Prelims Exam Topics

IRAN'S POSSIBLE WITHDRAWAL FROM THE NUCLEAR NON-PROLIFERATION TREATY (NPT)

Context:

- Iran's parliament is reviewing the possibility of **withdrawing from the Nuclear Non-Proliferation Treaty (NPT)** amid escalating tensions with **recent attacks on Iranian nuclear facilities**

About the Nuclear Non-Proliferation Treaty(NPT)

- The **NPT**, signed in **1968** and in force from **1970**, is a **landmark international treaty** aimed at:
  - **Preventing the spread** of nuclear weapons and technology.
  - **Promoting peaceful uses** of nuclear energy through international cooperation.
  - Working towards **global nuclear disarmament**.
- **Segregation of members into Nuclear and Non-nuclear States:** The treaty segregates the member States into two types as follows:
  - **Nuclear States:**
    - **Definition:** States, who manufactured and exploded a nuclear weapon or other nuclear explosive device before 1 January 1967.
    - There are five nuclear-weapon States parties to the Treaty namely – US, UK, France, Russia and China have signed the treaty.
    - **Obligation:** They committed not to in any way assist, encourage or induce any non-nuclear-weapon State to manufacture or acquire nuclear weapons.
  - **Non-nuclear states:** These are member States parties who have committed themselves not to manufacture or otherwise acquire nuclear weapons.
    - NNWS are entitled to **access nuclear technology for peaceful purposes**, under **IAEA safeguards**.
      - **Verification Mechanism:** IAEA inspectors conduct regular site visits to verify compliance and uphold the integrity of non-proliferation norms.
  - Today, **191 countries** are parties to the treaty. Iran has been a signatory since 1970.
      - However, **India, Pakistan, and Israel** have never signed it. **North Korea** signed in 1985 but withdrew in 2003.

India and NPT

- India is not a signatory to the NPT.
- India considers the NPT as discriminatory as it segregates the member states into nuclear and non-nuclear states and restrict the non-nuclear states to acquire the nuclear weapon. Instead India advocates for universal nuclear disarmament.

Article 10 of the Nuclear Non-Proliferation Treaty (NPT) – Withdrawal Clause

- **Right to Withdraw:** Any State Party has the right to **withdraw from the Treaty** if it decides that

extraordinary events related to the subject matter of the Treaty have **jeopardized its supreme interests**.

- **Notice Requirement:** The withdrawing state must **give notice 3 months in advance** to all other Parties and to the **United Nations Security Council (UNSC)**.
- **Justification Required:** The withdrawal notice must include a **statement of the extraordinary events** that the state believes have jeopardized its supreme interests.

HOME MINISTRY'S AI VISION

Context:

- A Parliamentary Committee report showed how the Ministry of Home Affairs is leveraging artificial intelligence (AI) as "a critical enabler" in strengthening India's internal security architecture.

How AI is being used to tackle Internal Security Threats

- **Predictive Policing:** AI analyses **crime patterns and location data** to predict offences and optimise deployment (crime analytics systems in police forces).
- **Cybercrime Detection:** AI tools monitor **phishing campaigns and suspicious transactions** on the internet and dark web (used by **Indian Cyber Crime Coordination Centre – I4C**).
- **Dark Web Monitoring:** AI systems track **illegal discussions, malware markets and cybercrime operations on dark web platforms** (used to identify cybercriminal networks).
- **Financial Fraud Identification:** AI identifies **mule bank accounts through behavioural transaction patterns** (I4C + **IIT Bombay, RBI Innovation Hub** assign **"suspect scores" to mule bank accounts**).
- **Child Exploitation Detection:** AI detects **child sexual abuse material online** before forwarding to police (CSEAM screening tools by **CDAC Mumbai**)
- **Content removal:** Automated detection and takedown of **illegal images/videos** through **hash-matching systems** (proposed **Surakshini platform**)..
- **Financial Cybercrime Prevention:** AI-driven tools such as **MuleHunter.ai** help identify suspicious financial accounts used for cyber fraud and money laundering.
- **Immigration Security:** The **IVFRT 3.0 system(**Immigration, Visa, Foreigners Registration & Tracking**)** will use **AI and machine learning for intelligent traveller profiling and immigration risk assessment** (launch planned April 2026).
- **Forensic Investigation:** AI-assisted digital forensics tools help analyse **electronic evidence, cybercrime data and document forgery patterns**

