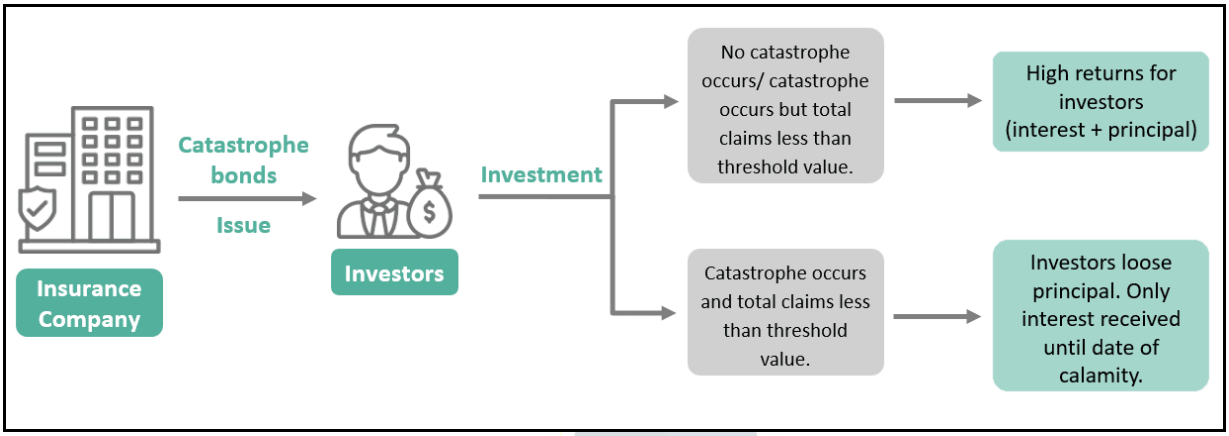
Today's Prelims Topics

Cat Bonds (Catastrophe Bonds)

Context

In the times of unpredictability and increase in frequency of extreme weather events like cyclones, floods, forest fires and devastating earthquakes in South Asia, highlights the need of cat bonds.

What is Cat Bond?



- They are a type of insurance-linked security that allows risk transfer of large-scale disaster events (like earthquakes, hurricanes, or floods) from the issuer (often a government or insurer) to investors in the financial market.
- **Purpose:** They provide quick post-disaster funds for recovery and reconstruction by converting insurance risk into tradable securities.
- **How is a Cat Bond Issued?**
    - **Sponsorship:** Typically, a sovereign government, insurer, or reinsurer (the "sponsor") identifies specific disaster risks to insure against (e.g., a cyclone of a certain magnitude).
    - **Intermediary:** The sponsor works with an intermediary (e.g., World Bank, Asian Development Bank, or a reinsurance company) to structure and issue the bond.
    - **Investment:** Investors purchase the bonds, providing upfront capital (the "principal").
    - **Terms:** The bond outlines trigger conditions (e.g., earthquake above magnitude 7), duration, and payout mechanisms.
    - **Premiums & Coupons:** The sponsor pays periodic premiums (high coupon rates) to the investors for taking on the risk.

- Catastrophe bonds **yield high returns**, but the **risk factor is also high.**
- Globally, about **$180 billion** in new cat bonds have been issued, with **$50 billion** outstanding.

Does India Need Cat Bonds?

- Yes, due to increasing frequency of **climate disasters** (cyclones, floods, heatwaves, forest fires).
- Rising **losses for insurers** make disaster insurance unviable.
- India spends **₹1.8 billion annually** on disaster mitigation.
- Could lead a **South Asian regional cat bond** effort for shared threats (e.g., earthquake zones in Bhutan, Nepal, tsunami risks in India, Sri Lanka, Maldives, etc.).

Pros of Cat Bonds	Cons of Cat Bonds
Risk diversification	Trigger risk – if meet pre-defined trigger parameters, no payout.

