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OFFICERS' PULSE



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CURRENT AFFAIRS
MONTHLY

The **PULSE** of UPSC at your fingertips.

Foreword

Officers Pulse-In Depth provides detailed analyses of significant articles from a variety of sources including **The Hindu, Indian Express, Business Standard, Yojana, Kurukshetra, Down to Earth, and others.** These insights are extremely valuable for UPSC CSE Mains preparation. To ensure comprehensive preparation for both Prelims & Mains, we recommend studying **Officers Pulse-In depth** along with **Officers Pulse-Digest.**

Note: The keywords provided in the blue box below are crucial for Mains. They highlight essential themes and terminologies that can enhance the quality of answers.

Sample:

KEY WORDS

- **Monetary Policy Committee (MPC)** – Six-member RBI body deciding repo-rate to maintain inflation target ($4 \pm 2\%$).
- **Core Inflation** – Inflation rate excluding food and fuel, showing underlying price trends.
- **Headline Inflation** – Overall inflation measured by Consumer Price Index (CPI).
- **Tolerance Band** – Permissible inflation range around RBI's target for policy flexibility.
- **Section 45ZN, RBI Act 1934** – Mandates RBI to explain causes and remedies if inflation exceeds target for three quarters.
- **Fiscal-Monetary Coordination** – Synchronization of government spending and RBI policy for macro stability.
- **Financial Inclusion** – Ensuring affordable access to financial services for all sections, esp. vulnerable groups.

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1) DELIMITATION IN INDIA

(GS - II 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)

Background

Context: Southern states has opposed the proposed delimitation, calling it a threat to democracy and federalism, as states with effective population control may lose representation.

- *Delimitation refers to redrawing constituency boundaries to ensure fair representation based on population changes.*
- *It is carried out by an independent body: the **Delimitation Commission**.*
- *Mandated under **Articles 82 and 170** of the Constitution.*
- **History:** *Conducted after the **1951, 1961, 1971, and 2002** Censuses; frozen by the **42nd Amendment (1976)** based on the 1971 Census.*
- **Present Status:** *Freeze extended till **2026** by the **84th Amendment (2001)**; last exercise implemented in **2008**, with fresh delimitation expected post-2026.*

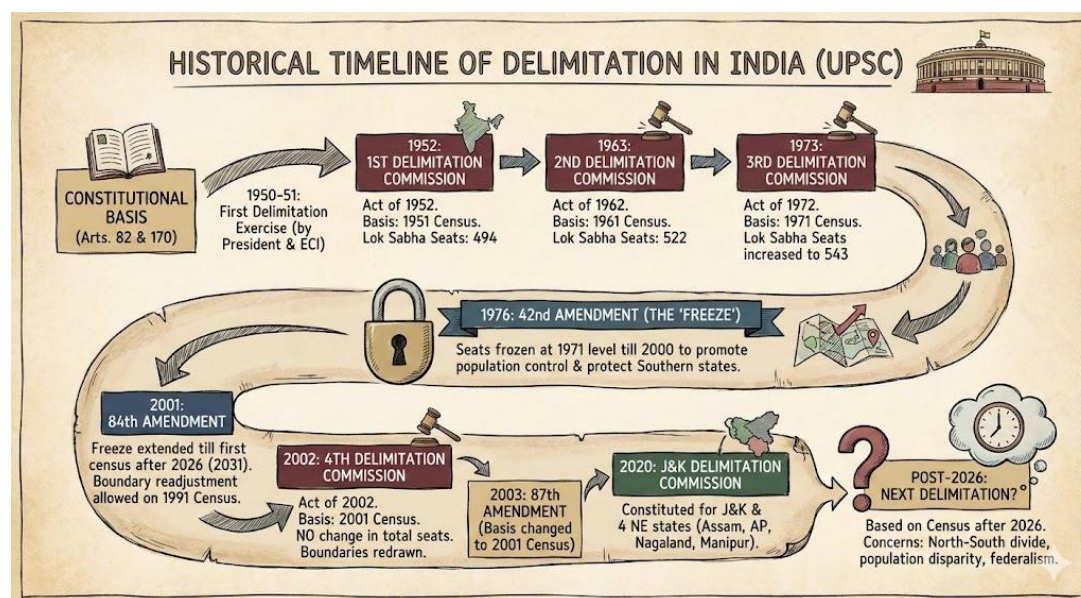
Composition of Delimitation Commission	
Appointment	Constituted by the President of India in consultation with the Election Commission of India (ECI).
Composition	Headed by a retired Supreme Court judge as Chairperson, with the Chief Election Commissioner and concerned State Election Commissioners as members.
Independence	Operates autonomously, free from executive control or influence.
Authority	Its decisions are binding, have the force of law, and are not open to challenge in courts or modification by Parliament or State Legislatures.

Factors Driving the Need for Delimitation

- **Ensures Equal Representation (One Person, One Vote):** Delimitation keeps elections fair by ensuring **equal value of every vote**. When some constituencies have far more voters than others, votes in smaller seats carry more weight.
Eg: If one seat has 25 lakh voters and another has 10 lakh but both elect one MP, representation becomes unequal.
- **Addressing Massive Population Growth:** India's parliamentary seats have been frozen since 1971 despite a huge population increase, resulting in each MP representing about 2.5 million people compared to around 90,000 people per MP in the UK, highlighting the need for delimitation to improve representation.
- **Maintain Regional Population Imbalance:** Uneven population growth across states requires proportional changes in parliamentary representation.
Eg: Bihar and Uttar Pradesh have seen much higher population growth than Kerala and Tamil Nadu, which may require adjustment in seat allocation to maintain fairness.

- **Enabling Women's Reservation:** In India, the implementation of the **Nari Shakti Vandan Adhiniyam** (33% women's reservation) is legally tied to the next delimitation exercise to identify which specific seats will be reserved.
- **Enabling Social Justice (SC/ST Reservations):** Reserved constituencies are adjusted based on updated demographic data.
Eg: Increase in ST population in certain districts may result in new ST-reserved seats.

Historical Timeline of Delimitation Exercises in India



Challenges in Conducting Delimitation in India

- **Federal Imbalance & Loss of Representation:** If seats are allocated purely on population, fast-growing states like **Uttar Pradesh** and **Madhya Pradesh** may gain many more seats, while **Kerala** may see almost no increase and **Tamil Nadu** only a small rise.
Eg: According to PRS Legislative Research, Uttar Pradesh could gain around 11 additional Lok Sabha seats (increasing from 80 to about 91), while **Kerala** might lose nearly 8 seats (reducing from 20 to around 12), significantly altering their relative political influence.
- **Reduced Bargaining Power in Parliament:** After delimitation, states that gain fewer or no additional seats may see a decline in their relative strength in Parliament, **reducing their influence in policy decisions and allocation of central funds.**
Eg: Northern states could have greater say in passing laws or negotiating central schemes, thereby reducing the relative bargaining power of southern states.
- **Electoral Boundary Manipulation:** Even though the Delimitation Commission is independent, there are concerns about manipulation (*Gerrymandering i.e. redrawing boundaries to favour a particular party*).
Eg: A constituency may be split in such a way that a strong opposition vote bank is divided across multiple seats, reducing its electoral impact.
- **Impact on Reserved & Women's Seats:** Redrawing boundaries can change which constituencies are reserved for SC/ST candidates.

Eg: A constituency currently reserved for SC in Tamil Nadu may become a general seat if demographic proportions change. Also, since women's reservation is linked to delimitation, delays may postpone the 33% reservation for women in legislatures.

- **Disruption of MPLADS Projects:** When boundaries change, ongoing development works may shift to another MP's area.

Eg: If an MP sanctioned funds for a community hall and the area moves to a new constituency after delimitation, the unspent funds may get delayed and the project may slow down due to change in responsibility.

Way Forward

- **Expanding the Lok Sabha:** A study by the **International Institute for Population Sciences (IIPS, 2024)** suggests expanding the Lok Sabha seats reflect demographic shifts without causing massive volatility.

Eg: One proposal suggests expanding the Lok Sabha to **848 seats**, so southern states do not lose their current seats even if northern states gain more.

- **Strengthening the Rajya Sabha:** To protect the federal balance, the Rajya Sabha could be empowered to act as a stronger counter-weight to the population-heavy Lok Sabha.

Eg: Proposals include restoring the **domicile requirement** for Rajya Sabha members or moving toward the **U.S. Senate model** of equal representation for every state regardless of size

- **Digressive Proportionality:** India can follow a model like the **European Parliament**, where smaller states are given slightly more seats than their population share.

Eg: According to *RSIS International Journal, 2025*, this would create a "ceiling" for larger states and a "floor" for smaller ones to ensure that the voice of the South isn't drowned out by the North.

- **Hybrid Weighted Formula for Seat Allocation:** India could adopt a **hybrid weighted formula** for seat allocation instead of relying only on population.

Eg: Seats could be distributed using **80% weight to population and 20% weight to demographic performance**, similar to the approach of the 15th Finance Commission. This would reward states that have achieved **replacement level fertility (TFR ≤ 2.1)**.

Conclusion

Delimitation can greatly influence coalition politics by shifting the balance of power among regional parties. The process must be transparent, involving experts and public consultations to ensure fairness and maintain trust. Internal constituency boundaries will be redrawn with careful attention to geography and administration to prevent manipulation. Overall, this critical exercise must uphold transparency, fairness, and federalism to strengthen democratic trust and avoid regional tensions.

