DISASTER MANAGEMENT GS PAPER III

Glacial Lake Outburst Floods (GLOFs) and India's Preparedness

Nepal recently witnessed successive GLOF events, including a July 2025 disaster along the Lende river, damaging infrastructure and hydropower. Rising temperatures and glacial melt are intensifying GLOF risks across the Himalayas, including India.

GLOF Events in Nepal:

- July 2025: Lende river GLOF destroyed a China-built bridge and crippled 4 hydropower plants (8% of Nepal's power).
- Same day: Moraine-dammed lake burst in Mustang.
- Earlier events: Humla (2025), Solukhumbu (2024 - destroyed Thame village).
- Historical: Cirenma Co (1981), Digi Tsho (1985), Tama Pokhari (1998).
- Nepal mitigated risk at **Imja Tsho and Tsho Rolpa** by drawing down water levels.
- Highlights **need for trans-boundary early warning protocols** (esp. China-Nepal).

GLOF Risk in India:

- Indian Himalayan Region (IHR): **11 river basins, 28,000 glacial lakes**; **7,500 lakes in India**, mostly >4,500m altitude.
- **Types of Lakes:**
    1. **Supraglacial lakes**: On glacier surface; prone to summer melting.
    2. **Moraine-dammed lakes**: Meltwater held by debris/ice-core; prone to sudden breaches.
- Triggers: Ice avalanches, landslides (⅔ events), excess meltwater pressure, earthquakes.
- Major incidents:
    - **South Lhonak GLOF (2023):** Destroyed Chungthang dam, raised Teesta riverbed.
    - **Chorabari GLOF (2013):** Led to Kedarnath floods.

    Challenges: Remote, high-altitude locations; lack of weather/water monitoring; dependence on post-facto remote sensing.

NDMA's Mitigation Measures:

- **Shift from response to risk reduction** via **Committee on Disaster Risk Reduction (CoDRR).**
- National programme ($20M) prioritised **56 high-risk lakes**, expanded to **195 lakes (4 risk levels).**
- **Five objectives:**
    1. Hazard assessment of each lake.
    2. Install **Automated Weather & Water Stations (AWWS).**
    3. **Early Warning Systems (EWS)** downstream.
    4. **Risk mitigation:** Draw down lake levels, build retention structures.
    5. **Community engagement** in expeditions and monitoring.
- Emphasis on **SAR interferometry** for slope stability, bathymetry, Electrical Resistivity Tomography (ERT), UAV surveys.
- ITBP deployed for manual early warning in high reaches.

Status & Way Forward:

- Expeditions (2024–25) in J&K, Ladakh, Himachal, Uttarakhand, Sikkim, Arunachal mapped lakes, installed AWWS in Sikkim.
- Plans to **scale up monitoring post-16th Finance Commission (FY2027-31).**
- **Gaps:** Sparse monitoring stations, limited Indian technology providers, need for stronger trans-boundary coordination and scientific expertise

Conclusion:

GLOFs pose a grave threat to Himalayan states, infrastructure, and communities. NDMA's proactive, technology-driven, and community-centric mitigation, combined with cross-border cooperation, is vital for long-term resilience.

CITIZENSHIP GS PAPER II

Clearing the Air on 'Citizenship' in Bihar Poll Roll Revision

- Objections raised against the Election Commission of India (ECI)'s Special Intensive Revision (SIR) of electoral rolls in Bihar, questioning verification of citizenship.
- Reveals lack of understanding of constitutional and legal provisions governing elections and citizenship.

Constitutional Framework

1. **Article 324**:
    - Vests the "superintendence, direction and control" of electoral rolls and conduct of elections in the ECI.

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2. **Article 326**:
   o Mandates elections based on **adult suffrage** (citizen of India + 18 years + not disqualified).
3. **Article 102 & 191**:
   o Disqualification for Parliament/State Legislature membership if not a citizen or if allegiance to a foreign state is shown.

