Factly Weekly

Compilation

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INDEX

Amazonian Stingless Bees To Get Legal Rights

News: Amazonian stingless bees became the world's first insect to get legal rights after ordinances passed by Satipo and Nauta municipalities in Peru.

About Amazonian Stingless Bees

Source – DTE

- Amazonian stingless bees are bees that either lack stingers or have stingers that cause little pain.
- Location: They are found mainly in tropical regions. About half of the 500 known species live in the Amazon, with more than 170 species in Peru.
- Origin: These bees have existed for nearly 80 million years, dating back to the time of the dinosaurs.
- Significance
    - Ecological: They pollinate over 80% of Amazonian flora and support crops like cacao, coffee, avocados, and blueberries.
    - Cultural: They are central to Asháninka and Kukama-Kukamiria traditions, knowledge systems, and spiritual beliefs.
    - Other: Their honey is used as traditional medicine and has anti-inflammatory, anti-bacterial, and anti-viral properties.
- Threats: Stingless bees face habitat loss due to deforestation, illegal logging, agriculture, cattle grazing, forest fires, climate change, pesticides, and competition from European bees.

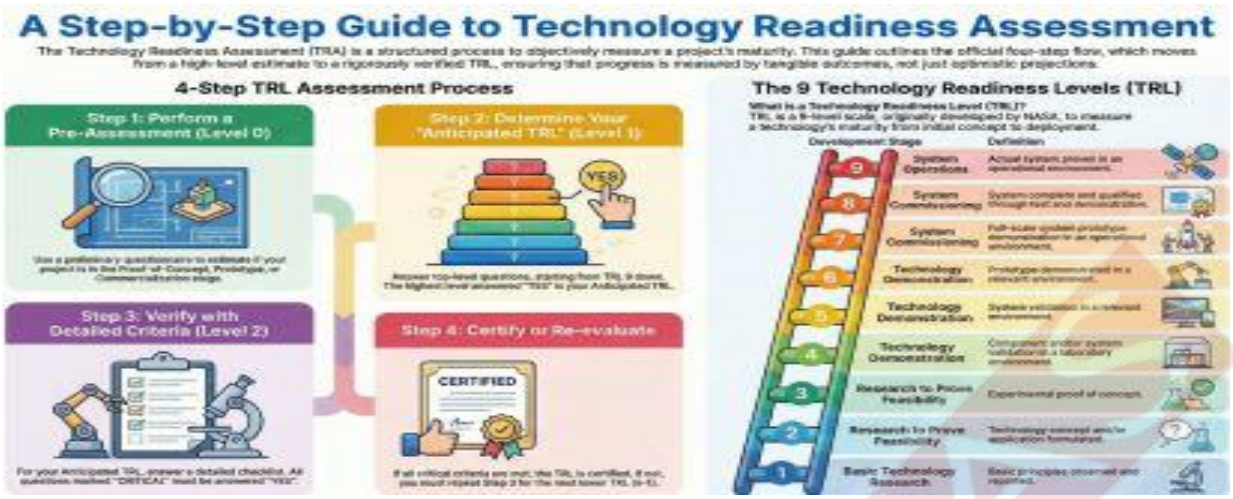
Amazonian Stingless Bees To Get Legal Rights

- Ordinances passed in: The landmark ordinances were first passed in the Peruvian municipality of Satipo (October 2025) and later in Nauta (December 2025).
- Legal Status: They are the first insects in the world to be recognized as "rights-bearing entities".
- The declaration is called the Declaration of Rights for Native Stingless Bees.
- Declaration developed by: The declaration was developed with Asháninka leaders and community members, with support from Amazon Research Internacional and the Earth Law Center.
- Rights provided: The bees have rights to exist, thrive, maintain healthy populations, restore habitats, live pollution-free, and be legally represented.

National Technology Readiness Assessment Framework (NTRAF)

News: The National Technology Readiness Assessment Framework was unveiled on December 29, 2025, by the Principal Scientific Adviser to the Government of India.

About National Technology Readiness Assessment Framework (NTRAF)



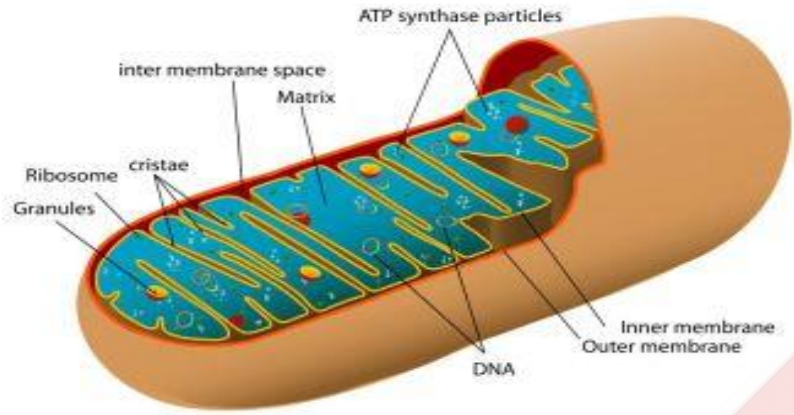
Source – PSA

- It is a framework that establishes a unified, objective yardstick to measure the maturity of technology projects from laboratory conception to commercial deployment.
- Developed by: The framework was developed by the Office of the Principal Scientific Adviser (Government of India) in collaboration with the Confederation of Indian Industry.
- Aim
    - The framework aims to create a rigorous and standard method to assess technology maturity across 9 Technology Readiness Levels, so funding decisions become more precise and evidence-based.
    - It also aims to bridge the "Valley of Death" between TRL 4 and TRL 7 by reducing perceived risk and supporting technology transfer towards market-ready deployment.
- Key Features of the Framework
    - Global best practices, Indian context: The framework draws from global standards such as NASA and adapts them to India's R&D ecosystem.
    - Objectivity over subjectivity: The framework replaces qualitative estimation with a structured, evidence-based checklist at each stage of development.
    - Sector-specific nuances: The framework includes specialised annexures for sectors like Healthcare & Pharmaceuticals and Software to reflect different development pathways.
    - Self-assessment tool: The framework enables Project Investigators to assess their readiness level and identify technical gaps before seeking funding.
    - Nine-level Technology Readiness framework: The framework assesses projects across nine Technology Readiness Levels, where TRL 1–3 cover proof of concept, TRL 4–6 focus on prototype development, and TRL 7–9 relate to operational deployment and commercialisation.

