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A. Polity & Governance

1. **Discuss how the expansion of Autonomous Hill Development Councils can strengthen decentralised governance and cultural protection in Ladakh. What concerns does the proposal raise?**

(10 Marks, 200 Words)

Introduction:

Ladakh's vast terrain, sparse population and distinct tribal cultures require governance adapted to local conditions. The proposal to establish **Autonomous Hill Development Councils in all seven districts**, extending the model beyond Leh and Kargil, seeks to deepen democratic decentralisation and grassroots participation.

Potential Benefits:

- **Participatory governance:** Elected councils can bring decision-making closer to villages and improve local accountability.
- **Context-specific planning:** Councils are better placed to formulate policies suited to Ladakh's difficult geography, pastoral economy and fragile ecology.
- **Balanced regional development:** Separate councils can address the distinct needs of areas such as Nubra, Changthang, Zaskar, Drass and Sham, reducing Leh-Kargil-centric development.
- **Cultural protection:** Local institutions can safeguard tribal customs, languages, traditional livelihoods, monasteries and community practices.
- **Responsive administration:** Decentralised control over development schemes may improve infrastructure, education, healthcare and disaster response.
- **Political inclusion:** Wider representation can reduce feelings of alienation following Ladakh's transition into a Union Territory.

Concerns Raised:

- Multiple councils may create **administrative fragmentation**, duplication and higher expenditure.
- Smaller districts may lack adequate finances and trained personnel.
- Unclear division of powers between councils and the Union Territory administration could generate conflict.
- Delimitation may trigger disputes over representation and resource distribution.
- Hill councils do not possess the constitutional autonomy of **Sixth Schedule institutions**; therefore, they may not fully satisfy demands for protection of land, jobs and tribal identity.
- Dominant local groups could marginalise smaller communities.

Conclusion:

The expansion can make governance more representative and culturally sensitive. However, its success requires clear powers, predictable finances, inclusive representation and stronger legal safeguards for Ladakh's land, ecology and identity.

2. **Judicial independence does not imply judicial immunity. Discuss the constitutional procedure for removing judges and the alternative mechanisms available for ensuring their accountability.** (10 Marks, 200 Words)

Introduction:

Judicial independence is a cornerstone of the Constitution, ensuring impartial adjudication free from executive or legislative influence. However, independence must be balanced with accountability, as judges remain subject to constitutional and ethical standards to preserve public confidence in the judiciary.

Constitutional Procedure for Removal of Judges:

- Articles 124(4), 124(5) and 217 provide for the removal of Supreme Court and High Court judges.
- A judge can be removed only on the grounds of **proved misbehaviour or incapacity**.
- A motion signed by the prescribed number of MPs is admitted by the **Speaker of the Lok Sabha or Chairman of the Rajya Sabha**.
- A three-member **Judges Inquiry Committee** investigates the allegations under the **Judges (Inquiry) Act, 1968**.
- If charges are proved, each House of Parliament must pass the motion by a **special majority**.
- The **President** issues the removal order after Parliament's approval.

Alternative Mechanisms for Judicial Accountability:

- **In-house procedure** of the Supreme Court for examining complaints against judges.
- **Restatement of Values of Judicial Life (1997)** and the **Bangalore Principles of Judicial Conduct** guide ethical behaviour.
- **Judicial review** and reasoned judgments ensure transparency and legal scrutiny.
- Public disclosure of assets and transparent appointment processes enhance accountability.
- Parliamentary scrutiny, media reporting and informed civil society strengthen institutional oversight while respecting judicial independence.

Conclusion:

An independent judiciary is indispensable for constitutional democracy, but independence cannot shield misconduct. Strengthening institutional accountability mechanisms while preserving judicial autonomy is essential to uphold the rule of law and maintain public trust in the justice delivery system.

3. **“Restoration of Jammu and Kashmir’s Statehood is not merely an administrative issue but a question of democratic trust and constitutional federalism.” Examine.** (15 Marks, 250 Words)

Introduction:

The **Jammu and Kashmir Reorganisation Act, 2019** bifurcated the erstwhile State into the Union Territories of **Jammu & Kashmir** and **Ladakh**, marking the first instance of a full-fledged State being downgraded into a Union Territory. The demand for restoration of Statehood has since evolved beyond administration into a test of **democratic legitimacy and cooperative federalism**.

Why Restoration of Statehood is a Democratic and Federal Imperative?**Restoring Democratic Trust:**

- Statehood enables an **elected government with greater executive authority**, strengthening representative democracy.
- It fulfils assurances given by the **Union Government** and acknowledged by the **Supreme Court**, enhancing public confidence in constitutional institutions.
- Greater political participation can reduce alienation and foster inclusive governance.
- Strengthens accountability by empowering elected representatives over governance and public service delivery.

Reinforcing Constitutional Federalism:

- Upholds the constitutional principle of **shared governance** between the Union and the States.
- Restores legislative and administrative autonomy over State List subjects, except those constitutionally reserved.

- Demonstrates India's commitment to **cooperative and asymmetrical federalism**, especially in sensitive border regions.
- Reinforces the spirit of **Articles 1 and 246** and the federal structure recognised as part of the **Basic Structure Doctrine**.

Concerns and Challenges:

- Persistent security concerns and cross-border terrorism require close coordination between the Union and the State.
- Fiscal dependence and developmental disparities may constrain effective governance.
- Delimitation, rehabilitation and regional representation remain politically sensitive issues.
- Balancing security imperatives with democratic decentralisation will remain a key challenge.

Way Forward:

- Restore Statehood at the earliest while ensuring robust security coordination.
- Strengthen democratic institutions through regular local body and Assembly elections.
- Promote inclusive development, dialogue and capacity-building to deepen public trust.

Conclusion:

The restoration of Jammu and Kashmir's Statehood is not merely an administrative rearrangement but a reaffirmation of **democratic accountability, constitutional morality and cooperative federalism**. A calibrated restoration, complemented by sustained peace and development, can strengthen both **national integration and the credibility of India's federal democracy**.

4. **Civil Society Organizations are often perceived as being anti-State actors rather than non-State actors. Do you agree? Justify.** (10 Marks, 150 Words)

Introduction:

Civil Society Organizations (CSOs) are voluntary, non-profit, non-State institutions that work to promote public welfare, rights, accountability and community participation. While some are perceived as adversarial to the government, equating CSOs with anti-State actors overlooks their broader role in strengthening democratic governance.

Why CSOs are Perceived as Anti-State?