Legal Provisions
1. **Representation of the People Act, 1950 (RPA 1950):**
   o **Section 15:** Preparation of rolls under ECI supervision.
   o **Section 16:** Disqualification from voter registration if not a citizen; erroneous inclusions to be struck off.
   o **Sections 21-24:** Roll revision, corrections, inclusion/exclusion, and appeals.
   o **Section 23(3):** No roll changes allowed after nomination deadlines.
2. **Citizenship Act, 1955:**
   o Citizenship determination for electoral rolls.
   o **Section 7B(2):** Overseas Citizens of India (OCI) cannot be voters.

Supreme Court Judgments:
- **Lakshmi Charan Sen v. A.K.M. Hassan Uzzaman (1985):** Electoral roll revision is continuous, not limited to election periods.
- **Dr. Yogesh Bhardwaj v. State of U.P. (1990):** Only lawful residence counts; illegal immigrants cannot claim "ordinary residence."

Role of Aadhaar in Citizenship:
- **Aadhaar Act, 2016 (Section 9):** Aadhaar is **not proof of citizenship or domicile**.
- It only establishes residence, not citizenship status.

ECI's Duty in Citizenship Verification:
- Mandatory for ECI to delete non-citizens' names from rolls under **Section 16(2) of RPA 1950**.
- Inclusion of non-citizens renders rolls **void ab initio**.
- Ensures only citizens can vote or contest elections.

Key Takeaways for UPSC:
- **Citizenship is a prerequisite** for voter registration and candidature in elections.
- ECI holds constitutional responsibility for roll verification and deletion of ineligible names.
- Aadhaar or voter ID alone does **not establish citizenship**.
- Legal framework robustly links **citizenship, suffrage, and legislative eligibility** to prevent electoral malpractice.

PRELIM FACTS

1. Gangaikonda Cholapuram Temple (History & Architecture)
- **Built by:** Rajendra Chola I (1014–1044 AD), son of Rajaraja Chola I.
- **Purpose:** Constructed after Rajendra Chola's victorious expedition up to the **Ganga river** and conquest of the **Pala Kingdom (Bengal)**.
- **Capital Shift:** Rajendra Chola shifted the Chola capital from **Thanjavur** to **Gangaikonda Cholapuram**.
- **Architectural Significance:**
   o Pinnacle of **Chola architecture**; often compared to Brihadeeswara Temple (Thanjavur).
   o Known for its intricate sculptures and grand scale.
   o Houses a massive **Shiva temple**, recognised as a **UNESCO World Heritage Site** under "Great Living Chola Temples."
- **Cholagangam Tank:**
   o A massive water reservoir built as a **symbol of victory** (Ganga-jalamayam jayasthambham – "liquid pillar of victory").
   o Represents Rajendra's campaign and symbolic bringing of the **Ganga water** to Tamil Nadu.
- **Chola Empire Extent:**
   o During Rajendra Chola's reign, empire stretched from **Ganga (north India)** to **Southeast Asia (Sumatra, Malaysia, Myanmar)** through naval expeditions.

Aadi Thiruvathirai Festival (Cultural Context)
- Celebrated in the Tamil month of **Aadi (July–August)**.
- Dedicated to **Lord Shiva (Nataraja)**, marking his cosmic dance (Thiruvathirai Star).

- In 2025, the festival coincides with **1,000 years of Rajendra Chola's maritime expedition** to Southeast Asia.
- Significant event linking **religion, culture, and Chola imperial glory**.

Political & Contemporary Context (PM Modi's Visit)

- PM Modi offered prayers at the temple (July 27, 2025) and released a **commemorative coin** honouring Rajendra Chola I.
- Announced plans for **grand statues of Rajaraja Chola and Rajendra Chola** in Tamil Nadu.
- Visit seen as highlighting **Chola maritime heritage and Tamil pride**, aligning with the **Centre's cultural outreach in South India**.
- Symbolically connects **Chola naval expansion** with India's current **maritime ambitions (Indo-Pacific focus)** and **civilizational pride**.

2. Android Earthquake Alert System (AEA)

Google and UC Berkeley's Seismology Lab have released a new global performance report of the Android Earthquake Alert (AEA) system.

- The system issued successful early warnings in 98 countries.