KEY WORDS

- **Articles 82 and 170-** To ensure equal representation based on population changes after every Census.
- **42nd Constitutional Amendment Act-** In 1976 froze delimitation based on the 1971 Census to promote population control.

UPSC PYQ

- *Discuss the implications of delimitation of constituencies on India's federal structure."***[2023]**
- *"What is delimitation? Examine the concerns associated with the upcoming delimitation exercise in India."***[2022]**
- *"How does delimitation affect the principle of 'one person, one vote, one value' in India?"***[2020]**
- *"Discuss the constitutional provisions related to delimitation and the role of the Delimitation Commission."***[2018]**

2) FREEDOM OF SPEECH AND EXPRESSION

(GS II Indian Constitution - Historical Underpinnings, Evolution, Features, Amendments, Significant Provisions and Basic Structure)

Background

"The recent controversy surrounding a Tamil film, which allegedly faced denials, delays, and repeated objections from the Central Board of Film Certification (CBFC) which highlights growing concerns over freedom of expression and artistic autonomy in India. Previously, the struggle against the misuse of censorship powers mirrors the ethical challenges seen in frequent internet shutdowns and the tightening of press freedom, all of which represent significant threats to the fundamental right to free speech.

Constitutional Provisions

- **Article 19(1)(a):** Guarantees freedom of speech and expression as a **Fundamental Right** under the Indian Constitution.
- **Beneficiaries:** Available **only to citizens of India**, not to foreign nationals.
- **Scope:** Includes the right to express opinions on any issue through **any medium**—speech, writing, print, art, or digital platforms.
- **Not Absolute:** Subject to **reasonable restrictions under Article 19(2)**.
- **Grounds of Restriction:** Sovereignty and integrity of India, security of the State, friendly relations with foreign States, public order, decency and morality, contempt of court, defamation, and incitement to an offence

Importance of Freedom of Speech and Expression in a Constitutional Democracy

- **Foundation of Democracy: Article 19(1)(a)** strengthens democracy by enabling citizens to engage in informed public debate and political decision-making. *Example: Romesh Thapar v. State of Madras (1950)* — free expression is the cornerstone of democracy.
- **Accountability and Good Governance:** Free speech empowers citizens, media, and civil society to question the State and expose corruption. *Example: Investigative journalism and RTI depend on free expression.*
- **Check on Arbitrary State Power:** A free press and dissent prevent authoritarianism and misuse of power. *Example: S. Rangarajan v. P. Jagjivan Ram (1989)* — speech cannot be curtailed merely for being controversial.
- **Individual Liberty and Dignity:** Freedom of expression is integral to personal autonomy and dignity under **Article 21**. *Example: SC's suo motu action against online mocking of PwDs.*
- **Social Reform and Pluralism:** Free speech drives social reform and empowers marginalised voices which upholds constitutional values of **pluralism** and **"Unity in Diversity."**

Challenges to Freedom of Speech and Expression

- **Vague & Draconian Laws:** Broad laws like UAPA, sedition-type provisions, criminal defamation, and Section 66A (now struck down) create a chilling effect on dissent. **Eg:** *Shreya Singhal v. Union of India (2015)* invalidated Section 66A for vagueness.
- **Public Order & National Security Overreach:** Section 144, preventive detention, and UAPA are frequently invoked to restrict protests and critical speech. **Eg:** Section 144 during CAA protests; *NewsClick case (2023)*.
- **Digital Censorship & Internet Shutdowns:** Frequent shutdowns and content blocking limit online expression and access to information. **Eg:** Prolonged Manipur internet shutdown (2023).
- **Judicial Delays & Contempt Powers:** Prolonged trials and expansive contempt jurisdiction discourage criticism of institutions. **Eg:** Prashant Bhushan contempt case (2020).
- **Prior Restraint & Gag Orders:** Courts sometimes impose pre-publication restrictions on media. **Eg:** Interim gag orders during ongoing investigations.
- **Media Capture & Self-Censorship:** Ownership concentration, paid news, TRP-driven content, and fear of reprisals weaken independent journalism and distort discourse. **Eg:** Paid political coverage during elections; media trials affecting investigations.

Way Forward: Strengthening Freedom of Speech & Expression

- **Judicial Guidelines on Hate Speech:** SC should frame clear, objective norms to separate hate speech from legitimate dissent (*reasonable person test – Imran Pratapgarhi, 2024*).
- **Platform Accountability:** Social media must follow transparent moderation and grievance redressal to balance regulation and free speech (*IT Rules, 2021 debate*).
- **Legal Reforms:** Outdated and vague laws need precision-based reform to avoid chilling effect (*Shreya Singhal, 2015*).
- **Protection from Non-State Actors:** State has an affirmative duty to protect speakers from mobs and private intimidation (*Kaushal Kishore, 2023*).
- **Civic Responsibility:** Promote digital literacy, verification, and restraint in line with **Article 51-A** (Fundamental Duties).
- **Constitutional Balance:** Free speech is not absolute and must respect dignity and public order (*Article 19(2)*).
- **Judicial Oversight:** Strong review under **Articles 32 & 226** is vital to check executive excess (*internet shutdown scrutiny*).

KEY WORDS

- **Article 19(1)(a)** - Grants citizens the right to freedom of speech and expression
- **Article 19(2)** - Permits the State to impose "**Reasonable Restrictions**"
- **K.A. Abbas v. Union of India (1970)** - Films enjoy free speech protection, subject to reasonable regulation.
- **S. Rangarajan v. P. Jagjivan Ram (1989)** - CBFC is a **certifying authority**, not a censoring body
- **Article 19** - guarantees fundamental freedoms such as speech and expression, subject to reasonable restrictions.
- **Article 21**- safeguards the right to life and personal liberty, interpreted broadly to include dignity and due process.

UPSC PYQ

- *What do you understand by the concept 'freedom of speech and expression'? Does it cover hate speech also? Why do the films in India stand on a slightly different plane from other forms of expression? Discuss." [2014]*

3) INDIA – EU DEAL

(GS II - Bilateral, Regional and Global Groupings and Agreement involving India and Affecting India's Interests)

Background

On January 27, 2026, during the 16th India-EU Summit in New Delhi, Prime Minister Narendra Modi and EU leaders announced the formal conclusion of the India-EU Free Trade Agreement (FTA). Termed the "Mother of All Deals," this landmark pact marks the end of an 18-year negotiation cycle that began in 2007.

India -EU bilateral Trade

India and the European Union share a major trading partnership.

- Bilateral merchandise trade was valued at **about USD 136.5 billion in 2024–25**.
- Indian exports to the EU stood at **nearly USD 75.8 billion**.
- Both sides aim to expand trade volumes to **USD 200 billion by 2030**.

Important provisions EU Deal

India secured key concessions to boost its manufacturing and services sectors:

- **Core Exports:** Duty-free exports are now available for labor-intensive items such as **textiles, leather, gems, and spices**.
- **Steel Industry:** India secured a **duty-free quota of 1.6 million tonnes** for steel, providing a significant boost to heavy industry.
- **Professional Mobility:** The pact makes it easier for **skilled Indian workers** to work across the 27-country bloc.
- **Sustainable Trade:** India secured a "**Forward-Looking Most-Favored Nation**" (MFN) **clause**. This ensures that if the EU gives any other country (like the US or UK) better terms or exemptions regarding the **Carbon Border Adjustment Mechanism (CBAM)**, those same terms will automatically apply to India.
- **Security & Defence:** For the first time, tariffs on arms, ammunition, and dual-use technology will be phased out over a 3-to-5-year period.

Significance for India

Major Export Boost:

- With the European Union removing duties on **99.5% of exports**, India gains near-full access to a vast market. Labour-intensive sectors like textiles, leather, and gems are likely to see strong growth, employment generation, and higher foreign exchange earnings.

Services & Skilled Mobility Gains:

- Expanded entry into 144 services sectors, combined with streamlined visa norms, reinforces India's competitiveness in global services trade. Facilitated professional mobility and recognition pathways for AYUSH practitioners promote economic gains while simultaneously projecting India's knowledge systems and soft power abroad.

Green Growth Support:

- Preferential treatment under EU carbon rules and **€500 million support** for decarbonisation will help India modernise industry, reduce emissions intensity, and maintain export competitiveness in a low-carbon global economy.

Protection of Domestic Interests:

- Products such as dairy, rice, wheat, and poultry have been kept outside tariff liberalisation commitments. This calibrated approach allows trade expansion while protecting farmers' incomes, preventing import surges, and ensuring domestic food security and rural stability.

Industrial & Technological Upgrading:

- Duty-free access to advanced EU machinery and pharmaceuticals lowers input costs and improves productivity. This supports manufacturing expansion, global value-chain integration, and national self-reliance initiatives.

Challenges of India-EU FTA

- **Regulatory barriers:** EU's strict environmental, labour and technical standards raise compliance costs for Indian exporters.
- **Carbon Border Adjustment Mechanism (CBAM):** EU's carbon tax may reduce competitiveness of Indian steel, cement and aluminium exports.
- **Market access disputes:** EU seeks tariff cuts on automobiles, wine & spirits; India is cautious due to domestic industry concerns.
- **Services & labour mobility:** Limited EU flexibility on movement of Indian professionals affects India's key demand.
- **Data protection rules:** Differences over data localisation and GDPR-style norms hinder digital trade negotiations.
- **MSME readiness:** Indian MSMEs may struggle with complex rules of origin and certification requirements.