Mitochondria Evolution in Insects

News: Researchers from the University of Guelph (in Canada) found an unexpected link between chromosome sets in insects and the speed of mitochondrial genome evolution.

About Mitochondria Evolution in Insects



Source – Wikipedia

- Mitochondria evolved from bacteria and retain a small independent genome:
    - Mitochondria originated when an ancient single-celled ancestor engulfed a bacterium, which later evolved into mitochondria.
    - Over time, most bacterial genes moved to the nucleus, leaving a very small mitochondrial genome that produces energy for all cellular functions through adenosine triphosphate (ATP).
- Key Evolutionary Patterns in Insects
    - Chromosome Systems in Insects
        - Haploid condition: In some insects, males develop from unfertilised eggs and carry only one set of chromosomes, which makes them haploid.
        - Diploid condition: Females in these insects develop from fertilised eggs and carry two sets of chromosomes, one from each parent, making them diploid.
        - Haplo-diploid system: Ants, bees, and wasps follow this system, where females are diploid and males are haploid, and this method is called haplo-diploid sex determination.
        - Diplo-diploid system: In this system, both males and females are diploid and differ only by their sex chromosomes, while both transmit one chromosome from each pair to their gametes.
    - Mitochondrial DNA: Mitochondria are inherited only through females-
        - Males do not pass mitochondria to offspring, even though mitochondrial function depends on interaction with nuclear genes.
        - Unexpected evolutionary link: Despite maternal inheritance, species with haplo-diploid systems showed faster mitochondrial evolution than diplo-diploid species across insect orders.
    - The COI Gene: The COI gene shows faster change in haplo-diploid species-
        - Cytochrome c oxidase subunit I (COI) is a key mitochondrial protein, and its COI gene is in the mitogenome.
        - Using consensus sequences for each insect family, researchers found that haplo-diploid species showed about 1.7 times more protein changes than diplo-diploid species.
- Implications for biodiversity tracking: Faster evolution of the COI gene in haplo-diploid insects means genetic barcodes may change unevenly, affecting accurate identification and monitoring of insect biodiversity.

Market Access Support (MAS) Intervention and Export Promotion Mission (EPM)

News: The Government of India has launched the Market Access Support (MAS) Intervention under the Export Promotion Mission (EPM), a flagship initiative approved by the Union Cabinet on 12 November 2025.

About Market Access Support (MAS) Intervention

Source – PIB

- The Market Access Support (MAS) Intervention is launched under the Export Promotion Mission (EPM), a flagship initiative approved on 12 November 2025.
- It is being implemented under the NIRYAT DISHA sub-scheme of EPM.
- Aim: It is aimed at strengthening international market access for Indian exporters, particularly MSMEs, first-time exporters and firms from priority sectors.
- Focus: The MAS Intervention focuses on improving buyer connect and enhancing India's presence in global markets through structured and outcome-oriented market access interventions.
- Working Mechanism: Under the Market Access Support Intervention, structured financial and institutional support will be provided for activities including Buyer-Seller Meets (BSMs), participation in international trade fairs and exhibitions, Mega Reverse Buyer-Seller Meets (RBSMs) organised in India and trade delegations to priority and emerging export markets.
- Features
    - A forward-looking three-to-five-year calendar of major market access events will be prepared and approved in advance, enabling exporters and organizing agencies to plan participation.
    - A minimum participation of 35 per cent MSMEs has been mandated for supported events, with special prioritization being accorded to new geographies and smaller markets to encourage export diversification.

- Delegation size has been benchmarked at a minimum of 50 participants, with flexibility provided based on market conditions and strategic relevance.
- Event-level financial support ceilings and cost-sharing ratios have been rationalised, with preferential support being extended to priority sectors and markets.
- Small exporters with export turnover of up to ₹75 lakh in the preceding year will be provided partial airfare support to encourage participation by new and small exporters.
- End-to-end processes for event listing, proposal submission, approvals, participant onboarding, fund release.
- Feedbacks: Mandatory online feedback mechanisms will be instituted for exporters participating in each supported event.
- A new component for Proofs-of-Concept and Product Demonstrations to potential overseas buyers, will be notified to complement existing market access interventions.

About Export Promotion Mission (EPM)

Source – DGFT

- It is a flagship initiative announced in the Union Budget 2025–26 to strengthen India's export competitiveness, particularly for MSMEs, first-time exporters, and labour-intensive sectors.
- The Mission will provide a comprehensive, flexible, and digitally driven framework for export promotion.
- Ministries involved: Department of Commerce, Ministry of MSME, Ministry of Finance
- Implemented by: It is jointly implemented by the Department of Commerce, Ministry of MSME and Ministry of Finance in coordination with Indian Missions abroad, Export Promotion Councils (EPCs), Commodity Boards and other industry associations.

