The post-2026 lifting of the freeze on the delimitation of parliamentary seats risks shifting political power away from states that have achieved demographic stability toward those with higher fertility rates. Critically evaluate the political and fiscal implications of this demographic divergence on the future of Indian federalism." (250 Words, 15 Marks)

1. Introduction

The structural stability of Indian federalism is facing a major challenge due to a growing gap between regional demographics and economic performance. Since the 1971 Census, political representation in Parliament has been frozen to shield states implementing population control policies from losing legislative influence. Lifting this freeze post-2026 without structural safeguards risks creating a severe representation gap between the northern and southern-western regions.

2. The Political Implications – Shifting Representation

Evaluating the political impact reveals a sharp division in legislative influence –

The Representation Deficit – States that successfully met national population stabilization goals (predominantly in the South and West) face a significant contraction in their parliamentary seat share. Data indicates that by the 2024 cycles, the four southern states lost out on an estimated 23 seats by sticking to the 1971 baseline.

The Northern Surplus – Conversely, states with delayed demographic transitions (the Hindi Heartland) stand to gain an estimated 31 additional seats based on current population metrics.

Erosion of the National Compact – This shift creates an institutional paradox – it penalizes states for policy compliance while rewarding lagging states with greater legislative dominance. These dynamic risks alienating high-performing regions and undermining the principle of cooperative federalism.

3. The Fiscal Implications – Contribution vs. Redistribution

The demographic imbalance directly shapes the dynamics of fiscal federalism –

The Tax-to-Transfer Wedge – Highly industrialized states function as net Donors (an index < 1), where their financial contributions far exceed what they receive back in central transfers. By 2023, western and southern states received 44% and 58% less relative to their tax contributions.

Open-Ended Beneficiaries – Lagging regions have become structural Beneficiaries (an index > 1). The Hindi Heartland now receives 90% more resources relative to its underlying economic base.

The Penalization Narrative – This economic polarization creates a damaging political narrative. High-performing states feel they are being financially and politically marginalized for their success in managing demography and driving economic growth.

4. Way Forward – Preserving Federal Sensibility

To prevent this combative dynamic from escalating, India must deploy a combination of policy and institutional remedies –

Decoupling Representation from Population – Amending the delimitation framework to weight parliamentary seats by a combination of population size and governance metrics (such as health, literacy, and demographic control).

Expanding the Role of the Rajya Sabha – Reforming the upper house to provide equal or more balanced representation to states regardless of size, acting as a structural check on population-weighted dominance in the Lok Sabha.

Rebalancing the Fiscal Formula – Ensuring the Finance Commission explicitly increases the weight assigned to "Efficiency" (tax collection, fiscal discipline, and fertility control) alongside "Equity" metrics.

Conclusion

Critically evaluating India's demographic divergence shows that relying strictly on population-based formulas will strain the constitutional compact. While equal voter representation (1 person = 1 vote = 1 value), is a fundamental democratic principle, it must not be enforced in a way that marginalizes high-performing states. The future stability of the Indian Union relies on the Centre exercising institutional self-restraint and consensus-building, ensuring that economic productivity and population control remain assets rather than political liabilities.

Source – Indian express

<https://indianexpress.com/article/explained/explained-politics/india-federalism-debate-democracy-fiscal-transfers-expert-explains-10695802/>

3. From Anai Mangalam to Leiden – Reclaiming A Civilisation's Memory (TP)

General Studies Paper – General Studies Paper I – Indian Culture and History

Topic – Indian culture and heritage

Sub-Topic – Maritime history and transnational exchanges

Introduction

The article discusses the rediscovery and significance of the Anaimangalam copper plate inscription linked to the Chola period. It highlights how ancient inscriptions reveal India's sophisticated governance systems, maritime diplomacy, educational patronage, and global cultural interactions. The article also argues that reclaiming such historical records is essential for restoring India's civilisational memory and cultural confidence.