- **Policy advocacy and public campaigns** often challenge government decisions on issues such as environment, land acquisition and human rights.
- Strategic litigation and protests may be viewed as obstructing development projects.
- Allegations regarding **foreign funding** and regulatory violations under the **Foreign Contribution (Regulation) Act (FCRA)** have reinforced such perceptions.
- Their criticism of government policies is sometimes interpreted as opposition to the State itself.

Why CSOs are Primarily Non-State Actors?

- They act as a **bridge between citizens and the government**, improving participatory governance.
- Complement State efforts in **education, healthcare, disaster relief, women empowerment and rural development**.
- Strengthen **transparency and accountability** through social audits, awareness campaigns and policy feedback.
- Promote constitutional values such as **justice, equality and participatory democracy**, thereby reinforcing rather than weakening the State.
- Successful initiatives such as the **Mazdoor Kisan Shakti Sangathan (MKSS)** contributed to the enactment of the **Right to Information Act, 2005**.

Conclusion:

Civil Society Organizations should not be viewed through the binary of being either pro-State or anti-State. In a constitutional democracy, they are **independent non-State actors** that constructively engage with the government, while holding it accountable and advancing the larger public interest.

5. Regulation of foreign contributions is necessary to protect national sovereignty, but excessive restrictions may weaken democratic civil society.” Discuss with reference to India’s FCRA framework.

(15 Marks, 250 Words)

Introduction:

The Foreign Contribution (Regulation) Act (FCRA), 2010 regulates foreign donations to ensure that they do not undermine India’s sovereignty, security or public interest. However, regulation must remain proportionate, as civil society is essential for participatory democracy, welfare delivery and governmental accountability.

Why Regulation is Necessary?

- **Protects sovereignty:** Prevents foreign actors from influencing elections, public policy, political mobilisation or strategic sectors.
- **Ensures financial integrity:** Registration, designated bank accounts, audits and annual returns improve transparency and accountability.
- **Counters illicit activities:** It restricts diversion of foreign funds towards terrorism, religious radicalisation, money laundering or activities threatening public order.
- **Safeguards democratic autonomy:** Political parties, candidates, legislators, judges and public servants are prohibited from accepting foreign contributions.
- **Enables oversight:** The 2020 amendments require receipt through a designated SBI account, prohibit transfer to another person and limit administrative expenditure to 20%.

Concerns and Challenges:

- **Shrinking civic space:** Cancellation or non-renewal may disrupt NGOs working in health, education, environment and human rights.
- **Executive discretion:** Broad terms such as “public interest” may allow selective enforcement, raising concerns under **Article 14**.
- **Freedom of association:** Disproportionate restrictions may indirectly affect **Article 19(1)(c)**.
- **Grassroots exclusion:** Prohibition on fund transfers disadvantages smaller organisations dependent on larger NGOs.
- **Compliance burden:** Centralised banking and reporting requirements impose high costs on small organisations.
- **Chilling effect:** Fear of punitive action may discourage legitimate advocacy and dissent.

The Supreme Court in **Noel Harper v. Union of India (2022)** broadly upheld the 2020 amendments, while affirming the State’s regulatory authority.

Way Forward:

- Adopt risk-based scrutiny instead of uniform restrictions.
- Provide prior notice, reasoned orders, independent review and speedy appeals.
- Distinguish deliberate misuse from minor procedural violations.
- Ensure transparent criteria for exemptions and asset vesting.
- Simplify compliance for smaller NGOs and promote domestic philanthropy.

Conclusion:

FCRA must operate as a shield against foreign interference, not as an instrument for suppressing legitimate dissent. Transparent, proportionate and non-discriminatory regulation can protect sovereignty while sustaining a vibrant democratic civil society.

B. Economy

6. **Coal gasification offers strategic and economic benefits, but its environmental and technological costs cannot be ignored. Critically evaluate India's policy push for coal gasification.** (15 Marks) 250 Words

Introduction:

Coal gasification converts coal into **syngas (carbon monoxide and hydrogen)**, which can be used to produce chemicals, fertilisers, hydrogen and clean fuels such as **Dimethyl Ether**. As India possesses abundant coal reserves but depends heavily on imported crude oil, LPG and natural gas, coal gasification is being promoted as a strategic energy-transition technology.

Strategic and Economic Benefits:

- **Energy security:** Reduces dependence on imported crude oil, LNG and LPG by producing domestic fuels and feedstocks.
- **Import substitution:** Supports production of methanol, DME, fertilisers and chemicals, lowering the import bill.
- **Value addition:** Converts low-grade domestic coal into high-value industrial products.
- **Industrial development:** Strengthens downstream sectors such as petrochemicals, fertilisers and clean fuels.
- **Employment and regional growth:** Encourages investments in coal-bearing states and promotes industrialisation.
- **Supports clean fuel transition:** DME can be blended with LPG using existing distribution infrastructure.

Challenges and Concerns:

- **High carbon emissions:** Without **Carbon Capture, Utilisation and Storage (CCUS)**, lifecycle emissions remain significant.
- **Water-intensive process:** Large freshwater requirement may aggravate water stress in coal-producing regions.
- **High capital cost:** Commercial-scale plants require substantial investment and long gestation periods.
- **Technological dependence:** India still relies on imported gasification technologies and specialised equipment.
- **Economic uncertainty:** Global transition towards renewable energy may reduce long-term commercial viability.
- **Environmental impacts:** Coal mining, ash generation and local pollution continue despite cleaner utilisation.

Way Forward:

- Integrate coal gasification with CCUS and renewable hydrogen.
- Prioritise efficient and low-emission gasification technologies.
- Promote indigenous R&D under public-private partnerships.
- Ensure strict environmental safeguards and sustainable water management.

Conclusion:

Coal gasification should serve as a **transitional strategy rather than a permanent energy solution**. India's policy must balance energy security and industrial growth with decarbonisation, technological self-reliance and environmental sustainability to achieve long-term strategic resilience.

7. **“Cooperatives are emerging as a democratic alternative to profit-driven corporate models in India’s evolving economy.” Critically examine.** (15 Marks, 250 Words)

Introduction:

Cooperatives represent an economy based on **participation, mutual benefit and collective ownership**, rather than only profit maximisation. In India’s evolving economy, recent reforms and digital platform cooperatives have renewed interest in cooperatives as instruments of inclusive and democratic development.

Recent Reforms Strengthening Cooperatives:

- Creation of a separate **Ministry of Cooperation** has given policy focus to the sector.
- **Computerisation of Primary Agricultural Credit Societies (PACS)** improves transparency, accounting and service delivery.
- PACS are being diversified into activities such as storage, dairy, fisheries, LPG distribution and common service centres.
- Reforms aim to strengthen the principle of **“Sahakar se Samridhi”** by linking cooperatives with rural entrepreneurship and local employment.
- Multi-State Cooperative Societies reforms seek better governance, audits and accountability.