- Implementing agency: The Directorate General of Foreign Trade (DGFT) will act as the implementing agency, with all processes being managed through a dedicated digital platform integrated with existing trade systems.
- Outlay and timeline: The Scheme is launched with a total outlay of 25,060 crore for FY 2025–26 to FY 2030–31.
- Uniqueness: EPM marks a strategic shift from multiple fragmented schemes to a single, outcome-based, and adaptive mechanism that can respond swiftly to global trade challenges and evolving exporter needs.
- Sub-schemes: The Mission will operate through two integrated sub-schemes:
    - NIRYAT PROTSAHAN: It focuses on improving access to affordable trade finance for MSMEs through a range of instruments such as interest subvention, export factoring, collateral guarantees, credit cards for e-commerce exporters, and credit enhancement support for diversification into new markets.
    - NIRYAT DISHA: It focuses on non-financial enablers that enhance market readiness and competitiveness, including export quality and compliance support, assistance for international branding, packaging, and participation in trade fairs, export warehousing and logistics, inland transport reimbursements, and trade intelligence and capacity-building initiatives.
- EPM consolidates key export support schemes such as the Interest Equalisation Scheme (IES) and Market Access Initiative (MAI), aligning them with contemporary trade needs.
- Feature
    - The Mission is designed to directly address structural challenges that constrain Indian exports, including:
        - Limited and expensive trade finance access,
        - High cost of compliance with international export standards,
        - Inadequate export branding and fragmented market access, and
        - Logistical disadvantages for exporters in interior and low-export-intensity regions.
    - Priority support: Under EPM, priority support will be extended to sectors impacted by recent global tariff escalations, such as textiles, leather, gems & jewellery, engineering goods, and marine products.
- The Mission is expected to:
    - facilitate access to affordable trade finance for MSMEs,
    - enhance export readiness through compliance and certification support,
    - improve market access and visibility for Indian products,
    - boost exports from non-traditional districts and sectors, and
    - generate employment across manufacturing, logistics, and allied services.

About Interest Equalisation Scheme (IES)

- The Interest Equalisation Scheme is designed to provide subsidies on interest rates for pre-shipment and post-shipment export credit to eligible exporters, particularly in the Micro, Small, and Medium Enterprises (MSME) sector.
- It was first implemented on 1st April, 2015.
- Implementing agency: It is being implemented by the RBI through various Public and non-Public Sector banks who provide pre- and post-shipment credit to the exporters.
- The Scheme is jointly monitored by the Directorate General of Foreign Trade (DGFT) and the RBI through a consultative mechanism.
- Goal: Its primary goal is to make Indian exports more competitive by reducing the financing costs for exporters.
- Beneficiaries: The IES is available to a broad range of exporters, including those in the MSME sector and manufacturers, regardless of their participation in the Production Linked Incentive (PLI) scheme.
- Eligibility: For export products to qualify under the IES, they must originate from India, which includes meeting the criteria for substantial value addition if imported inputs are used.
    - This ensures that the exported goods are sufficiently processed or manufactured in India, adhering to the rules of origin as outlined in the Foreign Trade Policy.

Mannathu Padmanabha

News: On the birth anniversary of Mannathu Padmanabhan today, Prime Minister remembered with deep reverence a towering personality whose life was dedicated to serving society.

About Mannathu Padmanabha

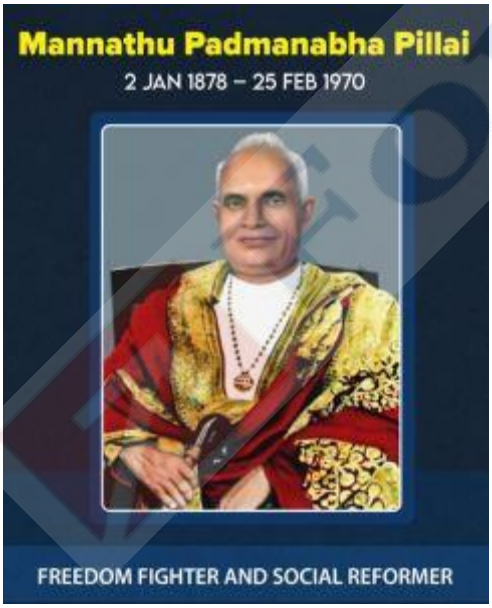


Figure 1. Source – INC Archive

- Mannathu Padmanabha Pillai (2 January 1878 – 25 February 1970), was an Indian social reformer and freedom fighter from the south-western state of Kerala.
- His birthday (2 January) is observed as Mannam Jayanti every year.

Nair Service Society (NSS)

- He is recognised as the founder of the Nair Service Society (NSS), which represents the Nair community.
- Objectives:
    - Social upliftment of the Nair community
    - Promotion of education and discipline
    - Removal of social evils and superstition
- NSS grew into one of the largest community organisations in India.

As a Social Reformer

- Actively supported the Vaikom Satyagraha (1924–25) for temple entry rights for lower castes, even though he was not directly involved in the satyagraha

- Played a crucial role in the Guruvayur Satyagraha (1931–32), advocating for temple entry for all Hindus.
- Strongly opposed caste discrimination and untouchability within the Nair community and society at large.

Role in Freedom Struggle

- Joined the Indian National Congress in the 1920s.
- Participated in the Salt Satyagraha (1930) and was imprisoned during the Civil Disobedience Movement.
- Later became a prominent leader in the Indian Independence Movement in Travancore.

Opposition to Communism

- Following India's independence, he shifted his focus through the Nair Service Society (NSS) to counter the expansion of communist influence in Kerala.

Honours

- Pillai received the Padma Bhushan award in 1966 from the Government of India for his contributions to social work.
- He was also honored with the title Bharata Kesari (Lion of India) by the President of India for his lifelong service to society and the independence movement.