1. What is the Anaimangalam Inscription?

Chola-Era Historical Record

1. The inscription belongs to the Chola period and is associated with Rajaraja Chola I.

Stored in Leiden, Netherlands

1. The copper plates are preserved in Leiden University in the Netherlands.

Valuable Historical Source

1. The inscription provides details about governance, grants, trade, diplomacy, and religious patronage.

2. Importance of Inscriptions in Indian History

Primary Historical Sources

1. Inscriptions provide direct evidence about political, economic, and social life.

Reliable Documentation

1. Unlike legends or oral traditions, inscriptions offer precise administrative and chronological details.

Understanding Ancient Governance

1. They help historians reconstruct taxation, land grants, local administration, and diplomatic relations.

3. Chola Empire and Maritime Power

Strong Naval Tradition

1. The Cholas developed one of the most powerful naval systems in medieval India.

Indian Ocean Trade Networks

1. The empire maintained commercial and cultural relations with Southeast Asia.

Maritime Diplomacy

1. Chola interactions extended beyond conquest to diplomacy, trade, and cultural exchange.

4. India's Historical Global Connectivity

Cultural Exchanges Across Asia

1. Indian civilisation influenced Southeast Asia through religion, language, architecture, and trade.

Educational and Religious Networks

1. Temples and monasteries acted as centres of learning and cultural dissemination.

Cosmopolitan Nature of Indian Civilisation

1. Ancient India actively participated in global intellectual and commercial systems.

5. Civilisational Memory and Historical Consciousness

Loss of Historical Awareness

1. Colonial historiography often underplayed India's global influence and institutional sophistication.

Importance of Historical Recovery

1. Rediscovering inscriptions and archives help restore confidence in India's civilisational achievements.

Beyond Political History

1. Historical memory includes culture, institutions, trade, knowledge systems, and social organisation.

6. Heritage Preservation and Repatriation Debate

Preservation Abroad

1. Many Indian artefacts and manuscripts remain in foreign museums and archives.

Debate on Ownership and Access

1. Questions arise regarding repatriation, digital access, and shared global heritage.

Need for Archival Collaboration

1. International cooperation can improve conservation and scholarly research.

7. India's Soft Power and Cultural Diplomacy

Civilisational Diplomacy

1. India increasingly uses historical and cultural connections to strengthen international relations.

Shared Asian Heritage

1. Historical maritime links help deepen ties with Southeast Asia and the Indo-Pacific region.

Global Interest in Indian Heritage

1. Ancient Indian knowledge systems and historical records enhance India's soft power.

8. Governance Lessons from Ancient India

Administrative Sophistication

1. Chola inscriptions demonstrate organised land administration and institutional governance.

Local Self-Governance

1. Village assemblies and decentralised administration existed in several parts of South India.

Economic Management

1. Revenue systems, trade regulation, and temple administration reflected institutional maturity.

9. Relevance in Contemporary India

Cultural Confidence

1. Understanding historical achievements strengthens national self-confidence.

Academic Research and Public Awareness

1. Greater focus on epigraphy, archaeology, and manuscript preservation is required.

Linking Heritage with Modern Identity

1. Civilisational continuity can coexist with modern democratic and technological progress.

10. Challenges in Heritage Preservation

Neglect of Historical Archives

1. Many inscriptions and manuscripts remain undocumented or poorly preserved.

Limited Public Awareness

1. Historical and epigraphic studies receive limited mainstream attention.

Need for Skilled Researchers

1. India requires more trained historians, archaeologists, and epigraphists.

11. Way Forward

Digitisation of Historical Records

1. Ancient manuscripts and inscriptions should be digitally preserved and publicly accessible.

Strengthen Archaeological Research

1. Greater investment is needed in heritage studies and conservation institutions.

Promote Civilisational Studies

1. Universities should encourage interdisciplinary research on India's global historical networks.

International Cultural Cooperation

1. India should collaborate globally for preservation and access to historical artefacts.

Conclusion

The Anaimangalam inscription is not merely an ancient record but a reminder of India's deep civilisational heritage, administrative sophistication, and global connectivity. Reclaiming such historical memory is essential for building cultural confidence and understanding India's long-standing contribution to world civilisation.