Why Cooperatives Are a Democratic Alternative?

- Based on **one member, one vote**, unlike corporations driven by shareholding power.
- Promote farmer producer organisations, dairy cooperatives, self-help groups and credit societies.
- Help small producers gain bargaining power, market access and fair prices.
- Digital platform cooperatives can give gig workers and service providers ownership over platforms, data and income distribution.
- They can reduce exploitation by algorithm-driven corporate platforms.

Limitations and Concerns:

- Many cooperatives suffer from political interference, elite capture and weak professional management.
- Financial dependence on government may reduce autonomy.
- Digital platform cooperatives face challenges of capital, technology, scale and competition from big platforms.
- Poor digital literacy and weak cybersecurity can exclude smaller members.

Way Forward:

- Ensure democratic elections, professional audits and member education.
- Provide digital public infrastructure, low-cost credit and legal support.
- Encourage cooperatives in agriculture, gig work, e-commerce, credit and services.

Conclusion:

Cooperatives cannot replace corporations entirely, but they can provide a **people-centred and democratic economic model**. Their success depends on combining cooperative values with technology, professionalism and accountability.

8. **India’s pesticide regulation faces the challenge of balancing agricultural productivity with public health and export competitiveness. Discuss.** (10 Marks, 150 words)

Introduction:

India is among the world’s largest consumers of pesticides, crucial for protecting crops and ensuring food security. However, rising concerns over pesticide residues, health hazards, and export rejections necessitate a regulatory framework that balances farm productivity with consumer safety and global market standards.

Need for pesticides in agriculture:

- Protect crops from pests and diseases, reducing yield losses (estimated 15–25%).
- Support food security for a growing population.
- Improve farmers' incomes by ensuring stable production.

Challenges in pesticide regulation:

- **Public health risks:** Excessive or unsafe pesticide residues linked to cancer, neurological disorders, and endocrine disruption.
- **Weak regulatory framework:** The Insecticides Act, 1968 is outdated; approval and monitoring mechanisms remain inadequate.
- **Export competitiveness:** Indian exports frequently face rejection due to Maximum Residue Limit (MRL) violations, especially in spices, rice, tea, and grapes.
- **Environmental concerns:** Soil degradation, water contamination, biodiversity loss, and decline of pollinators.
- **Enforcement gaps:** Limited residue testing laboratories, poor farmer awareness, and continued use of banned or highly hazardous pesticides.

Way forward:

- Enact the **Pesticide Management Bill** with science-based risk assessment.
- Promote **Integrated Pest Management (IPM)**, biopesticides, and precision agriculture.
- Harmonise Indian MRLs with **Codex Alimentarius** and key export markets.
- Strengthen surveillance, digital traceability, farmer training, and residue-testing infrastructure.

Conclusion:

India's pesticide policy must shift from merely increasing agricultural output to ensuring **safe, sustainable, and globally competitive agriculture**. A balanced regulatory regime will safeguard farmers' livelihoods, public health, environmental sustainability, and India's credibility in international agricultural trade.

9. **"India has emerged as 'the world's office' while China remains 'the world's factory'." Analyse the factors behind India's comparative advantage in services-led FDI, and discuss whether this trend is sustainable for a country with India's demographic profile.** (15 Marks, 250 Words)

Introduction:

Over the past two decades, India has established itself as a global hub for IT, business services, Global Capability Centres (GCCs), and digital innovation, attracting significant services-led Foreign Direct Investment (FDI). In contrast, China continues to dominate global manufacturing, reflecting the distinct comparative advantages of the two economies.

Factors Behind India's Comparative Advantage in Services-led FDI:

- **Large skilled workforce:** Abundant English-speaking professionals in IT, finance, engineering, and management.
- **Robust Digital Public Infrastructure (DPI):** Aadhaar, UPI, DigiLocker and India Stack have enhanced digital service delivery and innovation.
- **Cost competitiveness:** Lower operational costs compared to developed economies while maintaining high-quality services.
- **Strong IT ecosystem:** Presence of world-class IT firms, startups, and over 2,000 Global Capability Centres (GCCs).
- **Supportive policy framework:** Liberal FDI norms, Digital India, Startup India, and ease-of-doing-business reforms.

- **Global trust:** Democratic institutions, rule of law, and strong intellectual property protection attract multinational companies.
- **Time-zone advantage:** Facilitates 24×7 business operations and global outsourcing.

Sustainability for India's Demographic Profile:

Opportunities:

- A young population can supply skilled talent for AI, fintech, biotechnology, cybersecurity, and knowledge-intensive services.
- Expansion of GCCs into Tier-II and Tier-III cities can generate quality employment beyond metros.
- Growth in digital exports strengthens foreign exchange earnings and innovation capacity.

Concerns:

- Services alone cannot absorb India's large semi-skilled workforce entering the labour market annually.
- Manufacturing's share in employment remains inadequate despite initiatives like **Make in India** and **PLI Scheme**.
- Skill gaps, automation, AI-driven job displacement, and regional disparities may widen inequalities.

Way Forward:

- Pursue a **dual-engine growth strategy** by strengthening services while accelerating labour-intensive manufacturing.
- Invest in skilling, semiconductor and electronics ecosystems, logistics, and R&D.
- Promote Industry 4.0, innovation clusters, and MSME integration into global value chains.

Conclusion:

India's emergence as the "world's office" is a major strategic advantage, but demographic dividends can be fully realised only through balanced growth in both services and manufacturing. A complementary model that combines knowledge-driven services with employment-intensive manufacturing will ensure sustainable and inclusive economic development.

10. **"Women's employment is India's missing growth engine." Examine the factors limiting women's participation in productive employment, analyse its economic implications, and suggest suitable measures to improve such participation.** (150 words | 10 marks)

Introduction:

Women constitute nearly half of India's population, but their productive potential remains underused. PLFS 2025 recorded female labour-force participation at **40%**, compared with **79.1% for men**. Thus, women's employment remains India's **missing growth engine**.

Factors Limiting Participation:

- **Jobless growth:** Capital-intensive growth creates fewer suitable jobs for women.
- **Care burden:** Women disproportionately perform childcare, domestic work and eldercare.
- **Social barriers:** Gender norms and safety concerns limit mobility.
- **Employment mismatch:** Education gains have not produced enough secure, well-paid jobs.
- **Poor job quality:** Participation partly reflects **unpaid family labour** and distress-driven agricultural work.