Way forward

- **Phased Tariff Liberalisation** - Gradually reduce tariffs, giving sensitive sectors like agriculture, dairy, and MSMEs time to adjust.
- **Align with Make in India & PLI** - Leverage the FTA to boost high-value manufacturing, technology transfer, and industrial growth.
- **Protect Digital Sovereignty** - Negotiate data-sharing rules that balance trade facilitation with privacy and national digital infrastructure.
- **Address IPR & CBAM Issues** - Safeguard India's generic pharmaceutical industry and ensure competitiveness under EU carbon-related regulations.
- **Enhance Strategic & Services Gains** - Expand IT, telecom, and professional services exports, attract European FDI, and strengthen India's global economic resilience.

Conclusion

The India–EU FTA marks a strategic reset of supply chains between two major democratic economies. By ensuring near-universal duty-free access for Indian exports and a predictable green trade framework, it counters rising global protectionism and elevates the partnership beyond trade, supporting India’s long-term vision of becoming a **Viksit Bharat by 2047**.

KEY WORDS

- **MFN** – Most-Favoured-Nation (MFN) is a principle in international trade (primarily under the WTO) requiring countries to treat all trading partners equally.
- **Viksit Bharat** - Viksit Bharat (Developed India) @2047 is the Government of India's comprehensive, long-term vision to transform the nation into a fully developed, prosperous, and self-reliant country by 2047, marking 100 years of independence.
- **Carbon Tax** - A carbon tax is an environmental tax levied on fossil fuels based on their carbon content or CO₂-equivalent emissions. It aims to reduce greenhouse gas emissions by making pollution more expensive and encouraging cleaner energy choices. It is a market-based climate policy that internalises the environmental cost of carbon emissions.

UPSC PYQ

- *“The European Union has been a significant trading partner for India.” Discuss the opportunities and challenges in India–EU economic relations. [2020]*
- *How does the European Union function as an economic and political bloc? What are its implications for India’s foreign trade? [2018]*
- *Evaluate the significance of India–European Union relations in the context of global trade and multilateral institutions. [2016]*

4) GIG ECONOMY

(GS III- Indian Economy and issues relating to Planning, Mobilization of Resources, Growth, Development and Employment.)

What is Gig Economy?

As per Code on Social Security, a Gig worker is defined as a person who performs work or participates in a work arrangement and earns from such activities **outside of a traditional employer-employee relationship**.

Eg: Ola/Uber drivers, Zomato/Swiggy delivery partners, Photographers, Online tutors etc.

Types of Gig Economy

1) Platform-based

These are individuals who use **digital intermediaries** (apps or websites) to connect with customers and execute specific tasks. **Eg:** Ride-hailing drivers (Uber/Ola), delivery partners (Zomato/Amazon) etc.

2) Non-platform-based

These are independent workers who operate **outside the digital ecosystem** and traditional employer-employee contracts. They typically engage in "off-platform" casual or seasonal labor, **relying on local networks, physical marketplaces, or verbal contracts for task-based earnings**. **Eg:** Construction day-laborers, domestic help, casual wage earners etc.

Date & Trend

Aspect	Details
Data & Trend	As of early 2026, India has about 12 million (1.2 crore) gig workers
Share in Workforce	Gig workers constitute around 2% of India's total workforce
Women's Participation	Women form approximately 28% of the gig workforce
Key Sectors for Women	Beauty and home services
Creative Gigs	High participation in freelance writing, design, and tutoring
Care Work	Growing involvement in healthcare and domestic support platforms

Significance

- 1. Employment Generation:** The gig economy generates jobs rapidly as people can start work with minimal education, experience, or formal hiring processes. The number of **gig workers rose 55% to 1.2 crore in FY25 from 77 lakh in FY21**, driven by rising smartphone adoption and the spread of digital payments.

2. **Women Empowerment:** The gig economy enables women to work flexibly in terms of time and location, helping them balance employment with household and care responsibilities. A homemaker earns from home through online tutoring or freelancing. **Eg: Amazon's Ramp Back Program** enables employees to transition back to full-time work after a pregnancy-related leave or for child-rearing by offering 8 weeks of reduced, flexible hours.
3. **Skill Utilization:** The gig economy allows workers to use their skills on demand, avoiding underutilisation common in full-time jobs. A data analyst may not need a full-time office job, but companies can hire her for a short project to analyse sales data.
4. **Income Diversification:** The gig economy helps people earn extra money, in addition to their main job or studies, instead of depending on a single source of income. **Nearly 40% of gig workers work part-time which enables them to earn multiple incomes.**
5. **Formalisation of Informal work:** The **gig economy brings informal workers into the formal system** by paying them digitally, recording their work, and linking them to government welfare schemes.

Challenges

1. **Lack of social security:** Gig workers lack pension, insurance, paid leave, and job security; illness or accidents cause income loss (e.g., injured delivery worker earns nothing and pays medical bills).
2. **No employee status & rights:** They are not treated as regular employees, so minimum wages and labour protections are absent (e.g., cab driver's account blocked without notice).
3. **Digital divide:** Lack of smartphones, internet, or digital skills excludes many from gig work. A massive gap exists, with **urban areas** boasting higher internet penetration **(around 66% of homes)** compared to **rural areas (around 24%)**
4. **Skill stagnation:** Gig jobs offer little skill development, trapping workers in low-pay roles (e.g., delivery partner doing the same work for years).
5. **Gender-specific challenges:** Women face safety issues, lower earnings, and care burdens limiting work hours (e.g., woman cab driver works fewer hours due to safety and childcare).

Steps Taken

Code on Social Security, 2020

- It legally recognises gig and platform workers and mandates aggregator contributions to a Social Security Fund.
- Provision for a **National Social Security Fund** with mandatory contributions from aggregator platforms.
- Launch of the **e-Shram portal** to register gig workers and provide a Universal Account Number (UAN).

Code on Wages, 2019

It aims to ensure a universal minimum wage, and recent policy discussions propose **minimum hourly or task-based pay for gig workers** to prevent income instability.

Way forward

- **Platform accountability & transparency:** Gig platforms should clearly define pay calculation, incentives, ratings, and deactivation rules to prevent arbitrary income loss and job insecurity.
- **Extend social security coverage:** Gig workers should get **basic welfare benefits** like health insurance, accident cover, maternity leave, disability support, and pension, just like regular employees.
- **Skilling & Upskilling programs:** Gig workers should get **training and skill development** so they can take on **higher-paying tasks or long-term work**.
- **Access to institutional credit:** Gig workers should be enabled to access low-interest loans and financial products using digital work history and platform data instead of traditional employment proofs.
- **Collective bargaining rights:** Allow gig workers to form associations and negotiate with platforms to ensure fair contracts and better working conditions.

Conclusion

The gig economy is reshaping India's labour market by creating flexible employment and supporting digital growth. However, income insecurity and lack of social protection remain key concerns for workers. A balanced framework combining innovation with robust labour safeguards is essential for its sustainable and inclusive expansion.

KEY WORDS

- **Code on Social Security, 2020** – The Code on Wages, 2019 is a labour law enacted to simplify, consolidate, and rationalise wage-related laws in India.
- **e-Shram Portal** – National database registering gig and unorganised workers to enable access to welfare schemes.

UPSC PYQ

- Examine the role of 'Gig Economy' in the process of empowerment of women in India. [2021]

5) AVIATION SECTOR

(GS III - Infrastructure: Energy, Ports, Roads, Airports, Railways etc.)

Background

India's civil aviation sector is among the **fastest-growing globally**, driven by rising passenger demand, expanding airports, and improved regional connectivity. It supports **economic growth, tourism, trade, and employment**, but rapid expansion poses **challenges in safety, infrastructure, and regulation**, requiring sustainable governance. The sector enables efficient movement of people and goods, linking **major cities and smaller towns** across the country.

Data and Trend

Parameter	Details / Value
Operational Airports	74 (2014) → 164 (2025)
Domestic Aviation Market Ranking	3rd largest in the world (after US & China)
Contribution to GDP	~1.5% of India's total GDP

Regulating bodies

The **Ministry of Civil Aviation (MoCA)** is the apex body responsible for policy formulation and development.

Body	Full Form	Primary Role
DGCA	Directorate General of Civil Aviation	Safety and licensing regulator; issues pilot licenses, certifies aircraft, and enforces airworthiness standards.
BCAS	Bureau of Civil Aviation Security	Ensures security at airports and on flights (anti-hijacking, passenger screening, etc.).
AERA	Airports Economic Regulatory Authority	Tariff regulator; determines fees at major airports to ensure fair pricing for passengers.
AAI	Airports Authority of India	Infrastructure provider; manages most airports and handles Air Traffic Control (ATC) across Indian airspace.
AAIB	Aircraft Accident Investigation Bureau	Independent body investigating serious accidents and incidents to improve future safety.

Significance

- 1. Economic Growth:** Aviation acts as a strong economic engine, linked to tourism, manufacturing, construction, logistics, and services. According to the **Economic Survey 2025–26**, it has a **multiplier of 3.1**, meaning every ₹1 invested generates ₹3 in the wider economy.
- 2. Boosts Tourism:** Aviation is the main gateway for tourism, with **87% of foreign tourists arriving by air**, contributing over **\$30 billion annually** in foreign exchange.
- 3. Strategic & Defense Role:** Many airports operate as **civil enclaves within defence bases**, enabling rapid military mobilisation during conflicts or emergencies.

4. **Logistics:** Aviation supports **time-sensitive logistics** for e-commerce, pharmaceuticals, and high-value exports. Schemes like **Krishi Udan** transport perishable produce quickly, reducing wastage and increasing farmer incomes.
5. **Global Connectivity & Soft Power:** India's location between Europe, the Middle East, and Southeast Asia positions it to become a **global aviation hub**. Major airports like **Delhi and Navi Mumbai** strengthen its role as a transit and connectivity hub.

