Today's Prelims Topics

Hawkeye 360 Technology

Context

The United States has approved the sale of HawkEye 360 technology to India.

What is Hawkeye 360 Technology?

- It operates a **constellation of satellites in Low Earth Orbit (LEO)** designed to detect, geolocate, and analyze **Radio Frequency (RF) signals**.
- This allows users to:
    - Detect vessels even when they turn off AIS (Automatic Identification System) transponders ("**go dark**"),
    - Monitor RF activity in remote or contested areas,
    - Support military intelligence, maritime security, and spectrum monitoring.

Impact of HawkEye 360 on India

- **Enhanced Maritime Domain Awareness (MDA):** India will be better equipped to monitor its vast coastline and maritime interests, especially in the **Indian Ocean Region (IOR)**.
- **Detection of 'Dark Ships':** Ships that disable AIS to evade detection — often used in **illegal fishing, smuggling, or unauthorized surveillance** — can now be tracked via their RF emissions.
- **Surveillance of the Exclusive Economic Zone (EEZ):** The technology strengthens India's ability to safeguard its EEZ, ensuring better enforcement of **sovereignty and resource rights**.
- **Support to Naval and Coast Guard Operations:** Real-time and historical RF data enhances **mission planning, threat detection**, and **situational awareness**.
- **Indigenous Capability Building:** With training and software support included, India can **integrate this tech with existing platforms like P8i aircraft**, improving multi-source data fusion.

Difference Between Hawkeye 360 Technology & RADAR System

Feature / Aspect	RADAR System	HawkEye 360
Technology Base	Active detection using **radio wave reflections**	Passive detection using **radio frequency (RF) emissions**
Type of System	**Active** — emits signals and detects reflections	**Passive** — listens for and locates existing RF signals.

Hawkeye Technology in Sports

- Hawk-Eye uses 6 to 10 high-speed cameras placed around the playing area, typically on the stadium roof or strategic vantage points.
- The **cameras capture the ball's movement** from multiple angles, and the system uses triangulation to **calculate the ball's exact 3D position** at any moment.
- By **processing these images frame by frame**, Hawk-Eye **reconstructs the ball's path, predicts its future trajectory, and determines interactions with key features (like lines or stumps)**.
- The system provides visualizations and statistical data, which can be used instantly by referees, coaches, and TV audiences

Key Uses in Major Sports

Sport	Main Uses
Cricket	LBW (Leg Before Wicket) decisions, ball trajectory, bowler analysis
Tennis	Line calls (in/out), player challenges, match statistics
Football	Goal-line technology, offside detection, VAR support
Rugby	Try verification, ball tracking
Badminton	Line calls, shuttle trajectory

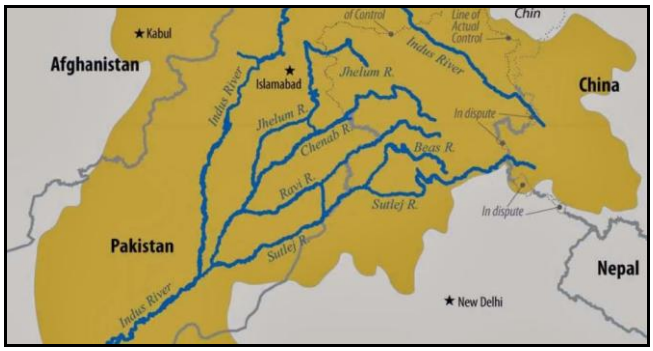
Source: [Newsonair: US approves sale of HawkEye 360 technology to India to boost the country's surveillance capabilities]

Chenab River

Context

Parts of the Chenab River in parts of Jammu and Kashmir near Pakistan started to dry up after India closed all the gates of the Baglihar Hydroelectric Power Project and Salal Dam.

About Chenab River



- **Origin and Course:** Chenab is a significant river in the **Indus River basin**.
    - It originates from the confluence of the **Chandra and Bhaga rivers** in **Himachal Pradesh**.
    - The river flows through **Jammu & Kashmir** before entering **Pakistan**, eventually merging with the **Sutlej River** to form the **Panjnad**, which later joins the **Indus**.

Fun Fact

- The **world's highest railway bridge**, the **Chenab Rail Bridge**, has been constructed over this river.