POPULATION CENSUS: FIRST DATA EXPECTED BY 2027

Context

India's upcoming Population Census 2027 will mark a major shift as the country's first fully digital census exercise. The initiative is being overseen by the Registrar General and Census Commissioner of India, Mritunjay Kumar Narayan, and is expected to introduce significant changes, including digital data collection and the possibility of caste-based enumeration.

Key highlights

- **Two-phase structure of census:**
  - **Phase 1: Houselisting and Housing Census (HLO):** This phase will collect data on housing conditions, basic amenities, and household assets, helping assess living standards across regions.
    - The first phase will run from April 1 to September 30
  - **Phase 2: Population Enumeration (PE):** This phase will gather detailed information on population characteristics such as age, education, migration, fertility, and socio-economic status.
    - The second phase would run in February 2027.
- **Changes since the 2011 census:** Several demographic and administrative shifts have taken place.
  - The number of villages has reduced by more than 1,000, while urban areas have expanded, with a rise of 1,087 statutory towns and 688 census towns.
  - The total number of states and Union Territories has increased to 36, districts to 784, and sub-districts to 7,092.
- **Digital integration:** For the first time, census data will be gathered primarily through digital platforms instead of traditional paper-based methods.
- **Data protection**: The growing use of smartphones and computers is expected to facilitate the digital census process.
  - Strong data protection measures will be in place, including secure data transfer systems, regular audits, and the use of data centers designated as Critical Information Infrastructure.
- **Self-enumeration:** Another new feature is self-enumeration, enabling individuals to submit their own details, which will later be verified by official enumerators.
- **Data confidentiality:** Census information will remain confidential under the provisions of the Census Act, 1948, with only aggregated data being made public.
  - In select regions such as the **Andaman and Nicobar Islands and Delhi Cantonment**, self-enumeration will be available between April 1 and April 15.
  - In snow-affected regions, both phases are scheduled to be completed by September 30 this year.
- **Caste enumeration in Phase 2:** Caste details will be recorded during the Population Enumeration phase, marking a significant addition to the Census exercise.
  - **Questionnaire yet to be finalised:** The format and questions for caste data collection will be decided after consultations and released later.

Note

- West Bengal remains the only state that has not yet issued a notification regarding the census, with a deadline set for September 30.
- Furthermore, census data cannot be accessed for individual purposes under the RTI Act and is not subject to investigation.

CENSUS 2027 AND DENOTIFIED, NOMADIC TRIBES (DNTS): AN OPPORTUNITY FOR JUSTICE

Context

The upcoming Census 2027, with caste enumeration, provides a rare chance to identify and include Denotified, Nomadic and Semi-Nomadic Tribes (DNT/NT). There are fears that these communities may again be left out, continuing a long history of neglect.