Rapid payouts	High costs (higher coupon rates)
Portfolio diversification	Structural complexity
Access to global capital	Limited investor interest (market size)
Encourages mitigation	Potential for risk mispricing

Source: The Hindu

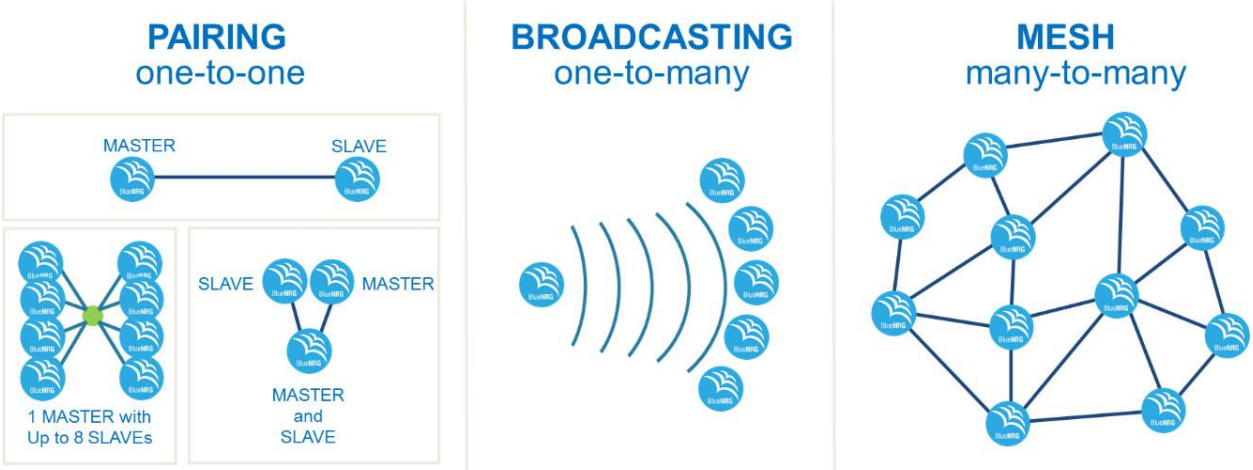
Bluetooth Mesh Networking

Context

Twitter co-founder **Jack Dorsey** has introduced **Bitchat**, a beta-stage messaging app that uses **Bluetooth mesh technology**.

Bluetooth Mesh Networking

- **What is Bluetooth Mesh?**
  - A **many-to-many (m:m)** wireless communication protocol based on **Bluetooth Low Energy (BLE)**.
  - Designed for **large-scale device networks**, such as in **smart buildings**, **industrial automation**, and **IoT ecosystems**.



- **How It Works**
  - Uses a **flooding message system**, where messages are relayed across nodes until they reach their destination.
  - Devices/nodes in the mesh can **send, receive, and relay** messages, ensuring robust connectivity.
- **Key Features**
  - **Scalability**: Supports **thousands of nodes** in a single network.
  - **Reliability**: Message redundancy and multi-path routing make it resilient.
  - **Security**: End-to-end encryption and authentication at the device and network level.
  - **Low Power Consumption**: Built on **BLE**, ensuring energy efficiency.
- **Advantages over Traditional Bluetooth**
  - Traditional Bluetooth is **point-to-point** or **star topology**.
  - Mesh allows for **extended range**, **no single point of failure**, and **better coverage**.
- **Applications**
  - **Smart lighting systems**
  - **Asset tracking**
  - **Environmental monitoring**
  - **Building automation**
  - **Industrial IoT**
- **Standardization**
  - Developed by the **Bluetooth Special Interest Group (SIG)**.
  - Fully compliant with **Bluetooth 4.0 and above**.

Source: TheHindu

MALE Class Drones

Context

The Indian government is **procuring 87 MALE drones** from **local manufacturers** under the **Make in India** initiative.

About MALE-Class Drones (Medium Altitude Long Endurance)

- **MALE-class drones** are **unmanned aerial vehicles (UAVs)** that operate at **medium altitudes** and are capable of **long-endurance missions**.
- They are designed for **real-time surveillance, intelligence gathering, reconnaissance**, and can be equipped for **combat roles**.
- **Altitude:** Operate up to ~35,000 feet.
- **Endurance:** Can fly continuously for **over 30 hours**.
- **Capabilities:**
    - Real-time **intelligence and surveillance**.
    - **Reconnaissance** over land and sea.
    - Can operate in **diverse terrains and weather conditions**.
    - May be armed for **strike missions** (if equipped).
- **Payloads:** High-resolution cameras, sensors, communication equipment, and sometimes precision-guided munitions.
- **Strategic Importance:**
    - Enhance **self-reliance** in defence.
    - **Reduce dependence on foreign suppliers** (previously sourced from Israel).
    - Improve **surveillance over Eastern and Western borders**.