- **Historical Significance:** In ancient texts:
    - Known as **Askini** (meaning "dark-coloured waters") in the **Rig Veda**.
    - Referred to as **Krishana** in the **Atharva Veda**.
    - During the **Mahabharata** period, it was called **Chandrabhaga**.
- The **Greeks** recorded it with names like **Snadrophagos**, **Sandabaga**, and **Cantabra**.
- The present name **"Chenab"** evolved under **Persian influence**.
- **Major Hydroelectric Projects:** Prominent projects on the Chenab include:
    - **Baglihar Project**
    - **Salal Dam**
    - **Ratle Project**
    - **Dul Hasti Project**
    - **Kishtwar Project**
    - **Kiru Project**
- **Water Sharing and Treaty Provisions:** As per the **Indus Waters Treaty**, the Chenab is categorized as a **western river**, with its waters primarily allocated to **Pakistan**.
    - However, **India** retains rights to develop **run-of-the-river hydroelectric projects** on the Chenab, without altering its flow significantly.

Source: Indian Express: Chenab River Dries Near Pak.

One Day One Genome

Context

The Department of Biotechnology (DBT) has over the past five months released detailed graphical summaries, infographics, and other details of over 100 bacterial genomes as part of the 'One Day One Genome' initiative.

About One Day One Genome Initiative

- **Launched by:** Department of Biotechnology (DBT) and Biotechnology Research and Innovation Council (BRIC)
- **Announced**: On November 9, 2024.
- **Aim:** To **publicly release one annotated microbial genome each day**, enhancing access to microbial genomic data for researchers and the scientific community.
- **Key Objectives:** Showcase **unique bacterial species** found in India.
    - Highlight the role of microbes in **environmental health, agriculture**, and **human well-being**.
- **Significance: Promotes innovation** in microbial genomics by systematically uncovering and studying previously unknown microbes.
    - Supports the implementation of **India's BioE3 policy** (Biotechnology for Economy, Environment, and Employment).
    - Aims to **unlock India's microbial potential**, boosting research and industrial applications.
    - Expected to **generate employment** and **stimulate the startup ecosystem** within the biotechnology sector.

Source: Indian Express: Lets Celebrate Invisible Biodiversity

Carbon Border Adjustment Mechanism (CBAM)

Context

Western labour and environmental standards remain a hurdle for Indian trade negotiators, with the UK's proposed carbon tax emerging as a major sticking point in the latest trade talks in London.

More in News

- The ongoing dialogue spans 3 separate but interconnected pacts—**the FTA, a bilateral investment treaty, and a social security agreement** officially known as the **Double Contribution Convention Agreement.**

What is the EU's Carbon Border Adjustment Mechanism (CBAM)?

- It is a proposed policy that would place a **price on the carbon content of certain imported goods.**
- Its **primary objective** is to avert **'carbon leakage',** which refers to a phenomenon where an EU manufacturer **moves carbon-intensive production** to countries outside the region with **less stringent climate policies** to avoid carbon pricing or other climate regulations.
- Under the CBAM proposal, **importers of certain goods** into the EU would be required to purchase emissions allowances at the same cost as EU companies under the **EU Emissions Trading System (EU ETS).**
- It ensures an **equivalent carbon price for domestic and imported production** on selected goods. This way, it would also **encourage trading partners to reduce their emissions.**
- CBAM was legislated as **part of the European Green Deal**, and CBAM takes effect on 1 July 2027, with reporting starting in 2023.
  - **The European Green Deal,** approved in 2020, is a set of policy initiatives by the European Commission with the overarching aim of making the **EU climate neutral in 2050**.

Source: [Indian Express: Trade deal stalled over UK carbon tax, India proposes plan for 'rebalancing'](#)

NAMASTE Scheme

Context

A special programme focused on the 'National Action Plan for Mechanized Sanitation Ecosystem (NAMASTE), through the Union Ministry of Social Justice and Empowerment was organized.