About DNTs

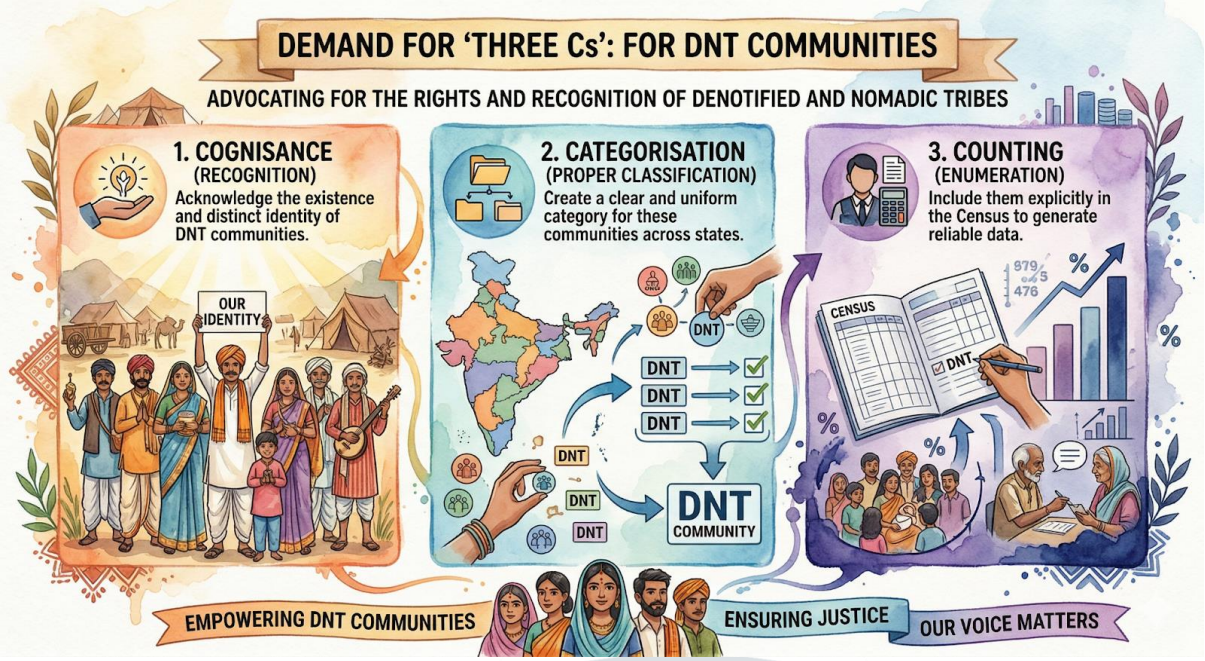
- **Historically marginalised communities:** DNTs include groups that were once labelled as "criminal tribes" under colonial laws and later freed after independence.
- **Diverse and scattered population:** These communities are spread across India, with different lifestyles such as nomadic, semi-nomadic, or settled.
- **Colonial legacy of stigma:** The Criminal Tribes Act, 1871 branded several communities as "criminal by birth", leading to social exclusion and surveillance.
    - Though the law was repealed in 1952, social stigma and institutional bias have persisted.

Present-day challenges

- **Lack of recognition:** Many DNT communities are not properly listed in official categories like SC, ST, or OBC.
- **No reliable population data:** The absence of proper counting makes policy planning difficult.
- **Fragmented classification**: The same community may be classified differently in different states, leading to confusion and uneven benefits.
    - A significant number of communities are not included in any category, excluding them from welfare schemes.
- **Loss of traditional livelihoods:** Modern economic changes have reduced demand for their traditional skills like crafts, animal rearing, and performing arts.
- **Poor access to basic services:** Low levels of education, healthcare access, and employment opportunities continue to affect these communities.
- **Institutional neglect:** Successive governments have not given adequate attention to DNT issues.
- **Limited public awareness:** These communities remain largely unknown in mainstream society, adding to their exclusion.

Key Committee recommendations

- **Renke Commission:** Identified the socio-economic conditions of DNTs and estimated their population at over 10 crore.
- **Idate Commission:** Listed over 1,200 DNT communities and recommended their proper classification and enumeration.



Significance of census inclusion

- **Targeted welfare policies**: Accurate data will help design schemes suited to their needs.
- **Social justice and inclusion**: Recognition in Census can reduce invisibility and social stigma.
- **Better governance**: Data-driven planning will improve delivery of benefits.
- **Availability of data sources:** Existing reports and surveys provide a strong base for identification.