Collateral Support for Export Credit Initiative

News: As part of the initial rollout of the Export Promotion Mission, Collateral Support for Export Credit initiative under the NIRYAT PROTSAHAN sub-scheme has been launched to strengthen MSME exports and improve access to trade finance.

About Collateral Support for Export Credit Initiative

Figure 2. Source – PIB

- The Collateral Support for Export Credit is a key component of the Export Promotion Mission (EPM) announced in the Union Budget 2025-26 and operationalized on January 2, 2026 by the Government of India.
  - It is being implemented under the NIRYAT PROTSAHAN sub-scheme of EPM.
- Aim: It is aimed at giving MSME exporters the ability to access bank credit even with limited collateral or third-party guarantees.
- Outlay: ₹2,114 crore
- Implementing Agency: The scheme would be implemented through the Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE) on a pilot
- It will be applicable to export-linked working capital loans.
- Beneficiaries: MSME exporters exporting notified tariff lines will be eligible for the collateral support.

- Benefits: Guarantee coverage of up to 85 per cent will be provided for Micro and Small exporters and up to 65 per cent for Medium exporters, with a maximum outstanding guaranteed exposure of ₹10 crore per exporter in a financial year.

Note: To know more about the Export Promotion Mission (EPM), please CLICK here.

Alps Mountain Range

News– A deadly bar fire at Crans-Montana, a Swiss ski resort located in the Alps mountain range, has drawn attention to the region, which is a major centre of alpine tourism and winter sports in Europe.

Figure 3. Source- PBS

About Alps Mountain Range

- Type & age: The Alps are young fold mountains, formed during the Alpine orogeny, which began around 65 million years ago towards the end of the Mesozoic Era.
- Plate tectonics:They were created due to the collision of the African and Eurasian tectonic plates, leading to intense folding, faulting, and uplift of marine sedimentary rocks.
- Relief & Structure:The range is characterised by rugged relief, sharp ridges, deep valleys, and high conical peaks, typical of young fold mountain systems.
- Extent & location: Stretching about 750 miles (around 1,200 km) in length, the Alps extend from the Mediterranean coast near Nice (France) to Vienna (Austria), where they merge with the Danube plains.
- Climatic significance: Due to their arc-like shape, the Alps act as a climatic divide, separating marine west coast climates of western Europe from the Mediterranean climate of southern Europe.
- Countries covered: The Alps span France, Italy, Switzerland, Germany, Austria, Slovenia, Croatia, Bosnia & Herzegovina, Montenegro, Serbia, and Albania.
    - Switzerland and Austria are considered true Alpine countries.
- Major Peaks:
    - Mont Blanc (around 4,810 m) – Highest peak of the Alps.
    - Monte Rosa (Dufourspitze – 4,634 m) – Highest peak of Switzerland
    - Dom (4,545 m) – One of the highest entirely within Switzerland Other notable peaks include Matterhorn, Weisshorn, Liskamm, Dent Blanche, and Grand Combin.

Euro Zone

News: Bulgaria adopted the euro as its currency in 2026, becoming the 21st euro zone member and gaining representation in ECB monetary decisions.

About Euro Zone

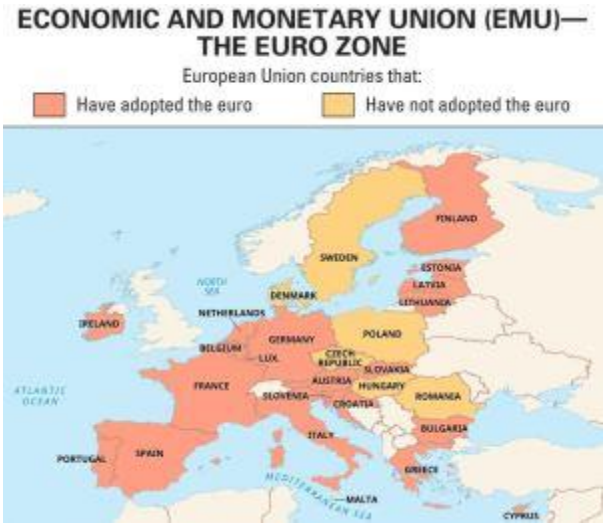


Figure 4. Source – Britannica

The euro zone, also called the euro area, is a currency union of European Union member states that use the euro as their sole legal tender.

- Total Members: The euro zone has a total of 21 member countries.
- Latest Entry: Bulgaria became the 21st member on January 1, 2026.
- Non-Euro EU Members (6) : The non-Euro EU members are Czech Republic, Denmark, Hungary, Poland, Romania, and Sweden, who maintain their national currencies, though most are legally committed to adopting the Euro once.
- History
  - Maastricht Treaty (1992): It was a landmark agreement that officially created the European Union (EU) consisting of three pillars:
    - European Communities;
    - Common Foreign and Security Policy (CFSP);
    - police and judicial cooperation in criminal matters (JHA).
  - It also established the legal framework for the Economic and Monetary Union (EMU).
  - It set out the path for a single currency (the euro) and a unified monetary policy under the European Central Bank (ECB).
  - Launch: The Euro was introduced for electronic payments in 1999 and physical notes/coins in 2002.