Source - <https://dailypioneer.com/news/from-anaimangalam-to-leiden-reclaiming-a-civilisations-memory>

Question

Q. "Ancient inscriptions are valuable instruments for reconstructing India's civilisational history and global interactions." Discuss with reference to the Chola period. (250 words)

Introduction

Ancient inscriptions are among the most reliable historical sources for understanding India's political, cultural, and economic history. Chola-period inscriptions particularly highlight India's advanced governance systems and maritime connections.

Importance of Chola Inscriptions

1. They provide detailed evidence regarding administration, taxation, and land grants.
2. Inscriptions reveal the role of village assemblies and decentralised governance.
3. They demonstrate the Chola Empire's strong naval and maritime capabilities.
4. They reflect India's cultural and trade relations with Southeast Asia.

Civilisational Significance

1. Chola inscriptions show India's participation in global commercial and cultural networks.
2. They highlight institutional sophistication and educational patronage.
3. Such records strengthen understanding of India's historical soft power and cosmopolitan traditions.

Contemporary Relevance

1. Rediscovery and preservation of inscriptions enhance cultural confidence.
2. Digitisation and research can improve public access to historical knowledge.
3. Civilisational heritage can strengthen India's cultural diplomacy and global engagement.

Conclusion

Ancient inscriptions are not merely historical artefacts but living records of India's civilisational depth, governance traditions, and global interactions. Their preservation is essential for understanding India's historical continuity and cultural legacy.

Source - <https://dailypioneer.com/news/from-anaimangalam-to-leiden-reclaiming-a-civilisations-memory>

4. Bright Quantum Morning (TS)

General Studies Paper – General Studies Paper IV – Ethics and Philosophy in Science

Topic – Emerging technologies and their applications

Sub-Topic – Indian philosophical traditions

Introduction

The article discusses the growing significance of quantum science and technology and connects it with philosophical ideas from Indian traditions, particularly Advaita Vedanta. It argues that quantum mechanics challenges classical notions of separateness and determinism, while also opening transformative possibilities in computing, medicine, communication, and materials science. The article further suggests that India can combine scientific advancement with civilisational wisdom to shape a more holistic technological future.

1. What is Quantum Science?

Study of the Microscopic World

1. Quantum mechanics explains the behaviour of matter and energy at atomic and subatomic scales.

Departure from Classical Physics

1. Classical physics assumes predictability and determinism.
2. Quantum physics introduces uncertainty, probability, and observer effects.

Foundation of Modern Technology

1. Quantum principles already underpin semiconductors, lasers, MRI machines, and modern electronics.

2. Key Concepts in Quantum Mechanics

Quantum Superposition

1. Particles can exist in multiple states simultaneously until observed.

Quantum Entanglement

1. Two particles can remain interconnected regardless of distance.

Wave-Particle Duality

1. Matter and light display both particle-like and wave-like behaviour.

Heisenberg Uncertainty Principle

1. Certain physical properties cannot be simultaneously measured with perfect precision.

3. Quantum Revolution and Technological Applications

Quantum Computing

1. Quantum computers use qubits capable of parallel computation.

Quantum Communication

1. Quantum encryption promises highly secure communication systems.

Quantum Sensors

1. Quantum technologies improve precision in navigation, defence, healthcare, and climate observation.

Drug Discovery and Materials Science

1. Quantum simulations may revolutionise chemistry and pharmaceutical research.

4. Global Quantum Race

Strategic Importance

1. Quantum technology is becoming a major area of geopolitical competition.

Investments by Major Powers

1. Countries like the US, China, and members of the EU are investing heavily in quantum research.

National Security Implications

1. Quantum technologies can reshape cybersecurity and intelligence systems.

5. India's Quantum Mission

National Quantum Mission (NQM)