PROPOSED EXPANSION OF SOCIAL MEDIA REGULATION

Context

- The Union government is planning to extend regulation beyond digital news platforms to include individual social media users, allowing authorities to act directly on user-generated content.

Key Changes in IT Rules, 2021

- **Direct action on user content:** The proposed amendments allow the Ministry of Information and Broadcasting to issue notices directly to users for their posts, expanding regulatory reach.
- **Conditional "safe harbour" protection:** Platforms may lose legal protection if they fail to follow government advisories, increasing their responsibility to regulate content.
- **Inter-departmental committee (IDC):** A new body is proposed to hear appeals related to content decisions, with broader authority beyond existing ethical guidelines.

Highlights and concerns

- **Rising content removal orders**: Authorities have been actively issuing notices to remove online content considered objectionable, indicating stricter monitoring of digital spaces.
- **Fears of excessive control**: Critics argue that the changes may increase censorship and give the government wider powers over online expression.

- **Judicial concerns**: Some experts believe the amendments may attempt to bypass earlier court observations that questioned similar oversight mechanisms.
- **Targeting diverse online content**: Recent actions include removal or blocking of content such as satirical posts, critical commentary, and AI-generated media.

Focus on misinformation and deepfakes: The government maintains that the objective is to curb fake news, especially AI-generated deepfakes, and ensure responsible use of digital platforms.

ROCKET RE-ENTRY: A NEW SOURCE OF UPPER-ATMOSPHERIC POLLUTION

Context

Recent findings published in Communications Earth & Environment have provided the first direct observational evidence that spacecraft re-entry leaves a significant chemical footprint in Earth's upper atmosphere.

Major findings

- A Falcon 9 upper stage re-entered the atmosphere at approximately 100 km altitude off the coast of Ireland, creating a visible fireball and a persistent vapor plume.
- Hours later, the lidar system detected a sudden spike in lithium concentration at an altitude of 96 km, increasing by a factor of 10 times the natural baseline.
- Man-made vs. Natural: While meteors naturally deposit about 80g of lithium daily into the atmosphere, a single rocket stage can contain 30 kg of lithium (from batteries and Li-Al alloys). This massive disparity makes lithium a perfect "tracer" for human-induced pollution.

How Re-entry Pollutes the Atmosphere

When satellites and rocket stages reach the end of their life, they are designed to burn up in the atmosphere to prevent space debris from reaching the ground. However, this process creates "invisible" pollutants:

- **Vaporization:** As the spacecraft ablates (melts and evaporates) at temperatures exceeding 933 K, metals like aluminum, lithium, and copper are released as fine aerosols.
- **Chemical Sponges**: These metal particles stay in the upper atmosphere significantly longer than ground-based pollutants because there is no rain (washout) to remove them.
- **The "Plastisphere" of Space**: Much like microplastics in the ocean, these metal vapors are now being found in roughly 10% of stratospheric aerosols.

Emerging Ecological and Climate Risks

- **Ozone Layer Depletion:** Metal oxides can act as catalysts for chemical reactions that destroy ozone molecules, potentially slowing the recovery of the ozone layer.
- **Radiative Forcing:** High-altitude soot and metal particles may absorb or reflect sunlight, subtly altering Earth's temperature and climate patterns.
- **Ionospheric Disruption:** Large-scale re-entries can create "holes" in the ionosphere, potentially interfering with radio and GPS communications.
- **Night Sky Brightness:** Excessive lithium deposition could induce an "airglow," increasing night sky brightness and hindering ground-based astronomical observations.

GRID DISCIPLINE VS. USABLE POWER: BALANCING STABILITY AND UTILITY

Context

Sustainable energy transitions require a synergy between strict grid frequency management (grid discipline) and the actual availability of reliable, high-quality power for end-users (usable power).