Source: TheHindu

Marlin Fish

Context

A **28-year-old man went missing** off the coast of Kerala after reportedly engaging in a dangerous duel with a **marlin fish**.

What Is a Marlin?

- **Family & species**
  - **Marlins belong to the billfish group** (*Xiphioidea*), within the family **Istiophoridae**.
  - They are **related to swordfish**, but taxonomically closer to **tuna and mackerels**.
  - There are **around 10–11 recognized species** of marlin.
- **Size & Appearance**

Species	Length	Weight	Notable Features
Blue marlin (*Makaira nigricans*)	Up to 5 m (14–16 ft)	≈900 kg (2,000 lb)	Cobalt-blue above, silvery below, tall dynamic dorsal fin.
Black marlin (*Istiompax indica*)	Over 5 m	>670 kg; record ≈700 kg	Rigid, non-retractable pectoral fins, renowned speed
Striped marlin (*Kajikia audax*)	Up to ~4.2 m	~220 kg	Bluish vertical stripes, can glow before hunting

- **All marlins feature:**
  - A **long spear-like bill** used to slash and stun prey.
  - Highly streamlined bodies, deep forked tails, and powerful muscles adapted for high-speed bursts.
- **Speeds & Hunting**
  - Among the **fastest fish**: Striped marlin clock ~110 km/h, black marlin are comparable
  - **Hunting method**: They slash through schools of smaller fish (tuna, mackerel, sardines), stunning them before catching
  - The striped marlin exhibits intriguing **fluorescent "glow" behavior** before attacks—likely coordination or confusion tactics
- **Distribution & Lifecycle**
  - Highly **migratory**, crossing entire ocean basins—blue marlin have been tagged moving from the Atlantic to Indian Ocean
  - **Habitat**: Prefer warm, open-water ("blue-water") pelagic zones above ~20 °C
  - **Reproduction**: Broadcast spawners—one female can release millions of eggs; marlin larvae are pelagic
- **Physiology & Adaptations**

  - Like other billfish, marlins have a **counter-current heat exchanger** to warm their brain and eyes—enhancing hunting focus and vision
  - **Color-change ability**: Marlins can shift skin patterns rapidly via iridophores and chromatophores—used for camouflage, communication, and the striped marlin's glow
- **Status & Conservation**
  - **Blue and white marlin** are listed as **Vulnerable**, due to intense fishing and bycatch
  - **Black marlin** status is data-deficient, but concerns arise from overfishing and sports fishing pressure
  - **Conservation measures**: Legislation like the US Billfish Conservation Act, catch-and-release programs, and tagging initiatives help track and protect them
- **Why They Captivate Humans**
  - **Sport fishing icons**—hooking a marlin is considered the ultimate big-game achievement
  - **Cultural lore**: Featured in Hemingway's *The Old Man and the Sea*, and names of sports teams (e.g., Miami Marlins)

Source: IndianExpress

Polycyclic aromatic hydrocarbons (PAHs)

Context

- Recent research shows that certain PAHs (like the indenyl cation, C9H7+) can cool down very quickly after absorbing high-energy light, preventing them from breaking apart.
    - This helps explain why so many PAHs survive in space.

What are PAHs (Polycyclic Aromatic Hydrocarbons)?

- They are molecules made entirely of carbon and hydrogen.
- They have a special structure: their atoms form multiple interconnected rings, like a honeycomb or chain of hexagons.
- **Key Facts About PAHs:**
    - **Found Everywhere:** PAHs are found on Earth (for example, in smoke from fires, grilled food, and fossil fuels), but they're also common in space. Astronomers estimate that PAHs make up about **one-fifth of all carbon in interstellar space**.
    - **Possible Origins of Life:** Some scientists believe that PAHs arrived on Earth via meteors, possibly helping create the first building blocks of life. Their ability to survive harsh space environments adds to this theory.
    - **Interstellar Survivors:** In places like the **Taurus Molecular Cloud 1 (TMC1)** — a vast, cold region of gas and dust in space — PAHs are found in larger quantities than expected, even though they are exposed to strong starlight that can break molecules apart.
    - **Molecular Structure:** PAHs can be "open-shell" or "closed-shell." This describes how their electrons are arranged. Closed-shell PAHs have electrons paired up, which can affect how they handle energy.
    - **Why They Matter in Space:** PAHs are important in space chemistry. Their survival and growth help spread carbon — a key ingredient for life — to planets and comets.