Challenges

1. Safety & Operational Challenges:

Flight accidents remain a major concern, as seen in the **Air India crash in Ahmedabad** and the **Baramati crash**.

2. Infrastructure Constraints:

Despite an increase in operational airports (**74 in 2014 → 164 in 2025**), many airports face **limited runway capacity, inadequate terminal space, and congested airspace**, affecting efficiency and passenger experience.

3. Human Capital Crisis:

- India requires **~30,000 pilots** for future growth but only **8,000–9,000 are active**. Poor crew planning caused **mass flight cancellations in Dec 2025**, affecting **9 lakh+ passengers**.
- There is also a **shortage of Aircraft Maintenance Engineers**, with many moving to Gulf airlines for better pay.

4. Poor Coordination:

Multiple governing bodies (**DGCA, AAI, BCAS, MoCA**) result in **delayed decision-making and weak coordination** across the sector.

5. Financial Stress on Airlines:

High fuel costs, airport charges, and rising debt burden have led to **financial stress and bankruptcy risks for smaller airlines**, affecting sector stability.

Government Initiatives

1. Bharatiya Vayuyan Adhiniyam (2025):

- It replaced the **Aircraft Act, 1934** to modernize India's aviation law.
- It brings **drones, flying taxis, and unmanned aircraft** clearly under legal regulation.
- It empowers **DGCA** to impose **spot fines and instantly suspend or cancel licenses** for violations.

2. DGCA launched India's first ranking system (**FTO Ranking Framework**) for flying schools to shift from **marketing-driven to performance-based admissions**.

3. **UDAN (Ude Desh ka Aam Naagrik)** aims to make air travel affordable by connecting **underserved and unserved regional airports**. It boosts regional connectivity.

4. **International UDAN:** Designed to connect Tier-2 and Tier-3 cities directly to **international destinations** in neighborhood countries to boost socio-economic growth.

Way forward

- **Make safety non-negotiable:** We can adopt predictive safety audits, real-time monitoring, and zero-tolerance enforcement to prevent accidents before they occur.
- **Build global aviation leadership:** To position India as an **Asia-Pacific aviation hub** by expanding long-haul capacity, MRO exports, and aviation services.
- **Boost indigenous capability:** To promote domestic aircraft components, engines, and drone manufacturing under *Make in India*.
- **Strengthen infrastructure:** To decongest metro airspace using advanced air-traffic management and develop secondary airports near major cities. **Developing vertiport infrastructure (e.g., UK/UAE).**
- **Promote green aviation:** Encourage Sustainable Aviation Fuel (SAF), fuel-efficient aircraft, and low-carbon airport infrastructure.

Conclusion

India's aviation sector stands at a critical juncture where rapid growth must be matched with strong safety, skilled manpower, and efficient governance. Recent reforms signal a shift toward modern, accountable, and performance-driven regulation. By investing in safety, indigenous capacity, and global connectivity, India can transform its aviation sector into a resilient growth engine. A balanced approach will help India emerge as a safe, competitive, and globally influential aviation hub.

KEY WORDS

- **Aviation Multiplier Effect** - The economic impact where aviation investment generates multiple times value in the wider economy.
- **Vertiport** - A vertiport is a place where air taxis or flying electric aircraft can take off, land, and recharge.

UPSC PYQ

- What is the need for expanding the regional air connectivity in India? In this context, discuss the government's UDAN Scheme and its achievements. **[2024]**
- "Investment in infrastructure is essential for more rapid and inclusive economic growth." Discuss in the light of India's experience. **[2021]**

6) STARTUP ECOSYSTEM

(GS III- Economic Development, Technology and Growth)

Introduction

According to the **Economic Survey 2025–26** and recent DPIIT updates, the number of recognized startups has surged to over **2.12 lakh**, with **125+ unicorns** now boasting a combined valuation of **\$350 billion**. Innovation has deeply decentralized, with **51% of startups** emerging from Tier-II and III cities. Furthermore, inclusivity has hit a new peak, with over **95,000 startups (45%)** being women-led. The focus has now shifted to **Deep-Tech and GenAI**, with active AI startups tripling to over **900** in the last year alone.

Definition

A startup in India is defined as an entity incorporated as a Private Limited Company, LLP, or Partnership Firm for up to **10 years**, provided its annual turnover has never exceeded **₹100 crore**. It must focus on innovation, development, or scalable employment generation and cannot be formed by splitting or reconstructing an existing business.

Significance

1. Economic Growth & Employment

- Startups contribute to GDP growth by creating new markets and business models.
- India's **2.07 lakh recognised startups** have created over **21.9 lakh direct jobs**, contributing nearly **4% to the national GDP** through a valuation of **\$354 billion**.
- They generate large-scale employment, especially for youth and skilled professionals

2. Innovation & Technology Development

- Startups act as engines of innovation in AI, deep-tech, biotech, fintech, and clean energy. They promote indigenous R&D and reduce dependence on imports.
- Example: Skyroot Aerospace (Space tech), Sarvam AI (Artificial Intelligence & Deep-Tech)

3. Formalisation of the Economy

- Encourage digital payments, tax compliance, and formal business practices.
- Support the transition from the informal to the formal sector. Example: Paytm enabling digital financial inclusion.

4. Entrepreneurship & Risk-Taking Culture

- Foster entrepreneurship, creativity, and problem-solving.
- Encourage first-generation entrepreneurs and women-led enterprises. 45% women-led startups highlight growing gender inclusivity. Example: Nykaa, Zivame.

5. Support to Government Initiatives

- Complement flagship initiatives such as Startup India, Digital India, Make in India, and Atmanirbhar Bharat.
- Provide innovative solutions in governance and public service delivery Example: BharatPe supporting MSMEs and financial inclusion.

Scheme / Initiative	Key Focus	Major Outcomes
Startup India Initiative	Promotes innovation, entrepreneurship, and employment	Generated 17.28 lakh jobs , mainly in IT, healthcare, and services
Atal Innovation Mission (AIM)	Innovation culture and incubation	10,000 Atal Tinkering Labs, 72 incubators ; supported 3,556 startups , created ~42,000 jobs
Startup India Seed Fund Scheme (₹945 crore)	Early-stage funding (PoC & product development)	213 incubators approved; 2,622 startups benefited
Fund of Funds for Startups (FFS) - SIDBI	Indirect equity funding via AIFs	1,173 startups funded, improving access to capital
Credit Guarantee Scheme for Startups	Collateral-free loans, incl. women-led startups	Loans worth ₹604 crore guaranteed (Jan 2025)
MeitY Startup Hub	Technology and deep-tech support	Supported 5,300+ tech startups ; strengthened AI & digital ecosystem

Challenges

- 1. Access to funding:** Difficulty in securing timely seed and growth capital, especially for early-stage and deep-tech startups. *Example:* Many deep-tech startups like **Ather Energy** and AI-focused startups faced initial difficulties raising venture capital due to long R&D cycles.
- 2. Regulatory and compliance burden:** Complex laws, frequent filings, and changing regulations increase costs.
- 3. Talent retention:** High attrition and shortage of skilled manpower due to competition from large firms. *Example:* **SaaS war: Freshworks vs Zoho**, **Zoho** acts as a "school" that trains fresh talent, only for **Freshworks** to hire them away by offering higher salaries and stock options that Zoho doesn't provide.
- 4. Scaling and infrastructure issues:** Problems in scaling operations, logistics, and accessing quality infrastructure, especially beyond metros. *Example:* E-commerce startups like **BigBasket**.
- 5. Sustainability & Profitability Pressure** – Focus on rapid growth often leads to losses, and investors demand quick returns. *Example:* **The EdTech Sector (Byju's)**

Way forward

- Strengthen collaboration between startups, academia, and government institutions to boost deep-tech innovation. *Example:* Anusandhan National Research Foundation (ANRF), NIDHI Program.

- Provide outcome-based funding to R&D-intensive startups through mission-mode programmes. Example: Mission for Advancement in High-impact Areas (MAHA), National Quantum Mission (NQM)
- Support startups in scaling globally competitive products and accessing international markets. Example: Startup India Seed Fund Scheme (SISFS)
- Promote green and sustainable startups aligned with India's clean-energy goals.
- Upgrade skilling programmes to build and retain future-ready talent in emerging technologies. Example: IndiaAI FutureSkills
- Simplify regulations through a unified digital compliance system to reduce startup burden

Conclusion

India's startup ecosystem is a key driver of innovation, employment, and inclusive economic growth. With focused support for deep-tech, easier regulations, and skilled talent, startups can play a decisive role in achieving Viksit Bharat 2047 and strengthening India's position as a global innovation hub.

KEY WORDS

- **Startup Boom** – India has over 2.12 lakh recognised startups, reflecting rapid entrepreneurial growth.
- **Decentralised Innovation** – 51% of startups from Tier-II and III cities show inclusive regional development.
- **Deep-Tech Focus** – Rising emphasis on AI, GenAI, and advanced technologies drives high-value innovation.
- **Employment Generator** – Startups create large-scale jobs, especially for youth and skilled professionals.

7) INDIAN TOURISM- EXPERIENCING A MAJOR BOOM

(GS III- Economy and Infrastructure)

Introduction

As India marches towards *Viksit Bharat 2047*, tourism has emerged as a powerful driver of economic growth, employment generation, and global engagement. **Contributing around 6–7% to GDP, supporting over 48 million jobs**, and earning more than ₹2.9 lakh crore in foreign exchange, the sector backed by nearly 300 crore domestic visits and rising international tourist inflows has positioned India as the world's 8th largest tourism economy.