Challenges in renewable energy sector

- **Frequency Fluctuations:** To prevent equipment damage or total grid collapse, frequency must stay within a tight band (**49.90 Hz to 50.05 Hz**). If demand exceeds supply, frequency drops; if supply is excessive, it rises.
- **Renewable Intermittency:** Integrating **500 GW of non-fossil capacity by 2030** complicates discipline.
    - Unlike steady base-load power (coal/nuclear), solar and wind fluctuate with weather, reducing "predictable usability."
- **Transmission Bottlenecks:** High generation in states like Rajasthan (solar) or Tamil Nadu (wind) often becomes "unusable" if transmission corridors are congested, regardless of how stable the grid frequency is.
- **Regulatory Penalties vs. Reality:** The **Deviation Settlement Mechanism (DSM)** penalizes utilities for frequency deviations. However, strict discipline without addressing aging infrastructure forces industries to rely on expensive, carbon-heavy diesel backups.
- **Resource Curtailment:** When a rigid grid cannot absorb sudden surges in renewable energy, that green power is "curtailed" (wasted), which disincentivizes long-term transition investments.
- **Information Asymmetry:** A lack of real-time, seamless data exchange between state-level distributors (**DISCOMs**) and the national grid controller hinders effective load balancing.

Suggested Measures for a Resilient Power Sector

To bridge the gap between technical stability and consumer utility, India must move beyond simple disciplinary penalties:

- **Energy Storage Systems (ESS):** Scale up **Battery Energy Storage (BESS)** and **Pumped Hydro** to store "undisciplined" excess renewable energy and release it as steady, "usable" power.
- **Smart Grid & Demand Response:** Transition to a "demand-follows-supply" model where industrial loads are incentivized to operate during peak renewable generation hours.
- **Flexible Transmission (FACTS):** Invest in **Flexible AC Transmission Systems** to enhance the carrying capacity of existing lines, ensuring stable power actually reaches the hubs where it is needed most.
- **Green Energy Corridors (GEC):** Accelerate the construction of dedicated transmission infrastructure to evacuate renewable power without congesting the main grid.

RETHINKING CLIMATE METRICS: ARE WE MEASURING GLOBAL WARMING ALL WRONG?

Context

A new study published in the UK-based journal Environmental Research Letters suggests that our current methods for measuring greenhouse gases are flawed.

The Flaw in Today's Carbon Accounting

Currently, climate policy relies on a common unit called Carbon Dioxide Equivalent

- **The GWP100 Multiplier:** To compare different gases, the world uses Global Warming Potential over a 100-year period (GWP100). For example, one tonne of methane is assigned a fixed value roughly 28 times that of CO2..
- **The Dilution Effect**: Methane is highly powerful but short-lived, while CO2 is less intense but lingers for centuries.
    - By averaging methane's impact over 100 years, its massive near-term warming effect is "diluted" on paper. This makes cutting methane emissions look less valuable than it truly is for slowing immediate warming.

The Proposed Solution: Radiative Forcing-based Accounting (RFA)

The study proposes a new framework called **Radiative Forcing-based Accounting (RFA)** to align carbon accounting with physical reality.

- **What is Radiative Forcing?** It measures how much a gas changes Earth's energy balance—the difference between incoming solar radiation and outgoing heat.
- **Sensitivity to Timing:** Unlike a fixed 100-year multiplier, RFA looks at how strongly a gas traps heat and how long it stays in the atmosphere. It recognizes that **cutting a tonne of methane today** is not the same as cutting it years later, as immediate reductions avoid warming much sooner.
- **Precision in Mitigation:** RFA accounts for a project's specific lifetime and the actual policy period rather than an arbitrary 100-year window.

The Impact of RFA on Carbon Markets

- When applied to real-world projects (like landfill gas in Guangzhou or waste diversion in Chandigarh), the study found that traditional accounting under-valued them by 36% to 40% compared to the RFA approach.
- Changing the calculation could revolutionize carbon markets. By assigning higher financial value to methane reduction, we can accelerate funding for projects that provide the "fastest" climate benefits.