Source: The Hindu

Also in News

➔ Prime Minister Narendra Modi was conferred with **Namibia's highest civilian award**, **'Order of the Most Ancient Welwitschia Mirabilis'**.

➔ The Ministry of Home Affairs has stated that **no final decision** has been taken yet on **updating** the **National Population Register (NPR).**

- **What is NPR?**
  - It is a comprehensive identity database of every **"usual resident"** (resided in an area for the past 6+ months) in India.
  - First created in 2010 alongside Census 2011; updated in 2015-16.

➔ **Gambhira bridge collapsed** in **Vadodara** (Gujarat).

- **What were the issues behind?**
  - **Ignored Warnings:** Multiple official warnings about the bridge's unsafe condition had been issued since 2021 but were ignored by authorities.
  - **Suppressed Technical Report**: A 2022 technical report declared the bridge "unfit for use," yet this report was hidden and no action was taken.
    - Despite repeated alerts from citizens and political figures, the **Roads & Buildings department failed to close or adequately repair the bridge**.
  - **Aging Infrastructure Under Strain:** The bridge, built in 1985–86, had surpassed its intended lifespan (around 40 years) and suffered from heavy, unauthorized vehicles (toll-evading trucks), accelerating decay.
- **Implications:**
  - **Infrastructure-age crisis**: Many mid-1980s bridges across India are now outliving their safe operational lifespan.
  - **Regulatory failures**: Ignored studies and suppressed negative reports erode public trust.
  - **Need for urgent reform**: Bridges spanning rivers or key routes—such as this vital Vadodara–Anand link—require proactive structural health monitoring and timely closure when deemed unsafe.
- **Similar past incident in Gujarat: Morbi bridge collapse** in 2022.

Editorial Summary

GM Crops in India

Context

US negotiators are increasing pressure on India to open its agriculture market to genetically modified (GM) crops.

What are GM Crops?

- They are plants whose DNA has been altered using genetic engineering techniques to introduce desirable traits—such as resistance to pests, diseases, herbicides, or environmental conditions, and improved nutritional content.
- This is done by inserting genes from unrelated species, resulting in crops that do not occur naturally.

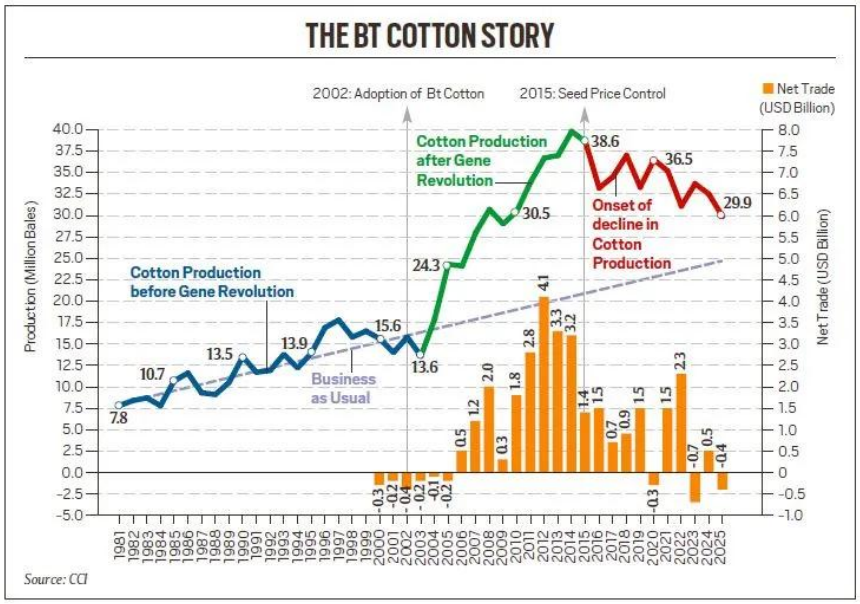
Historical Background of GM Crops in India