Economic Implications:

- **Growth loss:** Women's exclusion reduces labour supply, productive capacity and output.
- **Weak demand:** Lower female earnings constrain consumption, savings and investment.
- **Human-capital loss:** Reduced income weakens spending on children's nutrition, education and healthcare.
- **Demographic challenge:** Educated talent remains unused, weakening India's **demographic dividend**.

Measures Required:

- **Employment-intensive sectors:** Promote textiles, garments, food processing, electronics assembly and small manufacturing.
- **Enabling infrastructure:** Provide safe transport, childcare, hostels and secure workplaces.
- **Suitable work:** Encourage nearby jobs and flexible hours without weakening worker protections.
- **Good jobs:** As stressed by the **Economic Survey 2015–16**, jobs must be safe, productive and well-paying.

Conclusion:

Women's employment is not merely a welfare concern but an **economic necessity**. India must combine job creation with supportive services and social change to transform women's capabilities into inclusive and sustainable growth.

C. International Relations

11. **Discuss the strategic importance of the Indo-Pacific region for India. How do India's partnerships with Australia and New Zealand support a "free, open and inclusive" Indo-Pacific?** (10 marks, 150 Words)

Introduction:

The Indo-Pacific has emerged as the world's geopolitical and economic centre of gravity, accounting for a majority of global trade, maritime commerce, and strategic sea lanes. For India, the region is central to its **SAGAR (Security and Growth for All in the Region)** vision and **Act East Policy**, making it indispensable for national security and economic prosperity.

Strategic Importance of the Indo-Pacific for India:

- **Maritime Security:** Safeguards Sea Lines of Communication (SLOCs), especially through the Indian Ocean and the Strait of Malacca.
- **Economic Interests:** Over 90% of India's trade by volume is seaborne, making secure maritime routes vital.
- **Countering Strategic Challenges:** Balances China's expanding maritime presence while promoting a rules-based order.
- **Blue Economy:** Enhances opportunities in fisheries, renewable energy, seabed resources, and sustainable ocean governance.
- **Regional Connectivity:** Supports initiatives like IPOI (Indo-Pacific Oceans Initiative) and resilient supply chains.

Role of Australia and New Zealand:

- **Australia:**
 - Strengthens maritime security through the Quad, Malabar Exercise, and logistics cooperation.
 - Collaborates on critical minerals, clean energy, cybersecurity, and resilient supply chains.
 - Expands economic ties through the India–Australia ECTA.
- **New Zealand:**
 - Promotes cooperation in maritime governance, disaster resilience, climate action, and the Blue Economy.
 - Supports ASEAN centrality, international law, and freedom of navigation.
 - Enhances trade, education, innovation, and people-to-people ties.

Conclusion:

India's partnerships with Australia and New Zealand reinforce a free, open, inclusive, rules-based, and ASEAN-centric Indo-Pacific founded on respect for international law and freedom of navigation. Deepening these strategic partnerships will enhance regional stability, economic resilience, and India's role as a leading maritime power.

12. **Strategic autonomy requires diversified partnerships rather than isolation or excessive dependence on any single power. Examine in the context of India's relations with Russia, the West and countries of the Global South.** (15 Marks, 250 Words)

Introduction:

India's foreign policy is anchored in **strategic autonomy**, the ability to pursue independent national interests without aligning exclusively with any major power bloc. In an increasingly multipolar world, India seeks to balance relations with **Russia, the West, and the Global South**, reflecting the principle of **"multi-alignment"** rather than non-alignment.

Relations with Russia: Preserving a Time-Tested Strategic Partnership:

- Russia remains a key partner in **defence cooperation**, with major platforms such as the **S-400 system**, **BrahMos missile**, and **nuclear energy projects** (Kudankulam).
- Continued engagement secures India's defence preparedness and access to critical technologies.
- Imports of discounted crude oil have enhanced **energy security** amid global geopolitical uncertainties.
- Cooperation through **BRICS**, **SCO** and the **International North-South Transport Corridor (INSTC)** strengthens Eurasian connectivity.

Relations with the West: Expanding Technology and Economic Partnerships:

- The **India - US Comprehensive Global Strategic Partnership**, **iCET**, and **India-EU Trade and Technology Council (TTC)** deepen cooperation in critical technologies, semiconductors, AI, defence and clean energy.
- **QUAD**, defence agreements and logistics partnerships strengthen maritime security in the Indo-Pacific.
- Trade agreements such as the **India - UK Comprehensive Economic and Trade Agreement (CETA/FTA)** and negotiations with the EU diversify markets and investments.

Leadership of the Global South: Voice of Inclusive Development:

- India champions the concerns of developing countries through the **Voice of Global South Summit**, **G20 Presidency**, **International Solar Alliance (ISA)** and **Coalition for Disaster Resilient Infrastructure (CDRI)**.
- Development partnerships, digital public infrastructure, capacity building and South-South cooperation enhance India's credibility.
- Advocacy for **UN Security Council reforms**, climate justice and equitable global governance strengthens India's leadership role.

Significance of Diversified Partnerships:

- Reduces strategic vulnerability arising from excessive dependence on any one power.
- Enhances resilience in defence, technology, energy and supply chains.
- Increases India's diplomatic flexibility to respond to evolving geopolitical challenges.
- Strengthens India's position as a **leading power** in a multipolar world.

Conclusion:

Strategic autonomy in the 21st century is no longer about maintaining equal distance but about building **multiple, issue-based partnerships** while safeguarding national interests. By balancing ties with Russia, the West and the Global South, India is shaping itself as a **trusted, independent and influential pole** in the emerging multipolar global order.

13. **"The renewal of the Ganga Water Treaty should move beyond water allocation towards integrated river-basin governance." Discuss in the context of climate change and India - Bangladesh relations.**

(15 marks, 250 words).

Introduction:

The 1996 Ganga Water Sharing Treaty regulates lean-season flows at Farakka between India and Bangladesh and is due for renewal in 2026. Climate-induced hydrological uncertainty necessitates a shift from fixed water allocation to integrated, adaptive and basin-wide governance.

Why should the renewed treaty move beyond water allocation?

- **Climate variability:** Erratic monsoons, glacial retreat, droughts and extreme floods make fixed allocation formulas increasingly unreliable.
- **Ecological interdependence:** Upstream activities affect downstream fisheries, wetlands, agriculture and the Sundarbans.
- **Sedimentation:** Heavy siltation changes river channels, reduces carrying capacity and affects the availability of distributable water.
- **Water-quality concerns:** Pollution and salinity intrusion show that water quality is as important as its quantity.
- **Competing demands:** India must balance irrigation, drinking water, navigation and ecological flows, while Bangladesh faces lean-season scarcity and livelihood insecurity.