About National Action for Mechanised Sanitation Ecosystem (NAMASTE) Scheme

- **Launch Year:** 2022
- **Joint Initiative:** Ministry of Social Justice and Empowerment (MoSJE) and Ministry of Housing and Urban Affairs (MoHUA)
- **Scheme Type:** Central Sector
- **Coverage:** To be rolled out across all 4,800+ Urban Local Bodies (ULBs) in India.
- **Duration:** Implemented over three years, from FY 2023-24 to FY 2025-26.
- **Replaced by:** The scheme has replaced the Self-Employment Scheme for the Rehabilitation of Manual Scavengers (SRMS), which was started in 2007.
- **Aim:** To eliminate hazardous cleaning practices, prevent fatalities among sewer and septic tank workers and uphold their safety and dignity.
- **Key Features of the Scheme:**
    - **Identification:** Systematic identification of Sewer/Septic Tank Workers (SSWs) across ULBs. (Urban local bodies)
    - **Training and Safety Gear:** Provision of occupational training and distribution of Personal Protective Equipment (PPE) kits to SSWs.
    - **Safety Devices:** Assistance in acquiring safety devices for Sanitation Response Units (SRUs).
    - **Health Insurance:** Extension of health insurance benefits under the Ayushman Bharat - Pradhan Mantri Jan Arogya Yojana (AB-PMJAY) for identified SSWs and their families.
    - **Livelihood Support:** Promotion of mechanisation and enterprise development through funding support, including capital and interest subsidies for procuring sanitation-related equipment.
    - **Awareness Campaigns:** Extensive Information, Education, and Communication (IEC) campaigns conducted jointly by ULBs and the National Safai Karamcharis Finance & Development Corporation (NSKFDC) to raise awareness about NAMASTE interventions.

National Safai Karamcharis Finance & Development Corporation (NSKFDC)

- **Established:** January 1997 as a non profit company under section 8 of Company Act, 2013).
- It is **not a Statutory Body.**
- **Nodal Ministry:** Ministry of Social Justice & Empowerment
- **Functions:**
    - Mechanization of cleaning works
    - Training of Sanitation workers
    - Provides free skill development training to sanitation workers
    - Provides Loan facility to beneficiaries.

Source: PIB: Union Minister Shri B.L. Verma presides over Special Programme focused on 'NAMASTE Yojana', to honour Sanitation Workers, in Budaun today

Ozempic Drug

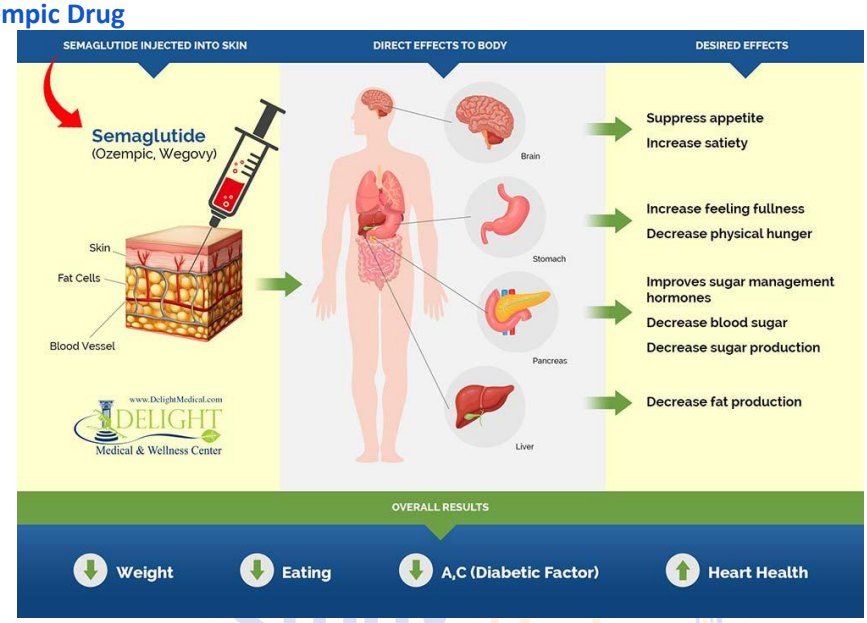
Context

Researchers found that ozempic drug (generically known as **semaglutide**) was effective at treating **Metabolic Dysfunction-Associated Steatohepatitis (MASH)**, a serious form of fatty liver disease

More in News

- It was developed to treat diabetes, and now also prescribed for weight loss.

About Ozempic Drug



- It is primarily used for **managing type 2 diabetes** in adults.
- Ozempic mimics the action of the natural hormone **GLP-1 (Glucagon-Like Peptide-1)**.
- **Working**:
    - **Stimulating insulin secretion** in response to high blood sugar
    - **Reducing glucose production** from the liver.
    - **Slowing gastric emptying**, which helps in appetite control.
- **Regulatory Approvals:**
    - **FDA Approval (2017):** Approved by the U.S. Food and Drug Administration for the treatment of type 2 diabetes.
    - **Wegovy (2021):** A higher-dose version of semaglutide was approved for **chronic weight management** in adults with obesity or weight-related conditions such as hypertension, type 2 diabetes, or high cholesterol.