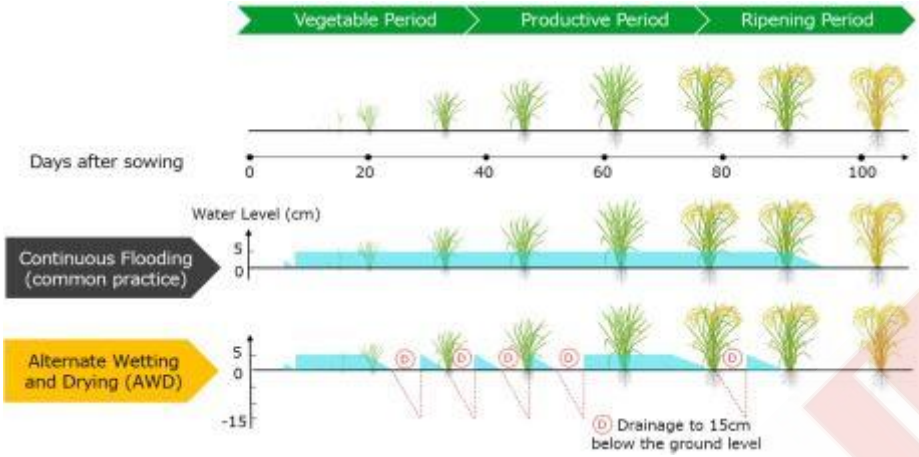
Institutional Framework

- Monetary Authority
  - Monetary policy in the euro zone is managed by the independent Eurosystem.
    - The Eurosystem includes the European Central Bank and national central banks of euro-area states.
  - The ECB's Governing Council sets a single monetary policy focused on price stability.
  - The Eurogroup: An informal body of finance ministers from Eurozone countries that coordinates fiscal policies.
  - European Stability Mechanism (ESM): A permanent bailout fund (established in 2012) providing financial assistance to Eurozone countries in severe financial distress.
- Joining Criteria (Maastricht Criteria)
  - Price Stability (Inflation): Average inflation must not exceed the average inflation of the three best-performing EU countries with the lowest inflation by more than 1.5 percentage points.
  - Sound Public Finances (Deficit): The annual government deficit must not be more than 3% of GDP. If the deficit is over this limit, it must be significantly reduced.
  - Sound Public Finances (Debt): Government debt should not exceed 60% of GDP. If it exceeds this level, it should be converging sustainably towards it.
  - Exchange-Rate Stability: The country must participate in the Exchange Rate Mechanism (ERM II) for at least two years. During this period, the country must not face severe tensions or devaluation.

Alternate Wetting and Drying (AWD) Technique for Rice Cultivation

News: Alternate Wetting and Drying is discussed due to its role in reducing methane emissions, saving water, and enabling carbon credit generation in rice farming.

About Alternate Wetting and Drying (AWD) Technique for Rice Cultivation



Source – Kubota Corp

- Alternate Wetting and Drying (AWD) is is a water-management technology for lowland rice cultivation that reduces water consumption and methane emissions by alternating between flooded and non-flooded periods.
- Core mechanism
    - Controlled Irrigation Cycle: Unlike traditional continuous flooding (CF), AWD allows the water level to recede naturally to a specific threshold – usually 10–15 cm below the soil surface – before the field is re-flooded to a depth of roughly 5 cm.
    - Monitoring: Farmers often use a simple field water tube (perforated PVC or bamboo pipe) to monitor the subsurface water level.
- Timings
    - Initial Phase: Fields are kept flooded for the first 15–20 days after transplanting to establish seedlings.
    - AWD Phase: The wetting-drying cycle continues until the flowering stage.
    - Flowering Stage: Continuous flooding (3–5 cm) is maintained to prevent moisture stress.
    - Post-Flowering: Cycles can resume during grain filling and ripening.
- Benefits
    - Water Conservation: Reduces water use by 25–40% compared to traditional methods.
    - Methane (CH_4) Mitigation: AWD lowers methane emissions by disrupting anaerobic conditions suitable for methane-producing microbes.
    - Cost Efficiency: Decreases irrigation frequency, leading to lower labor and energy (pumping) costs.
    - Soil and Crop Health: Enhances root development, improves nutrient uptake, and may reduce lodging.
    - Reduces toxic metal accumulation in grains: This method can reduce the accumulation of arsenic, lead, and cadmium in rice grains, with variants like e-AWD significantly lowering their levels.
    - Reduces pests and diseases: This method can reduce insect pests and diseases, and periodic soil drying may reduce the incidence of fungal diseases.
- Challenges

- Farmers may initially hesitate to adopt AWD due to unfamiliar irrigation practices.
- AWD requires monitoring of water levels and soil moisture, which needs basic field management awareness.

Rani Velu Nachiyar

News: The Prime Minister paid tributes to Rani Velu Nachiyar on her birth anniversary, highlighting her courage, leadership, and resistance to British rule.

About Rani Velu Nachiyar

Figure 5. Source – DD News

- Rani Velu Nachiyar (1730–1796) was the 18th-century queen of the Sivagangai estate in Tamil Nadu.
- She was the first queen in India to actively oppose British rule and fight for freedom.
- Early Life: Born on January 3, 1730, she was the only child of Raja Chellamuthu Vijayaragunatha Sethupathy of the Ramnad kingdom.
  - She later became the ruler of Sivaganga.
- Known as: She is known among Tamils as Veeramangai ("brave woman").
- Education and skills
  - She received training in warfare, including weapon usage, Valari, Silambam, horse riding, and archery.
  - She was a scholar and had proficiency in languages such as English, French, and Urdu.
- Key contributions
  - The Conflict: After her husband, Muthu Vaduganatha Periyavudaya Thevar, was killed by British soldiers and the Nawab of Arcot in the Kalaiyar Koil war (1772), she went into exile for eight years.
  - Strategic Alliances: During her exile, she built an alliance with Hyder Ali of Mysore and Gopala Nayaker.
  - Reclaiming Sivagangai (1780): With the help of her allies and the Marudu Brothers, she defeated the British and reclaimed her kingdom.
  - She created the first all-female army (Udaiyal) and utilized innovative tactics, including a woman who became a "human bomb" to destroy a British arsenal.