About Android Earthquake Alert System (AEA):

- **What is AEA?**
  - AEA is a **crowdsourced early warning system** that uses the **accelerometers** in Android smartphones to detect early seismic waves (P-waves) and send alerts **before destructive shaking (S-waves)**
- **Developed By:** Developed by Google in collaboration with the Seismology Laboratory of University of California, Berkeley.
- **How It Works?**
  - **Sensor Activation:** Android phones sense initial P-waves using onboard **accelerometers**.
  - **Crowdsourcing:** Data is sent to Google servers and cross-verified with signals from nearby devices.
  - **Real-time Processing:** If confirmed, servers estimate **epicentre**, **magnitude**, and **distance**.
  - **Alert Dispatch:** Warning is sent to users **before S-waves hit**, allowing 10–60 seconds of preparation.
- **Key Features:**
  - **Dual Alert Types:**
    - '**BeAware**' for mild shaking
    - '**TakeAction**' for strong tremors with override alerts
  - **Global Coverage:** Rolled out from the U.S. in 2020 to **98 countries** by 2024.
  - **User Impact:** Issued **79 crore alerts** and 79% of 1.5 lakh users found alerts highly useful.
  - **Algorithm Tweaks:** Reduced median error in quake magnitude estimates from 0.5 to 0.25.
  - **Accessibility:** Available on all Android devices with opt-in alert settings.
- **Significance:**
  - **Democratises Disaster Warning:** Extends early warning access from 25 crore to 250 crore people.
  - **Zero-Cost Infrastructure:** Utilises existing consumer smartphones—no additional sensors required.
  - **Time-Sensitive Alerts:** Provides crucial seconds for evacuation, safety, or halting transport systems.

3. Exercise Bold Kurukshetra 2025

The 14th edition of Exercise Bold Kurukshetra 2025 between India and Singapore began in Jodhpur, focusing on mechanised warfare and UN peacekeeping scenarios, further boosting bilateral defence ties.
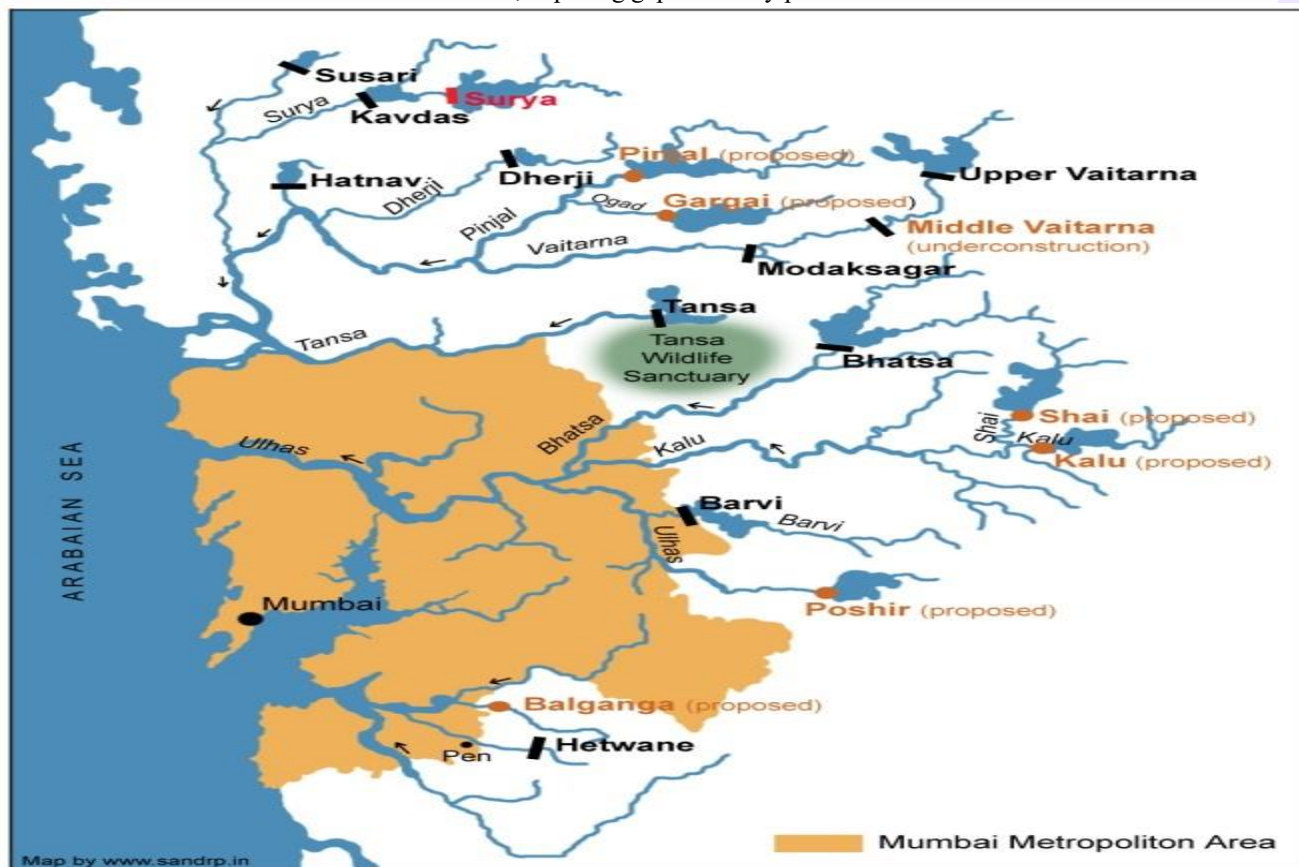
About Exercise Bold Kurukshetra 2025:

- **What Is It?**
  - A **bilateral military exercise** between the **Indian Army and the Singapore Armed Forces**, aimed at enhancing operational coordination, particularly under **United Nations mandates**.
- **Participating Nations:**
  - **India:** Mechanised Infantry Regiment
  - **Singapore:** 42nd Armoured Regiment, 4th Singapore Armoured Brigade
- **Key Features:**

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Plot-1441, Opp. IOCL Petrol Pump, CRP Square, Bhubaneswar-751015
Ph.: 8984111101, 8093083555, Web: www.vanikias.com, E-mail: vaniksias@gmail.com

- o **Format & Focus:** Conducted as a tabletop exercise and computer-based wargame to validate joint operational tactics in mechanised warfare.
- o **UN Mandate Simulation:** Emphasizes joint coordination during UN peacekeeping operations, enhancing combat readiness in multinational missions.
- o **Symbolic Handover:** Includes ceremonial regimental flag transfer to represent operational synergy and shared command spirit.
- o **Indian Army Showcase:** Culminates in a military equipment display, highlighting India's technological prowess and defence preparedness.
- o **Interoperability Training:** Reinforces tactical and strategic-level collaboration, improving joint mission execution capacity.
- **Strategic Significance**
  - o **Strengthens Indo-Pacific Security:** Reinforces India's strategic partnership with Singapore in a region marked by evolving security challenges.
  - o **Boosts Defence Diplomacy:** Serves as a model of military-to-military engagement, showcasing India's commitment to regional stability.
  - o **Capacity Building:** Enhances both armies' ability to operate jointly in multinational coalitions, especially under UN-led scenarios.

4. Kalu River

Over 300 trekkers were rescued in a 7-hour operation near the Kalu River in the Malshej Ghat region, after heavy rainfall caused a sudden rise in river water levels, exposing gaps in safety protocols in eco-tourism zones.

About Kalu River:
- **What is the Kalu River?**
  - o The Kalu River is a monsoon-fed river originating in the Kalsubai–Harishchandragad Wildlife Sanctuary, flowing through the Sahyadri ranges and finally draining into the Ulhas River.
- **Origin and Course**
  - o **Source:** Emerges from the Tolar Khind (Pass) near Harishchandragad Peak, close to Pimpalgaon Joga Dam in Pune district.