Significance of Tourism in India

- 1. Economic Growth & Revenue Generation-** Tourism is a major contributor to India's GDP and foreign exchange earnings through international visitors. Iconic attractions like **the Taj Mahal generate substantial ticket revenue, boost local businesses, and support ancillary services such as hotels, transport, and guides.**
- 2. Employment Generation-** The sector creates large-scale direct and indirect employment in hospitality, travel, handicrafts, food services, and transport. For example, **Goa's tourism industry** sustains livelihoods for hotels, taxi operators, beach vendors, and artisans.
- 3. Regional & Inclusive Development-** Tourism promotes growth in rural, tribal, and remote areas by improving infrastructure and market access. **Initiatives like homestays in Manali or Ladakh** help local communities earn sustainable incomes.
- 4. Cultural Preservation & Heritage Conservation-** Tourism incentivises the preservation of monuments, crafts, and traditions. **Sites like Hampi and Khajuraho** benefit from conservation efforts supported by tourism revenues and global attention.
- 5. Global Soft Power & Cultural Diplomacy-** Tourism enhances India's global image by showcasing its culture, diversity, and hospitality. **Events like the G20 meetings and spiritual tourism** (Buddhist and yoga circuits) strengthen people-to-people ties.

Challenges of Tourism in India

- 1. Visa and Travel Hurdles:** Complex visa processes and limited visa-free access deter potential international arrivals, unlike many Southeast Asian destinations with broader visa-free regimes. For example, **India** is ranked **75th** in the **Henley Passport Index**. Indian passport holders currently enjoy visa-free or visa-on-arrival access to **56 destinations** globally.
- 2. Infrastructure Shortfalls:** India has around **2 lakh hotel rooms** compared to China's millions, and transport networks in emerging regions remain underdeveloped.
- 3. Cleanliness and First Impressions:** Inadequate waste management and untidy public spaces near tourist hubs affect visitor experiences and global perception.
- 4. Safety Concerns:** Inadequate security and emergency services, especially in remote or high-traffic areas, weaken tourist confidence.
- 5. Low Global Promotion:** India's international tourism marketing has been inconsistent, with limited sustained campaigns, reducing visibility in competitive global markets.

6. **Underutilisation of Cultural Assets:** Despite having **44 UNESCO World Heritage Sites**, India attracts far fewer foreign tourists than countries with fewer such sites, indicating weak branding and promotional strategies.

Initiatives related to Tourism in India

1. **Ek Bharat Shreshtha Bharat** – Promotes cultural exchange through tourism linkages.
2. **Dekho Apna Desh** – Encourages domestic travel and awareness of India’s diverse destinations.
3. **Paryatan Parv** – Annual festival to celebrate and promote domestic tourism.
4. **PRASHAD Scheme** – Develops pilgrimage infrastructure across key spiritual centres.
5. **Swadesh Darshan Scheme** – Supports thematic tourism circuits and infrastructure projects.

Way forward for Tourism in India

- **Ease of Entry & Travel:** Expand and simplify e-Visas and visa-on-arrival, ensure faster immigration, modern airports, and multilingual support for a seamless tourist experience.
- **Leverage High-Value Destinations:** Sustainably develop destinations like **Lakshadweep** with controlled infrastructure to position them as exclusive global tourism hotspots.
- **Circuit-Based Tourism Promotion:** Use **Swadesh Darshan** and **PRASAD** to create premium circuits (Buddhist, Himalayan wellness, spiritual circuits) that encourage longer stays and higher spending.
- **World-Class Infrastructure:** Develop top tourist destinations through state partnerships, attract private investment by classifying hotels under the **Infrastructure Harmonized Master List (HML)**.
- **Strengthening Branding and Digital Outreach:** Effective global branding is crucial. India must leverage digital platforms, social media, virtual tours, and data analytics to target high-spending tourists. Campaigns like “**Incredible India**” should be modernized with region-specific marketing strategies. Collaboration with influencers and international travel platforms can enhance visibility.

Conclusion

Tourism has the potential to become a major engine of India’s growth and employment. With better infrastructure, easier travel, and stronger global promotion, the sector can significantly support **Viksit Bharat 2047** while showcasing India’s culture and diversity to the world.

KEY WORDS

- **Inclusive Development** – Promotes growth in rural, tribal, and remote areas through homestays and local enterprises.
- **Cultural Preservation** – Encourages the protection of monuments, crafts, and traditions like Hampi and Khajuraho.
- **Soft Power** – Enhances India’s global image and cultural diplomacy through tourism and international events.
- **Incredible India** – Government initiative promoting India’s tourism globally.
- **Eco & Adventure Tourism** – Nature-based and adventure-focused tourism in mountains, forests, and wildlife areas.
- **Medical & Wellness Tourism** – Travel for healthcare, yoga, Ayurveda, and wellness experiences.

UPSC PYQ

- How can the mountain ecosystem be restored from the negative impact of development initiatives and tourism? **[2019]**
- The states of Jammu and Kashmir, Himachal Pradesh, and Uttarakhand are reaching the limits of their ecological carrying capacity due to tourism. Critically evaluate. **[2015]**

8) CHANGING NATURE OF WAR

(GS III - Challenges to Internal Security through Communication Networks, Role of Media and Social Networking Sites in Internal Security Challenges, Basics of Cyber Security; Money-Laundering and its prevention.)

Background

The nature of warfare in the 21st century has undergone a profound shift, as seen in conflicts like Russia–Ukraine and Israel– Hamas, marked by hybrid, multi-domain and protracted wars, prompting India to rethink its defence doctrines and preparedness.

Evolution of Warfare in the 21st Century

1. Hybrid & Multi-Domain Warfare

- Combines kinetic (troops, missiles, bombs) and non-kinetic tools (cyber, information warfare, economic pressure, space ops).
- **Eg:** Russia–Ukraine war uses conventional forces alongside disinformation campaigns.

2. Non-Kinetic & Stand-Off Operations

- Drones, cyberattacks, electronic warfare, and precision long-range weapons reduce mass troop deployment.
- **Eg:** Nagorno-Karabakh conflict (2020) saw Azerbaijan using Turkish and Israeli drones to devastating effect.

3. Technology-Driven Transformation

- Emerging tech like AI, Machine Learning, Hypersonic Missiles, Quantum Computing, and Autonomous Systems redefines battlefield tactics.
- **Eg:** Ukraine's AI-assisted targeting and China's development of sixth-generation fighter jets.

4. Space Weapon Race & Militarization of Space

- Space is a critical warfighting domain, with satellite surveillance, communication, and anti-satellite (ASAT) weapons.
- **Eg:** India's Mission Shakti (2019 ASAT test), and U.S. & China developing ASAT capabilities.

5. Centrality of Civilians & Non-State Actors

- Private corporations and non-state actors influence conflicts using technology.
- **Eg:** Starlink satellite internet in Ukraine; Hamas and Houthis using drones and rockets to challenge conventional militaries.

6. Geoeconomic Warfare:

- The **weaponization of financial interdependence** through sanctions and SWIFT bans to cripple state capacity and force "strategic decoupling" without physical combat.
- **Eg:** The **2022 Russia Sanctions**, where Western powers froze **\$300 billion** in reserves and cut off **SWIFT** access, forcing a "strategic decoupling" from the dollar-based global economy.

Contemporary Changes related to India

1. **Rise of Network-Centric & Multi-Domain Warfare (MDW):** Future conflicts will involve synchronized operations across land, sea, air, cyber, and space, requiring deep integration of the three services under Unified Theatre Commands.
2. **AI and Autonomous Systems as Force Multipliers:** AI is being deployed for surveillance, data analysis, and autonomous decision-making to tackle information overload, particularly along the LoC and LAC. The Indian Army is focusing on manned-unmanned teaming (MUMT) and utilizing AI-enabled drone swarms for precision strikes.
3. **"Atmanirbharta" (Self-Reliance) in Defense:** To counter over-dependence on foreign suppliers, India is focusing on indigenous production (e.g., LCA Tejas, INS Vikrant, ATAGS) and leveraging private sector innovation through initiatives like iDEX.
4. **Increased Vulnerability to Cyber and Cognitive Warfare:** Modern wars aim to paralyze networks and destroy infrastructure. India is actively building defense capabilities against electronic jamming, spoofing, and misinformation campaigns that target public sentiment.
5. **Shift to "Non-Contact" Warfare:** As seen in recent exercises (e.g., Operation Sindoor), the trend is towards using long-range precision missiles and drones to strike deep inside enemy territory without deploying large troop numbers, reducing risks to personnel.
6. **Space as a Key Domain:** The establishment of the Defence Space Agency (DSA) underlines the importance of space-based surveillance, communication, and potential anti-satellite (ASAT) capabilities.
7. **Two-Front Challenge & Resource Constraints:** While modernizing, India must manage the financial strain of long-term mobilization and the need to simultaneously upgrade outdated equipment (like T-72 tanks) with limited budget allocations compared to rivals.