Components of integrated river-basin governance:

- Introduce **flexible, flow-based sharing arrangements** with drought- and flood-sharing protocols.
- Establish real-time exchange of rainfall, river-flow, groundwater and sediment data.
- Undertake joint flood forecasting, riverbank-erosion control and disaster management.
- Ensure minimum **environmental flows** for fisheries, wetlands and deltaic ecosystems.
- Develop coordinated mechanisms for pollution control and sediment management.
- Strengthen the Joint Rivers Commission through a permanent scientific secretariat and effective dispute-resolution mechanism.
- Involve West Bengal, Bihar, local communities and technical institutions in decision-making.

Significance for India - Bangladesh relations:

- An equitable arrangement would reduce Bangladesh's perception of Indian upstream dominance.
- It would reinforce India's **Neighbourhood First** and **Act East** policies.
- Water cooperation can support navigation, trade, energy connectivity and regional stability.
- Conversely, unresolved disputes may fuel anti-India sentiment and increase external strategic influence.

Conclusion:

The Ganga must be viewed not merely as divisible water but as a shared ecological and developmental system. A climate-resilient, participatory and science-based treaty can transform water from a source of friction into a foundation for enduring India-Bangladesh cooperation.

D. Environment, Ecology and Disaster Management

14. **“A project may be legally justified and strategically necessary, yet remain ethically unjust.” Discuss with reference to the Great Nicobar Island Project.** (10 Marks)

Introduction:

The Great Nicobar Island Project (GNIP) illustrates the distinction between **legality, strategic necessity and ethical legitimacy**. While statutory clearances and national security considerations may justify a project, ethical governance requires balancing development with justice, human dignity and environmental stewardship.

Why the project appears legally and strategically justified?

- Statutory environmental and forest clearances have been granted under existing laws.
- Enhances India's maritime presence near the **Strait of Malacca**, strengthening Indo-Pacific security.
- Supports economic growth through a transshipment port, airport, township and energy infrastructure.

Why ethical concerns persist?

- **Indigenous rights:** Risks displacement and cultural erosion of the **Shompen Tribe** and **Nicobarese**, challenging dignity and autonomy.
- **Environmental ethics:** Diversion of pristine forests and biodiversity loss violate the principles of stewardship and intergenerational equity.
- **Procedural justice:** Meaningful consultation, informed consent and transparency remain contested.
- **Distributive justice:** National benefits may disproportionately burden a small, vulnerable community.

Conclusion:

Ethically sound development demands **constitutional morality**, not merely legal compliance. The project should proceed only by ensuring **free, prior and informed consent, ecological safeguards, transparent decision-making and fair rehabilitation**, reconciling national interest with justice for both people and nature.

15. **Urban flooding in Indian cities is not merely a natural disaster but a result of poor urban planning and weakened ecological buffers. Discuss.** (10 Marks, 150 Words)

Introduction:

Urban floods are often triggered by intense rainfall, but the **disaster is largely human-made**. Rapid urbanisation, ecological degradation and inadequate planning have transformed natural hazards into recurring urban crises, highlighting the need for resilient and sustainable city development.

Role of Poor Urban Planning:

- **Unplanned urbanisation** has led to construction on floodplains, low-lying areas and natural drainage channels.
- **Inadequate stormwater drainage** and poor maintenance result in waterlogging even after moderate rainfall.
- **High concretisation** reduces groundwater recharge and increases surface runoff.
- Weak enforcement of **master plans and building regulations** encourages encroachments.
- Poor solid waste management blocks drains and aggravates flooding.

Loss of Ecological Buffers:

- Encroachment and reclamation of **wetlands, lakes and urban ponds** reduce natural water storage capacity.
- Destruction of **mangroves, floodplains and green spaces** weakens flood moderation.
- Declining vegetation lowers infiltration and increases runoff.
- Climate change-induced extreme rainfall further intensifies flooding where ecological resilience has been compromised.

Way Forward:

- Adopt **sponge city** principles with permeable surfaces and rainwater harvesting.
- Restore wetlands, urban lakes and natural drainage networks.
- Integrate **GIS-based flood-risk mapping** into urban planning.
- Strengthen urban local bodies through scientific planning, strict land-use regulation and climate-resilient infrastructure.

Conclusion:

Urban flooding reflects a **failure of governance as much as a failure of nature**. Building resilient cities requires treating ecological assets as critical urban infrastructure and embedding disaster risk reduction into every stage of urban planning.

- 16. Why is Long-Duration Energy Storage essential for India's transition towards reliable, round-the-clock renewable electricity? Discuss its role in grid stability, peak-demand management and reducing dependence on fossil-fuel backup.** (10 Marks, 150 words)

Introduction:

India's ambitious target of 500 GW of non-fossil fuel capacity by 2030 requires a reliable power system capable of managing the intermittent nature of solar and wind energy. Long-Duration Energy Storage (LDES), which stores electricity for 8 hours or more, is the critical bridge between renewable energy generation and round-the-clock (RTC) power supply.

Role of LDES in India's Energy Transition:

- 1. Enhancing Grid Stability:**
 - Balances fluctuations in renewable generation, maintaining grid frequency and voltage.
 - Provides **ancillary services**, reserve capacity and black-start capability, improving grid reliability.
- 2. Managing Peak Demand:**
 - Stores excess solar energy generated during the day and supplies it during evening peak demand.
 - Reduces grid congestion and minimises the need for expensive peaking power plants.
- 3. Reducing Dependence on Fossil-Fuel Backup:**
 - Replaces coal- and gas-based plants used to compensate for renewable intermittency.
 - Lowers carbon emissions, air pollution, and dependence on imported fossil fuels, improving energy security.
- 4. Enabling Higher Renewable Penetration:**
 - Facilitates seamless integration of large-scale solar and wind energy into the grid.
 - Supports Round-the-Clock (RTC) renewable power contracts and improves renewable energy utilisation.

Way Forward:

- Promote diverse LDES technologies such as Pumped Storage Projects (PSPs), flow batteries, compressed air, and thermal energy storage.
- Introduce market mechanisms and viability gap funding to improve commercial viability.
- Strengthen transmission infrastructure, smart grids, and time-of-day pricing.
- Encourage domestic manufacturing and R&D under National Green Hydrogen Mission and PLI schemes.

Conclusion:

Long-Duration Energy Storage is the missing link in India's clean energy transition, transforming intermittent renewables into reliable baseload power. Scaling LDES through supportive policies, innovation, and investment will be crucial for achieving energy security, grid resilience, and a low-carbon economy.