- o **Course:** Flows westward, forming Kalu Falls near Savarne–Malshej Ghat and traverses Khireshwar village.
  - o **Confluence:** Joined by **Doifodi** at Saralgaon and **Bhatsa River** near Ambivali.
  - o **Mouth:** Joins Ulhas River near Atali village. Ulhas then drains into Vasai Bay of the Arabian Sea.
  - o **Drainage Basin:** Acts as part of the west-flowing Konkan drainage system.
- **Key Features:**
  - o **Geological Transition:** It cascades from the **Deccan Plateau to the Konkan region**, creating dramatic waterfalls like Kalu Falls (1200 ft).
  - o **Ecological Zone:** Flows through wildlife-rich forests, including Kalsubai–Harishchandragad Sanctuary, home to leopards, snakes, and endemic flora.
  - o **Rainwater Hijacking:** Experts claim the river diverted upper Mula River flows, depriving Ahmednagar and Marathwada of needed rainwater.
  - o **Tourist Attraction:** Its scenic beauty draws thousands, but steep terrain, flash floods, and slippery trails make it hazard-prone.
  - o **Socio-Hydrological Impact:** Despite high rainfall, Konkan's excess water drains into the sea unused, highlighting the need for water diversion infrastructure.

ANSWER WRITING

Q. The ongoing ethnic conflict between the Kuki and Meitei communities in Manipur reflects deep-rooted historical and political fault lines. Analyse the root causes of the Manipur crisis and discuss the administrative and political measures necessary to bridge this crisis and restore lasting peace in the region. (10 Marks, 150 words)

Introduction

Manipur's turmoil has compelled the rare but justified **extension of President's Rule for another six months**, signalling a **constitutional breakdown and severe internal security challenge**. Despite a **crackdown on militant groups, reduced open violence, and some displaced families returning**, the **Kuki-Zo–Meitei ethnic and political schism** remains unbridged, with **buffer zones rigidly segregating communities** and polarised demands hardening.

Root Causes of the Manipur Crisis

- **Deep ethnic schism & competing political projects:** The core conflict is ideological and territorial, **Kuki-Zo groups demand separate administration**, while hardline Meitei groups label fellow citizens "outsiders."
- **Militant impunity and ethnic militarisation:** Armed groups acting for ethnic interests long enjoyed **impunity**, entrenching violence as a political language.
- **Spatial segregation through buffer zones:** Buffer zones rigidly segregate communities, institutionalising mistrust and preventing everyday reconciliation.
- **Governance bias & silencing of moderates:** Biased governance deepened alienation, civil society actors who critiqued it were hounded, shrinking the space for reconciliation.
- **Collapse of the elected government & trust deficit:** Post-resignation, violence dipped and some families returned, but the schism persists.
- **President's Rule as symptom, not cure:** While constitutionally valid in crises, President's Rule cannot substitute for reconciliation and political settlement.
  Eg: The extension of President's Rule reflects constitutional breakdown, but success "should not be measured by absence of violence alone."

Administrative & Political Measures to Bridge the Crisis and Restore Peace

- **Sustained de-weaponisation & defanging of militants:** Continuing to dismantle armed capacities ends the **aura of impunity** and empowers moderates.
- **Rebuild rule of law:** Guaranteeing space for **critical civil society voices** encourages reconciliation narratives to surface.
- **Structured political dialogue:** A transparent, Centre-facilitated, multi-stakeholder process must engage Kuki-Zo demands for separate administration and Meitei insecurities.
- **Shared political responsibility:** National parties must **actively lead**, and **regional parties & civil society** must **defy hardliners** to craft consensus.
- **Reconfigure/soften buffer zones through confidence-building:** Gradual dismantling or flexible management of buffer zones, with monitored returns, can normalise inter-community contact.
  Eg: Some displaced families returning since May 2023 shows calibrated reintegration is possible.
- **Time-bound roadmap under President's Rule:** Use the President's Rule window to set milestones dialogue, de-weaponisation, civil society protection and restore a representative government.

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Conclusion

Manipur's crisis reflects deep ethnic-political fault lines, not just law-and-order failure. Lasting peace requires a Centre-led, inclusive political process that protects civil society, curbs militancy, ends segregation, and fosters reconciliation measured by restored trust, not temporary calm.