- **1990s:** Research on GM crops begins in India.
- **2002:** Bt cotton (genetically modified to resist bollworm) becomes the first and only GM crop commercially approved in India, under the Vajpayee government.
- **Post-2002:** Bt cotton adoption rises sharply—over 90% of India's cotton area is under Bt cotton by 2020s.
- **2009:** Bt brinjal (eggplant) is developed but put under indefinite moratorium due to public and scientific concerns.
- **2016–2022:** GM mustard (DMH 11) developed by Delhi University receives in-principle approval from GEAC in 2016 and conditional environmental release in 2022, but full commercialisation is on hold pending further regulatory and legal review.
- **Present:** Only GM cotton is legally grown. Other GM crops (brinjal, mustard, soybean, corn) remain unapproved for commercial cultivation.

Concerns Associated with Acceptance of GM Crops

- **Food Safety:** Fears of allergenicity, toxicity, or unforeseen health impacts.
    - Lack of long-term studies on human health effects.
- **Environmental Risks:** Potential for cross-pollination with wild relatives or non-GM crops ("gene flow").
    - Evolution of super-pests and herbicide-resistant weeds.
    - Threat to biodiversity and non-target species (e.g., pollinators).
- **Socio-Economic Issues:** Dependence on a few multinational seed companies.
    - High seed costs for farmers.
    - Risk of illegal and unregulated GM seed circulation.
- **Regulatory and Ethical Issues:** Lack of transparency and public consultation.
    - Insufficient biosafety testing and regulatory capacity.
    - Ethical concerns about tampering with nature and food systems.
- **Trade Concerns:** Potential loss of export markets to countries that ban GM imports.

Impact of GM Crops in India



Positive:

- Bt cotton led to a dramatic increase in cotton yields (87% rise in productivity from 2002–2014).
- Cotton production tripled, making India a leading exporter.
- Reduction in pesticide use against bollworms, improved farmer incomes.

Negative:

- Recent stagnation and decline in cotton yields (from 566 kg/ha in 2013–14 to ~436 kg/ha in 2023–24) due to pest resistance and regulatory hurdles.
- Spread of illegal GM cotton seeds (HT-Bt), leading to unregulated farming and farmer vulnerability.
- Stalled innovation and technology adoption due to restrictive government policies and regulatory delays.
- India shifted from a net exporter to a net importer of cotton post-2015.

How Can the Challenges Be Resolved?

- **Strengthen Science-based Regulation:** Ensure robust, transparent, and independent biosafety assessment processes.
    - Regularly update and empower the Genetic Engineering Appraisal Committee (GEAC).
- **Foster Public Engagement:** Increase transparency in approval processes.
    - Educate the public and farmers on GM crops' risks and benefits.
- **Incentivize Innovation:** Rationalize seed pricing and trait fees to attract private investment in R&D.
    - Provide IP protection while ensuring affordable access.
- **Monitor and Manage Risks:** Develop strategies to counter pest resistance and regulate illegal seeds.
    - Promote crop rotation and integrated pest management.
- **Policy Clarity and Political Leadership:** Move towards clear, long-term policies favoring technology adoption.
    - Expedite approval of proven GM crops (HT-Bt cotton, Bt brinjal, GM mustard) after thorough risk assessment.
- **Learn from International Best Practices:** Learn from global experiences (e.g., the US, Brazil, China) in safe GM crop deployment and post-release monitoring.

Source: Indian Express

End Custodial Deaths

Context

Custodial deaths in Tamil Nadu highlighting the urgent need for human-centric policing reforms and legislative safeguards across India.