E. Science and Technology

- 17. “Control over frontier Artificial Intelligence can become a new instrument of geopolitical power.” Discuss the implications of restrictions on advanced AI models for India’s technological sovereignty and strategic autonomy.** (10 Marks 150 Words)

Introduction:

Artificial Intelligence is no longer only a commercial technology, it is becoming a **strategic infrastructure of power**, like oil, semiconductors and nuclear technology. Restrictions on advanced AI models show how a few countries and firms can influence the technological choices of the rest of the world.

Implications for India:

- 1. Technological Dependence:**
 - If India depends on foreign frontier models, its start-ups, researchers and government systems may face sudden denial of access.
 - This can create a new form of **digital dependency**.
- 2. Threat to Strategic Autonomy:**
 - AI is central to defence, cyber security, intelligence, space, health and governance.
 - External control over AI tools may limit India’s independent decision-making in critical sectors.
- 3. Data and Sovereignty Concerns:**
 - Foreign AI models may process Indian data under external legal and commercial frameworks.
 - This raise concerns over privacy, surveillance, algorithmic bias and national security.
- 4. Innovation Gap:**
 - Restrictions can widen the gap between AI-rich and AI-dependent countries.
 - Indian firms may remain users of AI rather than creators of foundational technologies.
- 5. Geopolitical Leverage:**
 - Countries controlling compute, chips, models and cloud infrastructure can use them as tools of diplomatic pressure.

Way Forward:

- Build sovereign AI models using Indian datasets and languages.
- Invest in compute infrastructure, chips and skilled manpower.
- Promote open-source and safe AI ecosystems.
- Strengthen AI diplomacy through Global South partnerships.
- Balance innovation with regulation and security.

Conclusion:

Frontier AI will increasingly shape global power. For India, technological sovereignty is essential not for isolation, but for preserving strategic autonomy, economic competitiveness and national security.

- 18. Examine the objectives of India's National Quantum Mission. What steps are needed for India to emerge as a global leader in quantum technologies?** (10 Marks, 150 Words)

Introduction:

Quantum technology harnesses the principles of quantum mechanics such as superposition and entanglement to enable breakthroughs in computing, communication, sensing and cryptography. India's **National Quantum Mission (NQM)** aims to build indigenous capabilities and position the country as a global quantum technology hub.

Objectives of the National Quantum Mission:

- Develop intermediate-scale quantum computers (50–1000 physical qubits) within India.
- Establish secure quantum communication networks, including satellite-based quantum key distribution (QKD).
- Promote high-precision quantum sensors for defence, navigation, healthcare and environmental monitoring.
- Advance quantum materials and devices, including superconducting and photonic technologies.
- Build a strong research ecosystem through academic institutions, startups and industry collaboration.
- Enhance technological self-reliance in critical and emerging technologies.

Steps Needed for Global Leadership:

- Increase sustained public and private investment in quantum R&D and innovation.
- Strengthen industry–academia collaboration and accelerate technology commercialization.
- Develop a skilled workforce through specialized quantum education and training.
- Encourage startups, intellectual property creation and indigenous hardware manufacturing.
- Expand international partnerships while safeguarding strategic technologies.
- Create robust ethical, cybersecurity and regulatory frameworks for responsible deployment.

Conclusion:

The National Quantum Mission provides a strategic roadmap for India's quantum ecosystem. By combining innovation, skilled talent, indigenous manufacturing and global collaboration, India can emerge as a leading nation in quantum technologies while strengthening its economic and national security.

19. Integrating Artificial Intelligence with Digital Public Infrastructure can significantly strengthen India's State capacity. Discuss its potential for governance and inclusive development. (15 Marks, 250 Words)

Introduction:

Artificial Intelligence (AI) enhances decision-making through data-driven insights, while Digital Public Infrastructure (DPI) provides interoperable digital platforms such as Aadhaar, UPI, DigiLocker, CoWIN and ONDC. Their integration can create a more efficient, transparent and citizen-centric governance ecosystem, strengthen India's State capacity and accelerating inclusive development.

Potential for Governance:

- **Improved Public Service Delivery:** AI can personalise and automate service delivery on DPI platforms, reducing delays and administrative costs.
- **Evidence-based Policymaking:** AI can analyse large datasets generated through DPI to support better planning in health, education and agriculture.
- **Targeted Welfare Delivery:** AI can identify beneficiaries, detect exclusions and reduce leakages in schemes such as PM-KISAN and PM-JANMAN.
- **Fraud Detection:** AI strengthens financial integrity by identifying anomalies in UPI transactions and welfare transfers.
- **Predictive Governance:** AI enables early warning systems for disasters, disease outbreaks and crop failures.
- **Judicial and Administrative Efficiency:** AI-powered document analysis and workflow automation reduce pendency and improve government productivity.

Role in Inclusive Development:

- **Financial Inclusion:** AI-driven digital credit assessment expands access to formal finance for underserved populations.
- **Healthcare:** AI integrated with the Ayushman Bharat Digital Mission supports disease diagnosis and telemedicine.
- **Education:** Adaptive learning platforms provide personalised education in regional languages.
- **Agriculture:** AI-based advisories improve productivity through weather forecasting and precision farming.
- **Accessibility:** Multilingual AI and voice interfaces make digital services accessible to digitally excluded citizens.

Challenges:

- Privacy and data protection concerns.
- Algorithmic bias and discrimination.
- Digital divide and unequal AI access.
- Cybersecurity risks and misinformation.
- Shortage of skilled AI professionals and quality datasets.

Way Forward:

- Implement the **Digital Personal Data Protection Act, 2023** with robust AI governance.
- Adopt responsible and explainable AI guided by the **IndiaAI Mission**.
- Strengthen digital infrastructure, cybersecurity and indigenous AI research.
- Promote AI literacy, multilingual datasets and public-private collaboration.
- Ensure ethical standards, transparency and independent oversight of AI systems.

Conclusion:

The convergence of AI and Digital Public Infrastructure offers India an opportunity to build a responsive, efficient and inclusive State. By combining technological innovation with strong ethical safeguards and universal digital access, India can harness AI to improve governance while ensuring that the benefits of digital transformation reach every citizen.

20. Explain India's three-stage nuclear power programme. How does the successful commissioning of the fast breeder reactor strengthen India's long-term energy security? (10 Marks, 150 words)

Introduction:

India's **Three-Stage Nuclear Power Programme**, conceived by Dr. Homi J. Bhabha, aims to achieve long-term energy security by optimally utilising the country's limited uranium and abundant thorium reserves. The commissioning of the **500 MW Prototype Fast Breeder Reactor (PFBR)** at Kalpakkam marks a major milestone in this strategy.