OPEC+ (PLUS)

News: OPEC+ agreed in principle to maintain steady oil output despite falling prices, internal tensions, and widening geopolitical uncertainty among key members.

About OPEC+

Source – OPEC

- OPEC+ is a grouping of 22 oil-exporting countries that meets regularly to decide crude oil production levels to stabilise the global oil market.
- Genesis of OPEC+: OPEC+ was formed in 2016 in response to falling oil prices caused by oversupply, largely due to rapid growth in U.S. shale oil production, which weakened OPEC's market control.
- Members: OPEC+ includes the 12 OPEC members and 10 non-OPEC producers such as Azerbaijan, Bahrain, Brunei, Kazakhstan, Malaysia, Mexico, Oman, Russia, South Sudan, and Sudan.
- Nature of OPEC+: OPEC+ operates through a Declaration of Cooperation, which provides a framework for voluntary dialogue and coordination on oil production rather than a formal treaty-based structure.
- Functions
    - OPEC+ works to adjust crude oil production levels collectively to bring stability to the global oil market.
    - The group regulates oil supply to manage price volatility and market balance.
- Significance
    - OPEC+ crude output represents about 41% of global oil production.
    - OPEC and OPEC+ countries together produce about 60% of global oil output, giving them strong influence over oil markets.

About OPEC

- Established: OPEC was founded in 1960 at the Baghdad Conference by Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela.
- Aim: OPEC coordinates petroleum policies to ensure stable oil prices, steady supply to consumers, and fair returns for investors.
- Members: OPEC currently has 12 members, mainly from the Middle East and Africa, after Angola withdrew in January 2024.
- Headquarters: OPEC is headquartered in Vienna, Austria.

Gandhar Oilfield

News: Oil and Natural Gas Corporation (ONGC) plans to store captured carbon dioxide in depleted wells at Gujarat's Gandhar oilfield, marking the company's first full-scale Carbon Capture and Storage (CCS) pilot.

About Gandhar Oilfield

Source – Science Direct

- Location: The Gandhar oilfield is a major oil and gas field located in the Jambusar-Broach block of the Cambay Basin in Gujarat, India.
- Field boundaries : The field is situated on the western flank of the Broach depression, between the Dadhar river in the north and the Narmada river in the south.
- Size: Gandhar is a major oil and gas field spreading over 800 sq. km.
- Operator: The Oil and Natural Gas Corporation (ONGC) is responsible for the field's operations and development.
- Discovery: The oil field was discovered in 1983.
- Status: It is one of India's largest onshore "brownfields" (mature/ageing fields).

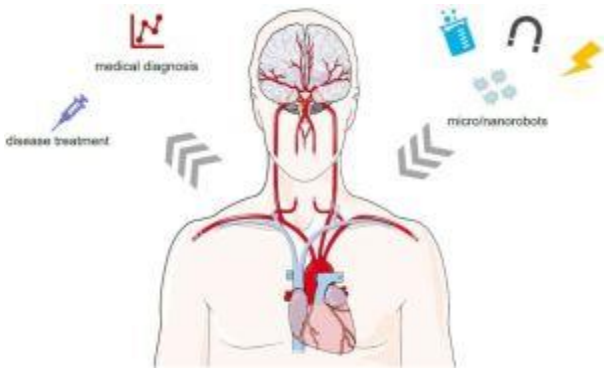
About ONGC Carbon Capture Pilot projects

- ONGC is currently spearheading its first full-scale Carbon Capture and Storage (CCS) pilot project at the Gandhar oilfield in Gujarat.
- This innovative project involves:
    - The project involves capturing CO_2 from nearby industries in Dahej and ONGC's Hazira plant.
    - The captured CO_2 will be transported to Gandhar and injected underground through two abandoned onshore wells at about 100 tonnes per day.
    - Aim: The project also aims to test using CO2 to enhance oil recovery (EOR), turning a potentially harmful greenhouse gas into a productive resource, they said.

Nanorobots

News: Dr. Ambarish Ghosh of IISc Bengaluru received the 2025 Tata Transformation Prize for developing magnetic nanorobots for cancer treatment.