Source: [Indian Express: Wonder drug Ozempic could reverse liver disease]

News in Short

HanThâm Monastery

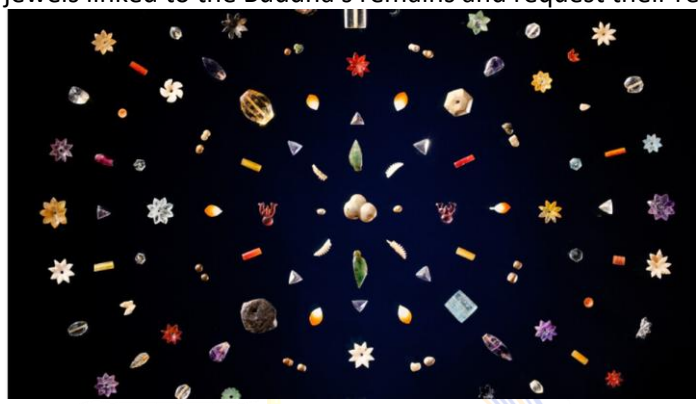
News? To mark the United Nations Day of Vesak (UNDV-2025) a vibrant exhibition on Buddha Dhamma was inaugurated at **HanhTâm Monastery in Ho Chi Minh City, Vietnam**.

More in News

- The **sacred Buddha Relic from Sarnath**, India, was transferred to Vietnam for this exhibition.

Buddha Relics Auction

News? The Indian government will take legal action against Sotheby's in Hong Kong unless they stop an upcoming auction of jewels linked to the Buddha's remains and request their return to India.



More in news

- The Indian ministry posted a letter it sent to Sotheby's and Chris Peppé, the **great-grandson of William Claxton Peppé.**
- William Claxton Peppé was an English estate manager who excavated a **stupa at Piprahwa (present day Uttar Pradesh)**, just **south of Lumbini in 1898**, the believed birthplace of Buddha.
    - The findings included nearly 1,800 gems, including rubies, topaz, sapphires and patterned gold sheets, stored inside a brick chamber.
    - The **bone relics** were gifted to the **Buddhist King of Siam (Rama V)**.
    - 5 **relic urns**, a **stone chest**, and most other items were sent to the **Indian Museum in Kolkata**, then known as the **Imperial Museum of Calcutta**.

Editorial Summary

Redrawing the not-so-pretty energy footprint of AI

Context

As AI tools advance, environmental impact will continue to become more detrimental, making this an unsustainable technology.

More in News

- Small modular nuclear reactors could be the energy answer to support booming AI and data infrastructure.

Benefits of AI

- **Productivity & Automation:** AI tools like ChatGPT-4o can draft reports, translate text, and generate images or code in seconds, dramatically cutting time and effort.
- **Enhanced Decision-Making:** Machine-learning models analyze vast datasets—financial markets, medical images, supply-chain metrics—revealing patterns and insights humans might miss.
- **Personalization:** Recommendation engines in e-commerce, streaming services, and digital advertising tailor experiences to individual preferences, boosting engagement and satisfaction.
- **Scientific & Medical Advances:** AI accelerates drug-discovery workflows, predicts protein structures (e.g., AlphaFold), and assists radiologists by flagging anomalies in imaging.
- **Accessibility:** Voice assistants and real-time captioning improve digital access for people with disabilities.

Environmental Impacts of AI

- **High Energy Consumption:** Training a large model can emit CO_2 equivalent to five cars driving continuously over their lifetimes. Every user query triggers computations in data centers that often rely on fossil-fuel power.
- **Rising Carbon Footprint:** Projections suggest that, by 2030, AI datacenters could consume up to 10% of global electricity unless more renewables are integrated.
- **Hardware Stress & Waste:** Intense GPU workloads generate heat (even "melting" units) and accelerate hardware turnover, contributing to electronic waste.
- **Water Usage:** Data-center cooling often depends on water, putting pressure on local resources in water-stressed regions.

Small Modular Reactors (SMRs) as a Sustainable Power Solution

- **Zero-Carbon Baseline Power:** SMRs generate continuous, emission-free electricity, unlike solar or wind which are weather-dependent.
- **Modularity & Scalability:** Factory-built modules can be added incrementally, matching power supply to AI demand growth.
- **Proximity to Load Centers:** Compact design allows siting near large data hubs, cutting transmission losses and improving grid resilience.
- **Enhanced Safety Features:** Passive cooling and simplified systems reduce accident risk compared to traditional reactors.
- **Faster Deployment & Lower Costs:** Modular construction can shorten build times and, over time, drive down per-kWh costs (in India projected to fall from ~₹10.3 to ₹5).