MCQ

1. Consider the following statements about Gangaikonda Cholapuram Temple:
   1. It was built by Rajaraja Chola I after his conquest of Sri Lanka.
   2. The temple is part of the UNESCO World Heritage Site "Great Living Chola Temples."
   3. The Cholagangam Tank at the site symbolises Rajendra Chola's victorious Ganga expedition.
   Which of the statements given above is/are correct?
   (a) 1 and 2 only   **(b) 2 and 3 only**
   (c) 1 and 3 only   (d) 1, 2 and 3

2. The Aadi Thiruvathirai festival, recently in news, is associated with:
   (a) Lord Vishnu and the Vaikunta Ekadashi ritual
   (**b) Lord Shiva's cosmic dance (Nataraja form)**
   (c) Lord Murugan and the Thaipusam celebrations
   (d) Goddess Parvati and the Navaratri observance

3. The Android Earthquake Alert System (AEA), recently reported in 98 countries, works primarily by:
   (a) Deploying satellite-based seismic sensors for real-time detection
   (b) Using smartphone accelerometers to crowdsource early detection of P-waves
   (c) Integrating government-run seismic stations into Android software
   (d) Relying on AI-driven simulation of tectonic activity to predict quakes

4. With reference to Exercise Bold Kurukshetra, consider the following statements:
   1. It is a trilateral naval exercise involving India, Singapore, and Thailand.
   2. The exercise focuses on mechanised warfare and UN peacekeeping scenarios.
   3. It involves participation of India's Mechanised Infantry Regiment.
   Which of the statements given above is/are correct?
   (a) 1 only   **(b) 2 and 3 only**
   (c) 1 and 2 only   (d) 1, 2 and 3

5. Which of the following rivers originates in the Kalsubai–Harishchandragad Wildlife Sanctuary and ultimately drains into the Arabian Sea via the Ulhas River?
   (a) Savitri River   **(b) Kalu River**
   (c) Bhima River   (d) Kundalika River

6. The Android Earthquake Alert System (AEA) is significant because it:
   1. Provides cost-free early warning by using consumer smartphones as sensors.

2. Extends earthquake early-warning access globally without extra infrastructure.
   3. Offers alerts only to premium Android users in seismically active regions.
   Which of the statements above is/are correct?
   (a) 1 and 2 only   (b) 2 and 3 only
   (c) 1 and 3 only   (d) 1, 2 and 3

7. Consider the following statements about Glacial Lake Outburst Floods (GLOFs):
   1. Moraine-dammed lakes are formed when meltwater is blocked by glacial debris or ice cores.
   2. Ice avalanches and earthquakes are major triggers of GLOFs.
   3. The 2013 Kedarnath floods were partly caused by a GLOF event.
   Which of the statements given above is/are correct?
   (a) 1 and 2 only   (b) 2 and 3 only
   (c) 1, 2 and 3   (d) 1 only

8. With reference to NDMA's measures to mitigate GLOF risks, which of the following is/are correct?
   1. Installation of Automated Weather & Water Stations (AWWS) in high-risk lake zones is a key step.
   2. SAR interferometry and UAV surveys are used for monitoring slope stability and lake mapping.
   3. Manual early warning systems in remote regions are assisted by the Indo-Tibetan Border Police (ITBP).
   Select the correct answer using the code given below:
   (a) 1 only   (b) 1 and 2 only
   (c) 2 and 3 only   **(d) 1, 2 and 3**

9. Under which of the following Articles is the conduct and supervision of elections, including electoral rolls, vested in the Election Commission of India?
   (**a) Article 324**   (b) Article 326
   (c) Article 102   (d) Article 21A

10. Which of the following statements is/are correct regarding the relationship between Aadhaar and citizenship in India?
    1. Aadhaar is valid proof of Indian citizenship.
    2. Under Section 9 of the Aadhaar Act, 2016, it is not proof of citizenship or domicile.
    3. Citizenship status for electoral rolls is determined under the Citizenship Act, 1955.
    (a) 1 and 2 only   **(b) 2 and 3 only**
    (c) 1 and 3 only   (d) 1, 2 and 3