Challenges in India's Modern Warfare Preparedness with Global Comparison

1. **Slow Procurement & Planning**
 - **Issue:** India's defence acquisition cycles are slow, lagging behind technological advances and affecting readiness.
 - **Example & Comparison:** Delays in **Arjun MBT Mk-II** and naval frigates slowed modernization, whereas countries like **Israel and the U.S.** maintain **rapid acquisition cycles**, allowing faster induction of advanced tanks and naval systems.
2. **Gap in Indigenous Capabilities**
 - **Issue:** India lags in **AI, drones, and hypersonic systems**, increasing reliance on imports.
 - **Example & Comparison:** **Tejas LCA delays** forced continued dependence on Russian MiG-21 replacements, whereas **China and the U.S.** have successfully developed **indigenous fighter jets, drones, and hypersonic weapons**, reducing foreign reliance.
3. **Cyber & AI Vulnerabilities**
 - **Issue:** Network-centric and AI-enabled systems are exposed to cyber intrusions and algorithmic attacks.

- **Example & Comparison: Cyberattacks on Indian power grids (2020–21)** exposed vulnerabilities; in contrast, **Israel and Estonia** have highly resilient **cyber defense frameworks** protecting critical infrastructure.

4. Two-Front War Risks

- **Issue:** Simultaneous conflict with **China and Pakistan** could overstretch resources.
- **Example & Comparison: 2020 Galwan clash** and ongoing LoC tensions demonstrate strain; countries like **U.S. and China** maintain **specialized rapid reaction forces and integrated command structures** to manage multi-front operations efficiently.

5. Doctrinal Lag

- **Issue:** Rapid tech shifts outpace doctrinal updates, risking miscalculations and delayed responses.
- **Example & Comparison:** Slow integration of **UAV/drone swarms and AI targeting** into doctrines, whereas **Israel and the U.S.** have **continuously updated doctrines** to incorporate AI, drone swarms, and network-centric warfare.

Way Forward

1. **Accelerate Defence Modernization & Integration:** Fast-track procurement reforms, establish fully functional Integrated Theatre Commands, and adopt real-time multi-domain coordination to prepare **India** for hybrid and two-front wars.
2. **Achieve Technological Self-Reliance:** Invest heavily in indigenous AI, drones, cyber systems, space tech, and advanced weapons while strengthening public-private defence innovation to reduce import dependence.
3. **Strengthen Cyber, Space & Strategic Preparedness:** Build robust cyber defence architecture, enhance satellite and ASAT capabilities, and develop doctrines for non-contact and cognitive warfare to counter future threats effectively.

Conclusion

India must modernise its military through doctrinal reforms, technological self-reliance, and strengthened deterrence. Manpower, logistics, and cyber capabilities need upgrading, while defence diplomacy and strategic partnerships enhance interoperability. A coordinated approach will ensure India remains resilient and capable in the era of hybrid, multi-domain warfare

KEY WORDS

- **Conventional warfare** - It is armed conflict between states or organized forces using traditional weapons and battlefield tactics.
- **Kinetic warfare** - Kinetic warfare is combat that uses direct physical force to destroy or neutralize enemy forces or targets.
- **Doctrine Lag** - Doctrinal lag occurs when armed forces rely on outdated strategies and doctrines that do not match contemporary warfare requirements.

9) URBAN WATER POLLUTION

(GS-III: Environment & Ecology, Disaster Management, Water Resources, and Governance (pollution control laws, urban sanitation, and public health preparedness)).

Background

The recent **water contamination incident in Indore**, which resulted in multiple deaths and thousands falling ill due to polluted municipal water supply, highlights the persistent challenge of **urban water pollution in India**. It underscores how water pollution is not merely an environmental issue but a **public health, governance, and infrastructure failure**.

Water Pollution and Groundwater Contamination in India:

- About 70% of India's surface water is unfit for consumption (CGWA).
- Nearly 60% of urban sewage is discharged untreated (CPCB & CGWB).
- **Groundwater in 150+ districts is contaminated with Arsenic, Fluoride, Nitrate, Uranium, and heavy metals due to industrial and agricultural runoff.**
- Water pollution in India leads to widespread health issues and costs ~3% of GDP annually (World Bank).

Causes of Water Pollution

1. **Domestic sewage and untreated effluents:** India produce **about 72,368 million liters** per day of sewage, but only about 28% of it is actually treated, leaving **roughly 72% of sewage untreated entering water bodies**.
2. **Industrial discharge:** Discharge of toxic chemicals, heavy metals, and organic waste pollutes water, often worsened by poor compliance with treatment norms. Thousands of polluting industries discharge wastewater; **only ~30-40% treated**.
3. **Agricultural runoff:** Excessive use of fertilizers and pesticides, combined with irrigation practices, leads to runoff of nutrients and chemicals into nearby water bodies, causing eutrophication and groundwater contamination.
4. **Solid waste dumping and urbanization:** Dumping waste including plastics, biomedical waste, and encroachment of water bodies degrades aquatic ecosystems. The **Hindon River** in Ghaziabad and the **Yamuna River** in Delhi are heavily polluted due to **industrial effluents, municipal solid waste, plastics, biomedical waste, and untreated sewage**,
5. **Weak governance and poor enforcement:** **Weak governance** including inadequate monitoring and underinvestment in treatment infrastructure, allow continued discharge of untreated sewage into rivers despite initiatives like Namami Gange
In Kanpur, the Ganga River receives large amounts of untreated **effluents from leather tanneries** containing **chromium and other toxic chemicals** due to weak governance, poor enforcement of environmental regulations.

Government Initiatives to Control Water Pollution in India

1. **Legal and Regulatory Framework** – The Water (Prevention and Control of Pollution) Act, 1974 empowers CPCB and SPCBs to regulate industrial discharge through permits, inspections, penalties, and closures.
2. **River Rejuvenation Programmes** – Namami Gange and the National River Conservation Plan (NRCP) focus on sewage treatment plants (STPs), river surface cleaning, and pollution abatement.
3. **Technology-Based Monitoring** – Online Continuous Effluent Monitoring Systems (OCEMS) track real-time industrial discharge to ensure compliance.
4. **Urban Sanitation & Water Management Missions** – AMRUT 2.0, Swachh Bharat Mission–Urban (SBM-U), and Jal Jeevan Mission improve sewage networks, wastewater treatment, and safe drinking water access.
5. **Groundwater and Community-Based Initiatives** – Atal Bhujal Yojana and NAQUIM (National Aquifer Mapping and Management Programme) promote sustainable groundwater management and scientific aquifer mapping.

Challenges in addressing Water Pollution

1. **Inadequate Sewage Treatment:** According to National Green Tribunal (NGT), India has around **1,261 sewage treatment plants (STPs)** across states and Union Territories. However, only about **56% of the installed treatment capacity is effectively utilised**. The remaining capacity is underused or non-functional.
2. **Urbanisation & Wastewater Mismanagement:** Rapid urban expansion generates wastewater beyond sewage network capacity.
3. **Weak Regulatory Enforcement:** Chronic understaffing and limited technical capacity in SPCBs result in poor monitoring and industrial non-compliance.
4. **Low Public Awareness & Participation:** Improper disposal of solid waste, plastics, and untreated wastewater continues due to insufficient citizen engagement.

Way Forward to Address Water Pollution

- **Support Innovation Ecosystems** – Use innovation challenges and funding, like the **Aquapreneur Initiative**, to scale solutions that save water and treat wastewater globally.
- **Nature-Based & Reuse Approaches** – Implement **managed aquifer recharge, riverfront green infrastructure, and potable reuse systems** like **Windhoek, Namibia**, for sustainable water management.
- **Innovative Industrial & Urban Solutions-** Encourage **zero-liquid discharge (ZLD) technologies** in industrial units, particularly tanneries and textile factories. Promote **circular water economy models** where wastewater is treated and reused within industries and urban clusters.
- **Governance reform-** Shift from **Output to Outcome-Based Governance** and Enhance **Public Participation and Transparency, and** citizen monitoring through **community-led water audits and mobile reporting apps**.

Conclusion

The Indore incident serves as a cautionary example of how **neglect of urban water management can quickly escalate into a public health disaster**. Addressing urban water pollution requires a shift from **reactive crisis management to preventive, accountable, and integrated urban water governance**, ensuring safe drinking water for all.

KEY WORDS

- **CGWA, CPCB & CGWB** - Central bodies for groundwater regulation, pollution control, and scientific groundwater assessment in India.
- **Namami Gange and AMRUT 2.0** - Government programs aimed at river rejuvenation and urban water infrastructure improvement.
- **OCEMS** - Continuously records industrial emissions and sends data to regulators in real time.
- **Atal Bhujal Yojana** - Improves groundwater management through community participation.
- **Aquapreneur Initiative** - Promotes entrepreneurship in sustainable aquaculture.
- **NAQUIM** - Maps and monitors aquifers to support sustainable groundwater management.
- **Jal Jeevan Mission** - Scheme ensuring access to safe and adequate drinking water for all rural households.

10) CLIMATE-RESILIENT AGRICULTURE

(GS-III: Environment & Ecology, Disaster Management, Water Resources, Agriculture, and Governance)

Background

According to FAO's *climate-resilient and green agriculture framework* Climate-resilient agriculture employs **agricultural practices, technologies and innovations** that enhance productivity in a sustainable manner; increase adaptation and resilience to climate change and extreme events, and help reduce vulnerability of agricultural systems to climate risks

In India, where **~55% of agriculture is rain-fed** and 86% of farmers are small and marginal, increasing climate extremes highlighted by IMD and IPCC reports pose serious risks to food security. Hence, CRA, promoted through initiatives like the National Mission for Sustainable Agriculture (NMSA), is critical for ensuring **sustainable and resilient Indian agriculture**.