Shortfalls & Challenges of SMRs

- **Regulatory Hurdles:** New licensing frameworks are needed for SMRs' novel designs, demanding time-consuming policy and safety reviews.

- **High Upfront Investment:** Though operating costs may fall, initial capital outlay is substantial and may deter private investors without government support.
- **Waste Management:** Spent fuel and radioactive waste still require secure, long-term storage solutions.
- **Public Perception:** Nuclear energy often faces social and political opposition, potentially slowing siting approvals.
- **Integration Complexity:** Balancing SMR roll-out with existing renewable projects will require careful grid planning to avoid redundancy and ensure optimal resource mix.

Conclusion

By combining transparent AI-energy reporting, efficiency improvements, and clean baseload sources like SMRs—in a well-structured public-private partnership—countries can support AI's growth while curbing its environmental footprint.

Source: The Hindu: Redrawing the not-so-pretty energy footprint of AI

Detaining non-citizens and the rule of law

Context

Assam's immigration detention regime not only endangers the liberty and well-being of those affected but also poses serious concerns regarding fundamental constitutional principles.

Legal Frameworks for Detention in India

- **Foreigners Act, 1946:** Empowers the government to detain and deport individuals deemed as foreigners without valid documents. In Assam, many declared "foreigners" by Foreigners Tribunals are detained under this Act.
- **National Security Act (NSA), 1980:** Allows preventive detention for up to 12 months without trial if an individual is considered a threat to national security or public order. Non-citizens can be detained under this law.
- **Passports Act, 1967:** Penalizes entry or stay in India without valid documents, often used alongside the above laws.

Challenges and Associated Issues

- **Indefinite and Arbitrary Detention**: Many non-citizens, especially in Assam, are detained for years without trial or realistic prospects of deportation.
    - As of December 2023, only a tiny fraction of the 1.5 lakh declared "foreigners" have actually been deported.
- **Due Process Violations**: Detainees are often denied adequate legal representation.
    - Decisions are frequently based on minor documentary errors (e.g., spelling mistakes, missing pre-1971 documents), despite lifelong residence in India.
- **Harsh Detention Conditions:** Detention camps are overcrowded, lack basic amenities, and detainees face psychological distress.
    - Families are separated, and many detainees cannot afford legal or financial support.
- **Procedural Irregularities**: Notices from Foreigners Tribunals often do not reach the intended individuals, leading to *ex parte* orders.
    - Many are picked up from their homes, not while crossing borders, and are detained without criminal conviction.
- **Statelessness and Deportation Dilemma:** Most detainees cannot be deported as they have no ties to any other country, and neighboring countries often refuse to accept them.

Judicial Intervention

- **Supreme Court Scrutiny:** The Supreme Court has repeatedly questioned the Assam government on the prolonged detention of non-citizens and lack of deportation.
    - In January 2025, the Court demanded explanations for detaining 270 people for up to 10 years without justification and directed the state to clarify its actions.
- **Rajubala Das v. Union of India:** The Supreme Court has ordered that individuals whose nationality is confirmed should be deported, and those whose status is unresolved should have their cases reconsidered with legal aid.
    - The Court also set aside certain Foreigners Tribunal orders and mandated fresh hearings, emphasizing procedural fairness.
- **Bail Orders:** The Supreme Court has allowed bail for detainees held for over three years, but the financial requirements are often unaffordable for most inmates.

Constitutional Implications

- **Article 21 – Right to Life and Personal Liberty:** Arbitrary and indefinite detention without fair reason or legal justification violates the fundamental right to life and liberty. Detention should not occur without conviction, trial, or a legitimate preventive purpose.

- **Article 22 – Procedural Safeguards:** This article mandates that detainees be informed of the grounds for detention and have access to legal counsel. Many detainees in Assam lack these protections.
- **Separation of Powers:** Detention decisions are often made by executive authorities or quasi-judicial tribunals without adequate judicial oversight, undermining the judiciary's constitutional role.

Way Forward

- **Judicial safeguards**: Reinforce Article 22 protections—timely review, clear grounds, maximum detention period.
- **Policy reforms**:
  - Alternative citizenship-verification mechanisms (e.g., statelessness status).
  - Legal aid and documentation support for vulnerable groups.
- **International best practices**: Adopt non-detention models for non-removable persons (as in Australia).

Source: The Hindu: Detaining non-citizens and the rule of law