Mains Exam Topics

DECLINE OF MAOISM AND FUTURE CHALLENGES

Context:

- Union Home Minister recently informed the **Lok Sabha** that **Naxalism** has been largely eliminated from the Bastar region of **Chhattisgarh**, marking a major milestone in the government's campaign to make India free of Maoist violence by March 2026.

Decline in Maoism

- **Leadership Loss:** Major Maoist leaders eliminated or surrendered (CPI-Maoist chief **Basavaraju killed in 2025 encounter**).
- **Cadre Neutralisation:** Large number of Maoists killed or surrendered (**531 Maoists neutralised in Chhattisgarh since 2024**).
    - E.g. Very few active Maoist cadres remain (**<40 active Maoists reported in Chhattisgarh**)
- **Organisational Collapse:** Top leadership weakened (**24 Politburo and Central Committee members killed/surrendered**).
- **Territorial Loss:** Security forces regained Maoist strongholds (**103 new security camps covering ~8,000 km² in Bastar region**). LWE-affected districts declined sharply (**~200 districts in early 2000s to 38 districts by 2025**).
- **Violence Decline:** LWE-related incidents and deaths reduced by **over 80% since 2010**.

Strategy to Tackling Maoism

- **Security Operations:** Intensified **joint operations by CRPF, state police and intelligence agencies** targeting Maoist leadership.
    - E.g. Under **Clear–Hold–Develop Strategy** security forces **clear insurgent zones, establish camps and enable civil administration**.
- **Area Domination:** Establishment of **forward police camps and security bases** in remote Maoist zones.
- **Infrastructure Push:** Expansion of **roads, bridges and connectivity projects in Maoist regions** (BRO road networks in Bastar).
    - Expansion of **road networks and bridges** to connect remote Maoist-affected areas (BRO built **75 km roads and 20 Bailey bridges in 15 months in Bijapur–Sukma region**).
    - Improving **all-weather transport access for remote villages** (benefits **25+ villages previously isolated during monsoon**).
    - Roads enable **faster troop movement and logistics support** in Maoist-dominated terrain (security forces earlier depended on **helicopters for supplies**).
    - **Strategic Corridors:** Key routes help monitor **Maoist movement corridors across state borders (Chhattisgarh–Telangana routes)**.
- **Development Outreach:** Improving **access to healthcare, education, markets and welfare schemes** in tribal regions.
- **Rehabilitation:** Encouraging **surrender and reintegration of Maoist cadres** through rehabilitation schemes.

- **Administrative Expansion:** Strengthening **governance presence in previously inaccessible areas**.
- **Technology Use:** Deployment of **AI surveillance, drone monitoring and data analytics** in security operations

What should the State do with the vacuum Maoists leave?

- **Governance Expansion:** Strengthen **schools, healthcare centres and welfare delivery** in remote tribal regions.
- **Local Institutionalisation:** Recruit **local youth into police, administration and governance structures**.
- **Sustained Security Presence:** Maintain **security camps temporarily** to prevent criminal or extremist groups filling the vacuum.
- **Development Acceleration:** Expand **roads, markets, telecom connectivity and livelihood opportunities** in tribal belts.
- **Administrative Responsiveness:** Ensure **efficient grievance redressal and accountable governance** to build state legitimacy.
- **Rehabilitation:** Reintegrate **surrendered Maoist cadres through livelihood and social rehabilitation schemes**.

Can Maoism—or Violent Far-Left Politics—Rise Again?

- **Remote Pockets:** Some forest regions remain poorly governed (**Abujhmad, Bastar interior**) where state presence is still weak.
- **Youth Discontent:** Unemployment and economic inequality may fuel radical mobilisation in some regions.
- **Ideological Adaptation:** Radical groups may shift to **urban issue-based activism** (land rights, environmental protests).
- **Local Grievances:** Land alienation, tribal displacement and mining conflicts can revive resentment against the state.