Issues Behind Custodial Deaths

- **Normalisation of Violence:** Use of force is routine, with torture seen as an investigative shortcut.
    - **E.g.,** Ajith Kumar (2025) suffered 44 injuries and torture in custody; Vignesh (2022) died with multiple injuries hours after detention.
- **Neglect of Mental Health:** Minimal investment in officers' psychological care leads to burnout and aggression.
- **Poor Training:** Outdated training ignores ethics, human rights, and trauma-informed policing.
- **Lack of Accountability:** Perpetrators are rarely prosecuted; suspensions are superficial.
    - **E.g.,** After the death of Raja (2024), only minor suspensions occurred; no convictions in many high-profile custodial deaths (e.g., Jayaraj-Bennicks, 2020).
- **Inadequate Oversight:** CCTV systems are non-operational or tampered with; real-time monitoring is lacking.
- **Weak Legal Framework:** No comprehensive anti-custodial violence law with time-bound investigations.

Reforms to Undertake

- **Budget Reallocation:** Allocate a portion of the policing budget (e.g., 5%) for district-level mental health units and mandatory counselling, similar to Kerala Police's mental health support programs.
- **Modernise Training:** Include ethics, human rights, community policing, and trauma management.
- **Legislative Action:** Enact a strong anti-custodial violence law, inspired by the Prevention of Torture Bill (yet to be passed in India), and as recommended by the Law Commission 273rd Report (2017).
- **Strengthen Oversight:** Ensure tamper-proof, real-time CCTV monitoring, as mandated by Supreme Court in the Paramvir Singh Saini case (2020).
- **Accountability Mechanisms:** Implement time-bound, independent investigations into custodial deaths.
- **Institutionalise Mental Wellness:** Mandate regular psychological assessments and quarterly counselling for officers, as piloted in Bengaluru City Police.

Source: The Hindu

Minding the Minerals Gap

Context

India faces strategic and economic risks in its green transition due to heavy reliance on imports of critical minerals, prompting engagement in international "mineral clubs" for supply security and resilience.

Why India Engages in Minerals Clubs ("Minilaterals")

- **Diversify and Secure Supply Chains:** Reduce dependence on China for critical minerals needed for EVs, solar, batteries, and semiconductors.
    - **Example:** Quad Critical Minerals Initiative and Minerals Security Partnership (MSP).
- **Collaborative Advantage:** Access to advanced technology, finance, and R&D through joint ventures with countries like Japan, Australia, and the US.
- **Overcome Domestic Gaps:** Indian companies lack extraction technology and face financial constraints; clubs help pool resources and de-risk overseas ventures.
- **Market Influence & ESG Standards:** Shape global environmental, social, and governance (ESG) standards and supply chain rules, presenting the Global South perspective.
- **Championing the Global South:** Leverage ties with Africa/Southeast Asia for fairer mineral trade and as a bridge between North and South.

Key Issues and Challenges

- **Technology and Investment Gaps:** Indian firms struggle with advanced mining tech and financing.
    - Hesitancy to invest in unstable jurisdictions abroad.
- **Risk of Low Value Addition:** India could become only a processing or transit hub, with higher value activities staying in developed countries.
- **Protectionism and Uncertain Access:** "Friendly stockpiling" agreements can break down due to geopolitical shifts, tariffs, or changing governments.
- **Slow Technology Transfer:** Developed countries may restrict sharing of cutting-edge tech and IP, as seen in vaccines and clean tech.
- **ESG Compliance Pressure:** Need to align with high global ESG standards, which can be resource-intensive for Indian firms.

Way Forward

- **Negotiate R&D and Tech Transfer Clauses:** Ensure mineral agreements include mandatory investment in Indian R&D, technology access, and academic exchanges.
- **Strengthen Domestic Capacity:** Invest in advanced exploration, mining, and refining capabilities at home; scale up battery, EV, and material manufacturing.
- **De-risk Overseas Ventures:** Develop blended finance and export credit mechanisms to support Indian companies abroad, especially in risky countries.
- **Clear, Reciprocal Agreements:** Push for transparent governance, defined access rights, and protection from abrupt restrictions in mineral clubs.
- **Lead ESG Standard-Setting:** Use club membership to advocate for ESG standards reflecting India's context and the broader Global South.
- **Integrate Value Chains:** Promote vertical integration from mining to manufacturing, preventing India from being just a demand centre.
- **Balance Global and Domestic Priorities:** Ensure all international partnerships complement India's "Make in India" and "Atmanirbhar Bharat" goals.

Source: Indian Express