About Nanorobots



Source – MDPI

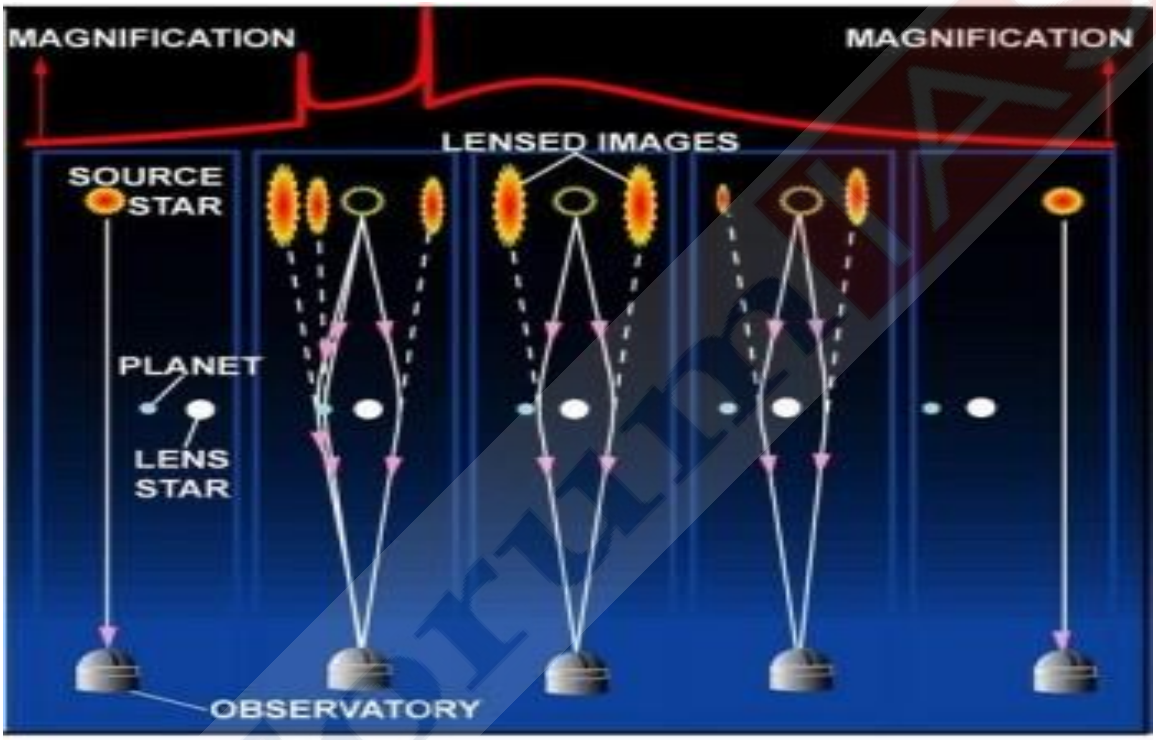
- Nanobots are microscopic robots (often around 1–100 nm) that can be programmed to carry out specific tasks.
- When nanorobots are designed specifically for healthcare/medical tasks, they are referred to as medical nanobots or nano medical robots.
- Working Mechanism of Nanorobots
    - Nanorobots work through a combination of sensing, movement, control, and action at the nanoscale.
    - Navigation: They move through body fluids like blood using chemical reactions, magnetic fields, or natural fluid flow.
    - Sensing: Sensors on nanorobots detect specific cells, chemicals, or conditions such as cancer markers or infection signals.
    - Decision-making: Pre-programmed instructions guide their response after detecting the target.
    - Action: They release drugs, destroy harmful cells, repair tissues, or send diagnostic information.
    - Exit or breakdown: After completing their task, they are designed to safely degrade or be removed from the body.
- Applications
    - Medical Applications
        - Targeted drug delivery: Nanorobots deliver medicines directly to diseased cells, reducing side effects on healthy tissues.
        - Cancer treatment: They identify tumour cells and release anti-cancer drugs precisely at the target site.
        - Early disease diagnosis: Nanorobots detect infections, cancer markers, or abnormal proteins at an early stage.
        - Blood clot removal: They help break down clots inside blood vessels without major surgery.
        - Precision surgery: Nanorobots assist in repairing tissues and cells at microscopic levels.
        - Continuous health monitoring: Nanorobots track blood sugar, toxins, or disease markers inside the body.
        - Pathogen detection: They identify bacteria and viruses quickly and accurately.
    - Environmental Applications: Nanorobots help detect and remove pollutants, heavy metals, and toxic chemicals from water, air, and soil.

- Industrial Applications: Nanorobots support precision manufacturing, material assembly at the molecular level, and detection of microscopic defects.
- Agricultural Applications: Nanorobots assist in targeted delivery of nutrients and pesticides, early detection of plant diseases, and soil health monitoring.

Microlensing

News: A recent study used microlensing to measure the mass of a rogue planet, meaning a planet that does not orbit a star.

About Microlensing



Source: The Planetary Society

- Microlensing is a method astronomers use to find planets far away from Earth.
- Working mechanism
  - It is based on Einstein's theory of gravity, which says that massive objects like stars can bend light.
  - Microlensing occurs when a star passes in front of another distant star as seen from Earth.
  - The gravity of the front star bends and magnifies the light from the background star.
    - This bending of light causes the star to appear much brighter for a short period of time.
  - When the alignment is nearly perfect, the light forms a circular shape called an Einstein ring.
    - The brightness of the star increases, reaches a peak, and then slowly decreases over weeks or months.
- How microlensing detects planets
  - If the lensing star has a planet, the planet's gravity also bends the light.
  - This produces a short and sudden spike in brightness during the microlensing event.
  - The spike can last from a few hours to a few days.

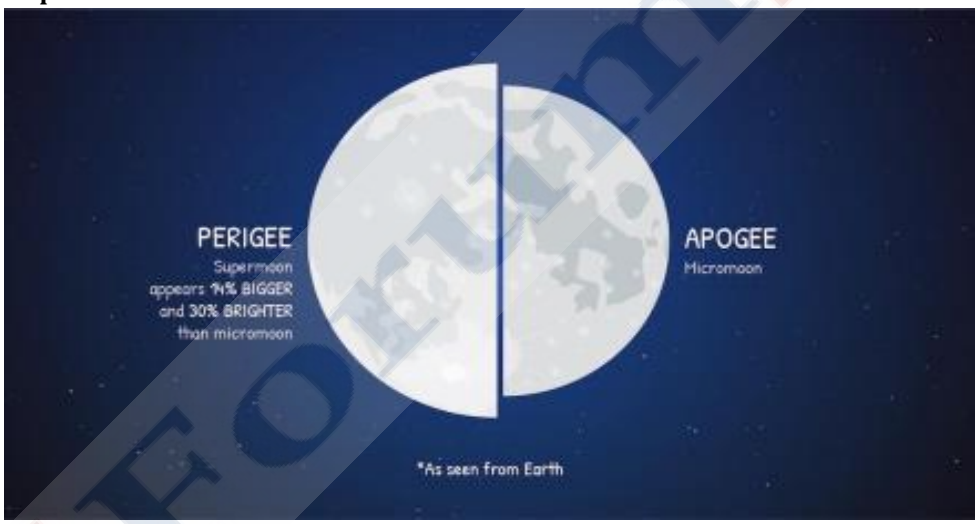
- By studying this spike, scientists can estimate the planet's mass and its distance from the star.