Why India Needs Climate-Resilient Agriculture (CRA)

1. Rising Climate Variability

India is increasingly affected by **droughts (Bundelkhand), floods (Assam, Bihar), cyclones (Odisha), and heatwaves**, directly impacting yields of major crops like **wheat, rice, and maize**. Nearly half of the farmland depends on rainfall, so irregular rains cause frequent **crop failures and farmer distress, as seen in Maharashtra and Telangana**.

Example: Heat stress in North India has reduced wheat yields in recent years.

2. Food and Nutritional Security Risks

Climate variability reduces yields of cereals like rice, wheat, maize, and sorghum, and also affects pulses and oilseeds through heat stress, drought, and erratic rainfall. **Chickpea yields** have declined in several states, **while rain-fed pulses** are impacted by changing **rainfall patterns**. Oilseed crops such as **groundnut and mustard** are particularly vulnerable to **high temperatures and water scarcity** threatening **food availability, nutrition, and price stability for India's growing population**.

3. Greenhouse gas emissions

Agriculture is the largest source of methane emissions in India, **accounting for over 40% of the country's total methane**, with enteric fermentation from livestock and rice cultivation being the primary contributors.

4. Natural Resource Degradation

Input-intensive farming has led to **soil degradation, groundwater depletion, and biodiversity loss**. Climate-resilient practices promote sustainability and long-term productivity.

5. Farmer Income and Livelihood Security

Climate shocks increase crop losses, indebtedness, and rural poverty. CRA helps **stabilize yields**, reduce risks, and improve income security.

Government Initiatives Promoting CRA

1. **National Mission for Sustainable Agriculture (NMSA)**- Under the National Action Plan on Climate Change.
2. **Pradhan Mantri Krishi Sinchai Yojana (PMKSY)**- Micro-irrigation “per drop more crop” initiative
3. **Climate-Resilient Crop Varieties (ICAR)**- Under the National Innovations in Climate Resilient Agriculture (NICRA).
4. **Pradhan Mantri Fasal Bima Yojana (PMFBY)**- A flagship crop insurance scheme
5. **Digital & Advisory Support Systems**- IMD weather forecasts, Kisan SMS, and agromet advisory services
6. **Paramparagat Krishi Vikas Yojana (PKVY)**- To enhance soil health.

Challenges in Implementation of Climate-Resilient Agriculture

1. **Small and Fragmented Landholdings:** About 85% of Indian farmers cultivate less than 2 hectares of land, making most holdings small and fragmented. Such small plots limit mechanisation, crop diversification, and adoption of water-efficient technologies, constraining agricultural productivity and climate resilience.
2. **Low Awareness and Adoption Gaps:** Climate-resilient practices and seed varieties often fail to reach last-mile farmers effectively.
3. **Institutional and Capacity Constraints:** Weak extension services and limited coordination between Centre, States, and research bodies.
4. **Financial and Credit Limitations:** Small and marginal farmers, forming 86% of India’s farmers, often cannot afford micro-irrigation, resilient seeds, or modern technologies. Consequently, larger and medium farmers capture a greater share of subsidies, credit, and technology benefits.
5. **Climate Uncertainty and Data Gaps:** Localized climate impacts and inadequate district-level data reduce effectiveness of planning and advisories.

Way Forward

- **Scale up resilient technologies** such as stress-tolerant crops, micro-irrigation.
- **Strengthen last-mile extension** using ICT, KVVKs, and agromet advisories.
- **Ensure convergence and regional tailoring** of schemes for rainfed, coastal, arid, and hill regions.
- **Enhance institutional and financial support** through credit, insurance.
- **Build farmer capacity and community participation** via FPOs and local institutions.

Climate resilient agriculture practices

System of Rice Intensification (SRI) Saves water, boosts yields.

Crop diversification: Reduces climate risk, improves soil fertility.

Millets: Drought-tolerant, low input, nutritious.

Agroforestry: Conserves resources, sequesters carbon, diversifies income.

Weather advisories: Enable timely decisions, minimize climate losses.

Alternate Wetting and Drying (AWD): AWD allows fields to dry intermittently, lowering methane emissions (studies show reductions of ~48–60 % compared with traditional flooding).

Direct-Seeded Rice (DSR): Techniques like DSR reduce methane emissions by avoiding continuous flooding and also save water by 20–40 %.

Conclusion

Climate-resilient agriculture is critical for **food security, farmer livelihoods, and sustainable development** in a climate-uncertain future. India must shift from short-term productivity gains to **long-term resilience and sustainability**.

KEY WORDS

- **System of Rice Intensification (SRI)** - A water-saving rice cultivation technique using young seedlings, wider spacing, and alternate wetting and drying to enhance productivity.
- **Agromet Advisories** - Weather-based farm advisories that help farmers take timely decisions on sowing, irrigation, and harvesting.
- **ICT Platforms** - Digital tools such as mobile apps and SMS services used to deliver agricultural, weather, and market information to farmers.
- **Krishi Vigyan Kendras (KVKs)** - District-level agricultural extension centers that provide training and demonstrations to transfer scientific farming practices.

UPSC PYQ

“What are the present challenges before crop diversification? How do emerging technologies provide an opportunity for crop diversification? [2021]”

11) ARTIFICIAL INTELLIGENCE (AI) REGULATION

(GS III - Awareness in the fields of IT, Space, Computers, Robotics- Science and Technology- Developments and their Applications and Effects in Everyday Life. Role of Media and Social Networking Sites in Internal Security Challenges, Cyber Security)

AI Everywhere

The ability of machines to simulate human intelligence such as learning, reasoning, and decision-making is Artificial Intelligence. It works by processing large datasets through algorithms and machine-learning models to identify patterns and generate predictions or automated responses. AI is widely applied in governance, healthcare, agriculture, finance, defence, and industry to improve efficiency, accuracy, and decision-making.

However, its rapid adoption also raises ethical, social, economic, and security challenges. Therefore, there is an urgent need for **robust AI regulation** to ensure that technological innovation is aligned with public interest, constitutional values, and sustainable development.

Why AI Regulation is Necessary

- **Data Privacy & Surveillance:** Large-scale data collection raises risks of profiling, behavioural manipulation, and intrusive surveillance, leading to constitutional rights(right to privacy) violations in India.
Eg: Facebook Data Scandal (2018): Personal data of millions of Facebook users was harvested without consent and used for targeted political advertising in elections, including the US and UK (Brexit).
- **Security and Democratic Risks:** AI-powered cyber-attacks, autonomous weapon systems and deepfakes pose new-age threats to national security and democratic processes.
Eg: Deepfake Political Content (India & US): During the 2020 Delhi elections, AI-generated videos were used to create multilingual campaign speeches of politicians, showing how AI can manipulate voter perception.
- **Ethical and Social Concerns:** AI systems learn from data that often reflects social biases and structural inequalities. Can reinforce discrimination rather than eliminate it. The opacity of many AI models, described as the “black box” problem, further erodes accountability and undermines democratic oversight.
Eg: Amazon AI Recruitment Tool (2018): Amazon scrapped an internal artificial intelligence (AI) recruiting tool because it exhibited significant bias against female candidates.
- **Economic & Labour Implications:** AI-driven automation may displace jobs, especially in routine and low-skill sectors, potentially increasing inequality.
Example: IT Sector Layoffs: Several global tech firms cited AI-led restructuring as a factor in workforce reductions.

Approaches to AI Regulation

Global Approach to AI Regulation	India's Approach to AI Regulation
Bletchley Declaration on AI (2023)	National Strategy for AI – “AI for All” (NITI Aayog, 2018)
United Nations (UN): A 2024 resolution on “Safe, Secure, and Trustworthy AI”	Digital Personal Data Protection Act, 2023
UNESCO Recommendation on the Ethics of AI (2021)	IT (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021
OECD AI Principles (2019)	IT Act, 2000 & Proposed Digital India Act
Council of Europe (COE) Framework Convention on AI.	IndiaAI Mission
European Union – EU AI Act (2021–2024): First comprehensive legal framework	Centres of Excellence & National Data Governance Frameworks

Challenges in AI regulation

- Rapid Technological Evolution:** AI evolves faster than policy cycles, making regulations quickly outdated. This creates a persistent regulatory lag that limits the effectiveness of **traditional legal frameworks**.

Eg: The rapid rise of tools like ChatGPT and Gemini outpaced existing copyright, academic integrity, and misinformation laws. Many governments had no regulatory clarity when these tools went viral.
- Complexity and Technical Knowledge Gap:** Regulators often **lack expertise** to fully understand AI systems and algorithms.

Eg: India– AI in Policing: Predictive policing tools such as crime mapping systems in some Indian states raised concerns, as officials often lacked clarity on how algorithms generated risk scores.
- Implementation and Enforcement Capacity:** Limited institutional capacity and monitoring mechanisms weaken effective implementation of AI regulations.

Eg: European regulators fined Clearview AI for unlawful facial data scraping. However, the company has no physical presence in many EU countries, making enforcement and penalty recovery difficult.
- Cross-Border Nature:** AI often operate across borders with **global data flows and multinational platforms**, complicating enforcement across jurisdictions.

Eg: Global Operations of Big Tech: Companies like Meta Platforms and Google process user data across multiple countries, making it difficult for any single nation to assert full regulatory control.

Way Forward

- Adopt **adaptive, technology-neutral and principle-based regulations** that can evolve with AI advancements instead of rigid, prescriptive laws.
- Build **institutional AI capacity** by training regulators, policymakers, judiciary, and law-enforcement agencies in AI and data science. Establish **multidisciplinary expert bodies** involving technologists, ethicists, and legal experts.
- Create **dedicated AI regulatory authorities or cells** with adequate resources and monitoring powers. Mandate **algorithmic audits, impact assessments, and compliance reporting** for high-risk AI systems.
- Enhance international cooperation and harmonisation of standards through multilateral forums like the UN, OECD, & G20. And develop **cross-border data governance frameworks**.