India's Three-Stage Nuclear Power Programme:

Stage	Reactor/Fuel Cycle	Explanation
Stage I	Pressurised Heavy Water Reactors (PHWRs)	• Use natural uranium as fuel. • Generate electricity and produce plutonium-239 as a by-product.
Stage II	Fast Breeder Reactors (FBRs)	• Use plutonium-based mixed oxide (MOX) fuel. • "Breed" more fissile material than they consume by converting Uranium-238 into plutonium, significantly improving fuel utilisation.
Stage III	Thorium-based Reactors	• Use Thorium-232 to produce Uranium-233, enabling long-term exploitation of India's vast thorium reserves.

How the Fast Breeder Reactor Strengthens Energy Security?

- Bridges the transition from uranium-based to thorium-based nuclear power.
- Maximises energy extracted from limited domestic uranium resources.
- Reduces dependence on imported nuclear fuel and fossil fuels.
- Enables efficient recycling of spent nuclear fuel, reducing radioactive waste.
- Supports India's Net Zero by 2070 goal through reliable low-carbon baseload power.
- Enhances strategic autonomy and indigenous technological capabilities in advanced nuclear technology.

Conclusion:

The commissioning of the Fast Breeder Reactor is a transformative step in India's nuclear journey. By unlocking the full potential of the three-stage programme, it strengthens long-term energy security, accelerates clean energy transition, and positions India among the few nations possessing advanced breeder reactor technology.

- 21. How can private launch vehicles complement ISRO and strengthen India's position in the global small-satellite launch market? Discuss with reference to technological innovation, cost competitiveness and regulatory support.** (15 Marks, 250 Words)

Introduction:

India's space sector has entered a new era with the participation of private players following the space sector reforms and the establishment of **IN-SPACe**. The successful development of indigenous private launch vehicles has the potential to complement ISRO's capabilities and position India as a competitive hub in the rapidly expanding global small-satellite launch market.

How Private Launch Vehicles Complement ISRO?

- **Enhance Launch Capacity:** Private companies can undertake commercial missions, enabling ISRO to focus on strategic, scientific and deep-space programmes.
- **Technological Innovation:** Adoption of reusable launch systems, AI-driven mission planning, advanced propulsion, lightweight materials and 3D printing accelerates innovation.
- **Faster Commercialisation:** Industry-led R&D shortens development cycles and brings space technologies to the market more quickly.
- **Strengthen Space Ecosystem:** Encourages startups, MSMEs and academia to participate in satellite manufacturing and launch services.

Strengthening India's Position in the Global Small-Satellite Launch Market:

- **Cost Competitiveness:** Lower manufacturing and labour costs enable affordable launch services for international customers.
- **Dedicated Small-Satellite Launches:** Customised launch schedules reduce waiting time compared to rideshare missions.
- **Growing Global Demand:** Expansion of communication, Earth observation and IoT satellites creates significant market opportunities.
- **Commercial Exports:** Increased launches generate foreign exchange and enhance India's share in the global space economy.

Regulatory Support Required:

- Strengthen **IN-SPACe** as a single-window regulatory and authorization mechanism.
- Expand the role of **NSIL** in commercialisation and market access.

- Provide access to ISRO infrastructure, testing facilities and launch pads.
- Introduce space insurance, venture financing and tax incentives for startups.
- Enact a comprehensive **Space Activities Law** with clear provisions on licensing, liability and safety.
- Promote international collaborations and technology partnerships.

Challenges:

- Limited private testing and launch infrastructure.
- Dependence on imported critical components and advanced materials.
- Need for greater access to long-term capital and insurance.
- Competition from established launch providers such as SpaceX, Rocket Lab, and China.

Conclusion:

Private launch vehicles are not competitors but force multipliers for ISRO. By combining technological innovation, competitive pricing, and a robust regulatory ecosystem, India can significantly expand its share in the global small-satellite launch market while advancing the vision of **Aatmanirbhar Bharat** and becoming a leading space economy by **2047**.

F. History

22. The American Revolution was not merely a revolt against taxation, but a contest between two conflicting ideas of imperial sovereignty. Examine. (10 Marks, 150 Words)

Introduction:

The American Revolution began with protests against British taxes, but its deeper cause was a constitutional conflict over **who possessed sovereign authority** over the colonies - the British Parliament or the colonial people through their own assemblies.

Conflict over Taxation and Representation:

- After the Seven Years' War, Britain imposed measures such as the **Sugar Act, Stamp Act and Tea Act** to recover imperial expenses.
- Colonists opposed them through the slogan **"No taxation without representation."**
- They argued that taxation required consent through elected colonial assemblies.

Two Ideas of Sovereignty:

British View: Parliamentary Sovereignty:

- Britain believed Parliament had supreme authority over the entire empire.
- The Declaratory Act, 1766 asserted Parliament's right to legislate for colonies "in all cases whatsoever."

Colonial View: Popular and Local Sovereignty:

- Colonists accepted the King but denied Parliament's right to tax them without representation.
- They believed sovereignty came from the consent of the governed, influenced by Locke and Enlightenment thought.

From Imperial Dispute to Revolution:

- British coercive measures after the Boston Tea Party deepened the crisis.
- The Declaration of Independence, 1776 transformed the conflict into a claim for national self-rule.

Conclusion:

Thus, taxation was only the immediate issue. The American Revolution was fundamentally a struggle between **centralised imperial sovereignty** and **representative popular sovereignty**, making it a landmark in modern democratic history.

G. Geography

- 23. Hydropower is renewable, but its development in the Himalayas is not necessarily sustainable. Critically examine with reference to ecological fragility, climate risks and workers' safety. (15 Marks, 250 Words)**

Introduction:

Hydropower is a vital component of India's clean energy strategy, contributing to renewable energy targets and energy security. However, the **fragile Himalayan ecosystem**, increasing climate-induced disasters, and recent tunnel accidents have highlighted that renewable energy projects are not automatically environmentally or socially sustainable.

Why Hydropower Development in the Himalayas Raises Sustainability Concerns?

1. Ecological Fragility:

- The Himalayas are **young fold mountains** with unstable geology, making them highly prone to landslides and earthquakes.
- Large dams, tunnelling and blasting disturb mountain slopes, forests and wildlife habitats.
- River fragmentation alters **environmental flows**, affecting aquatic biodiversity and fish migration.
- Muck disposal and deforestation accelerate soil erosion and sedimentation.

2. Climate Risks:

- Climate change has increased the frequency of **Glacial Lake Outburst Floods (GLOFs)**, cloudbursts and flash floods.
- Extreme weather events threaten dam safety and reduce the reliability of hydropower generation.
- Changing glacier melt patterns create uncertainty in long-term river flows.
- Projects may suffer heavy economic losses due to repeated disaster-related damage.