1. India launched the National Quantum Mission to strengthen indigenous capabilities.

Objectives of the Mission

1. Development of quantum computing, communication, sensing, and materials research.

Building Domestic Ecosystem

1. India aims to create research institutions, startups, and skilled manpower in quantum technologies.

6. Link with Indian Philosophy

Advaita Vedanta and non-dualism

1. Advaita philosophy views reality as fundamentally interconnected.

Parallels with Quantum Ideas

1. Quantum entanglement and interconnectedness resemble philosophical notions of unity.

Science and Spiritual Inquiry

1. The article suggests that scientific and philosophical inquiry need not be mutually exclusive.

7. Vivekananda and Scientific Temper

Bridging Science and Spirituality

1. Swami Vivekananda encouraged harmonising scientific inquiry with spiritual understanding.

Rational Interpretation of Philosophy

1. Indian philosophical traditions often encouraged questioning and intellectual exploration.

Human-Centric Knowledge

1. Science should contribute to ethical and social advancement.

8. Ethical and Social Dimensions of Quantum Technologies

Responsible Innovation

1. Quantum technologies should be developed with ethical safeguards.

Digital and Strategic Inequality

1. Unequal access to advanced technologies may widen global power disparities.

Need for Global Governance

1. International cooperation is required to regulate emerging technological risks.

9. Challenges Before India

Research Infrastructure Constraints

1. Quantum science requires advanced laboratories and expensive infrastructure.

Talent and Skill Gaps

1. India needs a larger pool of quantum scientists and engineers.

Global Competition

1. Intense technological competition may create dependency risks.

Commercialisation Challenges

1. Translating laboratory research into scalable industrial applications remains difficult.

10. Opportunities for India

Demographic Advantage

1. India's young scientific workforce can contribute significantly to emerging technologies.

Strong IT Ecosystem

1. India's software and digital capabilities provide a foundation for quantum innovation.

Interdisciplinary Potential

1. India can uniquely integrate philosophy, ethics, mathematics, and technology.

11. Way Forward

Strengthen Quantum Education

1. Universities should promote specialised quantum science programmes.

Increase R&D Investment

1. Long-term funding for quantum research and startups is essential.

Encourage Industry-Academia Collaboration

1. Collaboration can accelerate innovation and commercialisation.

Promote Ethical Technology Governance

1. India should develop responsible regulatory and ethical frameworks.

Integrate Scientific Temper with Civilisational Wisdom

1. Science and philosophy can jointly contribute to sustainable and humane technological progress.

Conclusion

The quantum revolution represents not only a technological transformation but also a deeper shift in humanity's understanding of reality and interconnectedness. India has the opportunity to emerge as a major quantum power by combining scientific innovation with its rich philosophical and intellectual traditions.

Source - <https://www.thestatesman.com/opinion/bright-quantum-morning-1503595460.html>

Question

Q. "Quantum technologies are reshaping the future of science, security, and global power politics." Discuss India's opportunities and challenges in the quantum era. (250 words)

Introduction

Quantum technologies represent the next frontier in science and innovation. Quantum computing, communication, and sensing are expected to transform industries, defence systems, healthcare, and cybersecurity.

Importance of Quantum Technologies

1. Quantum computing can solve complex problems beyond the capability of classical computers.
2. Quantum communication provides highly secure encryption systems.
3. Quantum sensors improve precision in defence, navigation, and healthcare.
4. These technologies have major economic and strategic implications.

India's Opportunities

1. India has launched the National Quantum Mission to strengthen domestic capabilities.
2. Strong IT and digital ecosystems provide a foundation for innovation.
3. India's large scientific workforce can contribute significantly to quantum research.
4. India can emerge as a trusted global technology partner.

Challenges

1. Quantum research requires expensive infrastructure and advanced expertise.
2. Global competition from technologically advanced countries is intense.
3. Commercialisation and industry adoption remain limited.
4. Ethical and cybersecurity concerns require effective governance frameworks.

Conclusion

Quantum technologies are likely to redefine global technological leadership in the coming decades. India's success in the quantum era will depend on sustained investment, scientific innovation, skilled manpower, and responsible governance.

Source - <https://www.thestatesman.com/opinion/bright-quantum-morning-1503595460.html>