Conclusion

AI regulation is not about resisting technological change but about governing it with wisdom and foresight. For India, the challenge lies in harmonising innovation with equity, efficiency with ethics, and automation with accountability.

Anchored in constitutional morality and human-centric values, a balanced regulatory framework can ensure that AI becomes a tool of empowerment rather than exclusion. Such an approach can help shape a future that is both technologically advanced and socially just.

KEY WORDS

- **Machine Learning** - The process by which machines learn from data to perform tasks and improve outcomes without explicit programming. It is a subset of **Artificial Intelligence**.
- **Profiling** - The practice of collecting and analysing personal data to evaluate, predict, or classify an individual's behaviour, preferences, characteristics, or risks.
- **Deepfakes** - Synthetic media-videos, images, or audio, created using Artificial Intelligence, especially deep learning, to realistically manipulate or replace a person's identity or actions.
- **Deep Learning** - Deep learning is a machine learning technique that uses layered neural networks to analyse complex data and make intelligent decisions.
- **Black box problem** - The black box problem refers to the lack of transparency and explainability in many AI systems, where the internal logic behind an AI's decision-making is not easily understood by humans.

12) ARAVALLI HILLS

(GSIII - Conservation, Environmental Pollution and Degradation, Environmental Impact Assessment.)

Introduction

The Aravallis are one among the oldest fold mountain ranges globally, approximately **2 billion years old**. They stretch over **~650 km** from **Delhi in the northeast through southern Haryana and Rajasthan to Gujarat in the southwest**.

Characterized by low ridges, rocky outcrops and hillocks, typically interspersed with valleys and plateaus, their average elevation is relatively modest compared to the Himalayas but they form a stable geological structure.

Importance of Aravalli range

- **Geographical Importance**
Acts as a **watershed region** for rivers like **Chambal, Sabarmati, Luni**, and several seasonal streams. Serves as a **natural barrier against the eastward expansion of the Thar Desert**. Also regulates **drainage patterns, soil stability, and landforms** in western India.
- **Environmental Importance**
Plays a crucial role in **groundwater recharge** and sustenance of aquifers. Prevents **soil erosion and desertification**, maintaining ecological balance in surrounding plains. Supports **dry deciduous forests** and rich biodiversity including **leopards, hyenas, nilgai, and avifauna**. Helps in **microclimate regulation**, moderating temperatures and aiding monsoon movement.
- **Economic Importance**
Rich in **minerals** such as **marble, limestone, quartzite, copper, lead, zinc**, supporting mining and allied industries. Provides **raw materials** for cement, construction, and handicraft industries.
Supports **tourism and cultural economy** through heritage sites like **Mount Abu, Ajmer, Pushkar, and Kumbhalgarh**.

Issues affecting Aravalli range

- **Mining and Quarrying**
The Aravallis are rich in **minerals like marble, limestone, and quartzite**, which has made mining a major economic activity. However, **excessive mining—both legal and illegal—has caused deforestation, destruction of hillocks, and soil erosion**, while reducing the natural capacity of the range to **recharge groundwater** and regulate local climate.
- **Urbanisation and Infrastructure Pressure**
Rapid expansion of urban areas like **Delhi-NCR, Gurugram, Faridabad, and Jaipur** has led to **encroachment into eco-sensitive zones**. This results in **fragmentation of forests, destruction of wildlife corridors, and altered drainage patterns**, increasing flood and waterlogging risks.

- **Deforestation and Land Degradation**

Forest clearing for **agriculture, grazing, and construction** has intensified soil erosion and **accelerated desertification**, reduced the ecological resilience of the region, affecting local communities dependent on forest resources.

- **Groundwater Depletion**

Mining and urban encroachment have **flattened hillocks and disturbed recharge zones**, leading to a sharp **decline in groundwater levels**. Many seasonal streams and wells in surrounding plains have dried up, aggravating water scarcity.

- **Climate Stress**

Rising **temperatures and erratic rainfall patterns**, compounded by ecological degradation, make the Aravallis more vulnerable to **droughts, desertification, and biodiversity loss**, reducing their role as a **natural climate regulator**.

Way Forward

1. Strict Regulation of Mining

- Enforce **existing Supreme Court and NGT bans** on illegal mining.
- Allow mining only in **designated zones** with **scientific planning and environmental safeguards**.

2. Urban Planning and Eco-sensitive Zone Protection

- Prevent **encroachment into eco-sensitive areas**.
- Promote **green belts, controlled urban expansion, and zoning regulations** around the Aravallis.

3. Afforestation and Land Restoration

- Undertake **massive tree plantation, soil stabilization, and rehabilitation of degraded lands**.
- Restore **hillocks and forest patches** to improve ecological resilience.

4. Groundwater Conservation

- Implement **watershed management, rainwater harvesting, and recharge structures**.
- Protect natural **recharge zones** to restore groundwater levels.

5. Climate and Biodiversity Management

- Promote **ecosystem-based adaptation** to climate stress.
- Protect **wildlife corridors and biodiversity hotspots** to maintain ecological balance.

6. Community Participation and Awareness

- Engage **local communities, NGOs, and citizen groups** in monitoring, conservation, and reporting violations.

7. Integrated Management Plan

- Ensure **inter-state coordination** among Haryana, Rajasthan, Delhi, and Gujarat for consistent enforcement.

CURRENT CONTROVERSY

Despite bans dating from the 1990s and restrictions under **Supreme Court and National Green Tribunal(NGT) directives**, unregulated quarrying remains widespread, contributing to loss of hills and ecological functions.

In **December 2025**, the **Supreme Court / Environment Ministry clarified the definition of Aravalli Hills** based on a **height criterion**: Hills ≥ 100 meters above the local terrain are considered part of the Aravalli range.

Why is it controversial?

- Low-height ridges and hillocks that were previously **protected as part of the Aravallis** may now be considered outside the "official" range.
- This opens the door for **real estate, industrial, and mining projects** in previously restricted areas. Conflict arises between **economic interests** (mining revenue, employment) and **environmental protection**.

As of late 2025, **over 1,200 mining leases** were still active across Aravalli districts in Rajasthan covering large areas, despite regulatory restrictions.

But now, Supreme Court clarified that mining is permissible in only **~0.19% of the Aravalli area** with **strict environmental safeguards**.

Conclusion

The Aravalli Hills represent a **critical ecological, geographical and economic asset** for India, functioning as a natural bulwark against desertification, a regulator of micro-climates, a source of groundwater recharge and a support for biodiversity. However, they face **multifaceted challenges**, especially from mining and associated policy debates. Balanced, science-based conservation strategies that reconcile ecological preservation with sustainable economic use are essential to protect this ancient mountain system for future generations.

KEY WORDS

- **Hillocks**- Small, low-elevation hills or mounds that are part of the Aravalli terrain, often less than 100 meters above the surrounding plains
- **Watershed region** - Land area that channels rainfall into rivers and streams, supporting groundwater recharge, soil conservation, and local ecosystems.
- **Old-fold ranges** - Ancient mountain ranges formed by early tectonic plate movements, typically eroded, low in height, and geologically stable, like the Aravalli Hills.
- **Microclimate** - The localized climate of a small area, influenced by terrain, vegetation, or water bodies, affecting temperature, rainfall, and humidity differently from the surrounding region.
- **Eco sensitive zone**- A designated area around protected forests, wildlife sanctuaries, or national parks where human activities are regulated to minimize ecological damage and conserve biodiversity.

MODEL QUESTIONS

- 1) Delimitation in India is not merely a technical exercise but a deeply political one with implications for democracy and federalism." Critically analyse.
- 2) Discuss how the Supreme Court has interpreted the role of the State and the CBFC in protecting freedom of expression, with reference to relevant judgments.
- 3) India–European Union trade relations have gained renewed momentum in recent years amid negotiations for a comprehensive Free Trade Agreement (FTA).
- 4) While the gig economy offers a flexible solution to India's burgeoning unemployment, it risks institutionalizing job insecurity. Critically evaluate the adequacy of the Code on Social Security, 2020, in protecting gig workers.
- 5) In the light of recent flight accidents in India, critically examine the challenges to aviation safety in the country. Suggest measures to strengthen safety oversight and ensure sustainable growth of the civil aviation sector.
- 6) Discuss how Indian startups can achieve global competitiveness in deep-tech sectors. What challenges hinder their scaling, and what measures are needed to overcome them?
- 7) How can tourism in India be developed sustainably while preserving the environment and local culture?
- 8) "Examine the changing nature of modern warfare and its implications for India's security strategy."
- 9) Examine the factors responsible for water and groundwater pollution in India. Suggest government measures and initiatives to address the problem.
- 10) Climate-resilient agriculture is critical for India's food security and farmers' livelihoods. Discuss its importance, key practices, and the role of government initiatives in promoting it."
- 11) "Artificial Intelligence presents both transformative opportunities and serious regulatory challenges." Discuss the need for AI regulation in India, highlighting the ethical, legal, economic, and security concerns involved.
- 12) "Mining in Aravalli Hills have raised concerns over environmental degradation and groundwater depletion, despite their economic significance." Critically examine the challenges posed by mining in the Aravalli Hills and suggest sustainable measures to balance economic development with ecological conservation.