3. Workers' Safety:

- Construction workers face high risks from tunnel collapses, landslides and flooding in difficult terrain.
- Inadequate geological surveys and weak emergency preparedness increase accident risks.
- Long working hours, remote locations and limited medical facilities aggravate occupational hazards.

Way Forward:

- Conduct **cumulative basin-level Environmental Impact Assessments (EIAs)** instead of project-wise approvals.
- Ensure environmental flows, scientific muck disposal and afforestation.
- Integrate climate-risk assessments and GLOF monitoring into project design.
- Adopt advanced tunnelling technologies, real-time monitoring and strict occupational safety standards.
- Prioritise local community participation and independent environmental audits.

Conclusion:

Hydropower can support India's low-carbon transition only if ecological conservation, climate resilience and human safety are treated as core design principles rather than post-project concerns. Sustainable Himalayan development requires balancing **energy security with environmental integrity and workers' welfare**.

H. Indian Society

24. Discuss the challenges posed by social networking sites to society, governance and law enforcement.

(10 Marks)

Introduction:

Social networking sites have transformed communication, democratic participation and access to information. However, their speed, anonymity and algorithm-driven amplification have also made them a source of significant **social, governance and internal security challenges**, requiring a careful balance between **freedom of expression and public safety**.

Challenges to Society:

- Spread of misinformation and fake news, influencing public opinion and electoral behaviour.
- Hate speech, communal polarisation and online radicalisation, leading to social unrest.
- Cyberbullying, trolling and harassment, particularly affecting women and children.
- Mental health concerns, including addiction, anxiety and reduced social well-being.

Challenges to Governance:

- Manipulation of democratic processes through coordinated disinformation campaigns and deepfakes.
- Erosion of public trust in institutions due to viral false narratives.
- Difficulty in regulating cross-border digital platforms operating across jurisdictions.
- Misuse of platforms for rumours during disasters, pandemics and public emergencies.

Challenges to Law Enforcement:

- Encrypted communication and anonymity hinder investigation of crimes.
- Platforms facilitate terrorist propaganda, organised crime, drug trafficking and financial fraud.
- Rapid spread of unlawful content often outpaces regulatory response.
- Challenges in digital evidence collection, attribution and international cooperation.

Way Forward:

- Strengthen digital literacy and fact-checking mechanisms.
- Enhance platform accountability through transparent algorithms and grievance redressal.
- Improve cyber policing, AI-enabled monitoring and international cooperation while safeguarding constitutional freedoms.

Conclusion:

Social networking sites are powerful instruments of innovation and democratic engagement, but their benefits can be sustained only through **responsible platform governance, informed digital citizenship and effective legal oversight**, ensuring that technology strengthens rather than undermines society and national security.

I. Ethics

25. What is moral capital? Explain how consistency between a country's constitutional values and foreign-policy conduct strengthens its international credibility. (10 Marks, 150 Words)

Introduction:

Moral capital is the accumulated trust, legitimacy and goodwill a country earns through principled, humane and responsible conduct. It supplements military and economic power by enabling influence through credibility and voluntary acceptance.

Constitutional Values and International Credibility:

- **Authenticity:** Practising the Preamble's ideals of justice, liberty, equality and fraternity enables a State to advocate them internationally without appearing hypocritical.
- **Rule-based conduct:** Respect for constitutionalism and the rule of law signals that treaties and international commitments will be honoured.
- **Soft power:** Democracy, secularism and pluralism enhance a country's attractiveness and persuasive influence.
- **Normative leadership:** Article 51 directs India to promote international peace, just relations, respect for international law and peaceful dispute settlement.
- **Humanitarian credibility:** India's disaster relief, development partnerships and *Vaccine Maitri* demonstrate solidarity beyond narrow national interest.
- **Global South leadership:** Domestic commitment to social justice strengthens India's advocacy of climate equity, reformed multilateralism and equitable development.

Challenges:

- Selective application of human rights creates a **values - conduct gap**.
- Strategic partnerships with authoritarian regimes may produce ethical dilemmas.
- National security and economic interests may conflict with declared principles.

Way Forward:

- Apply principles consistently while recognising legitimate strategic constraints.
- Subject foreign-policy decisions to legality, proportionality and humanitarian impact.
- Strengthen democratic institutions and constitutional conduct at home.

Conclusion:

Constitutional values become credible internationally only when reflected consistently in State conduct. By aligning strategic autonomy with Article 51 and *Vasudhaiva Kutumbakam*, India can convert moral capital into durable trust and diplomatic leadership.

J. Internal Security

26. “The cybersecurity of critical infrastructure is only as strong as the weakest link in its supply chain.” Examine this statement in the context of the reported Kudankulam data leak. Suggest measures to strengthen India’s critical infrastructure cybersecurity. (10 Marks, 150 Words)

Introduction:

Critical infrastructure such as nuclear plants, power grids and transport networks increasingly depends on complex digital supply chains involving multiple vendors and contractors. The reported **Kudankulam Nuclear Power Plant data leak** highlights how vulnerabilities in third-party systems can compromise national security even when core operational networks remain protected.

Kudankulam Data Leak: Significance:

- Demonstrated that **supply-chain vulnerabilities** can expose sensitive information despite strong protection of core systems.
- Third-party vendors, software providers and maintenance contractors may become entry points for cyberattacks.
- Data breaches can facilitate espionage, ransomware attacks and disruption of critical services.
- Undermines public trust in strategic infrastructure and exposes national security risks.

Measures to Strengthen Critical Infrastructure Cybersecurity:

- Enforce **strict cybersecurity standards** and periodic audits for all vendors and contractors.
- Adopt a **Zero-Trust Architecture**, ensuring continuous authentication and least-privilege access.
- Strengthen **CERT-In, NCIIPC**, and sector-specific Security Operations Centres (SOCs) for real-time threat monitoring.
- Promote indigenous hardware, software and secure supply chains under **Aatmanirbhar Bharat**.
- Mandate regular penetration testing, cyber drills and vulnerability assessments.
- Enhance encryption, network segmentation and offline backups for critical systems.
- Build skilled cybersecurity manpower through continuous training and public-private collaboration.
- Strengthen cyber incident reporting and information sharing among government, industry and academia.

Conclusion:

As critical infrastructure becomes increasingly interconnected, cybersecurity must extend beyond the core facility to the entire digital supply chain. A resilient ecosystem based on robust standards, trusted vendors, indigenous technologies and proactive cyber governance is essential to safeguard India's critical infrastructure and national security.



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