- Advantages of microlensing
  - Microlensing is the only known method capable of discovering planets at truly great distances from the Earth and is capable of finding the smallest of exoplanets.
  - This method is effective for finding planets that orbit far from their stars.
  - Microlensing can detect free-floating planets that do not orbit any star.
  - Many stars can be observed at the same time, increasing the chance of detection.
- Disadvantages of microlensing
  - Each microlensing event happens only once and cannot be observed again.
  - Planets discovered by microlensing cannot be studied in detail after the event ends.
  - The distance to the detected planet is only roughly estimated.
  - Microlensing events are rare and depend on precise alignment of stars and planets.

Wolf Supermoon

News: The first supermoon of 2026, commonly called the Wolf Moon, illuminated the night skies over India, the United States, and many other parts of the world on January 3.

About Wolf Supermoon



Source: TH

- A wolf supermoon is a full moon in January that occurs when the Moon is near perigee, its closest point to Earth.
- Wolf supermoons are relatively uncommon and occur only when the January full moon aligns with a supermoon.
- Meaning of the Wolf Moon: The term "wolf moon" refers to the traditional name for the January full moon.
- What Is a Supermoon: A supermoon is an astronomical event that takes place when a full moon coincides with the Moon's closest approach to Earth.
- The Moon travels around Earth in an elliptical orbit rather than a perfect circle. When the Moon is near perigee, it appears slightly larger and brighter than a typical full moon.
- Change in Size and Brightness: During a wolf supermoon, the Moon can appear up to 14 % larger and about 30 % brighter than when it is at apogee.

- The difference in size and brightness is real but subtle and is easier to notice in photographs than by casual observation.

- As the Moon rises or sets, it may appear orange or reddish due to atmospheric filtering of light.
  - When the Moon is higher in the sky, it usually appears bright white.
- A common visual effect during a supermoon is the moon illusion, which makes the moon appear larger near the horizon.
  - The moon illusion is caused by human perception of distance and scale rather than any physical change in the Moon.

Ozempic

News: A trend has been seen promoting a drink made by blending oats with water or juice, commonly referred to as "oatzempic."

About Oatzempic

Source – DTE

- Oatzempic is oat-based drink that people consume in the morning, often on an empty stomach for weight loss, appetite control or other health outcomes.
- The name references Ozempic, a prescription drug primarily prescribed for type 2 diabetes that is also known for its appetite-suppressing effects.
- The idea behind it is that Oats are rich in beta-glucan, a type of soluble fibre that forms a gel-like substance when mixed with water.
  - This slows down digestion which helps you to feel full.
- There are no scientific studies that look at the "oatzempic drink" for weight loss, appetite control or other health outcomes.

About Ozempic

- Ozempic is a medication that contains the active ingredient semaglutide.
- Semaglutide belongs to a class of drugs known as glucagon-like peptide-1 (GLP-1) receptor agonists.
- Ozempic mimics the natural GLP-1 hormone that is released in the body after eating.
- How Ozempic Works
  - Ozempic increases the release of insulin when blood sugar levels are high.
  - It slows down stomach emptying, which helps people feel full for a longer period.

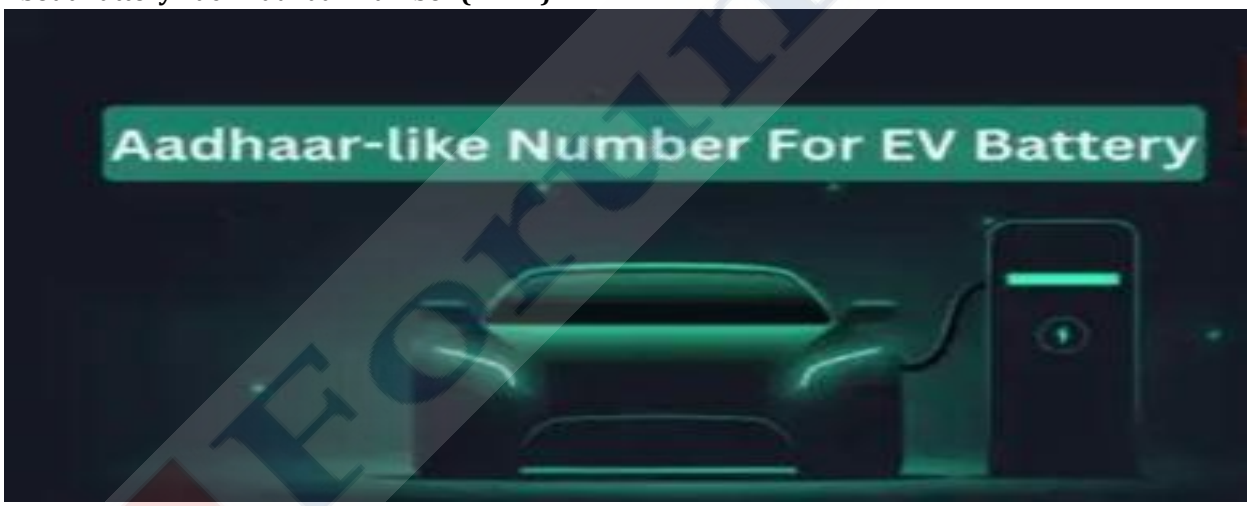
- Ozempic reduces the amount of sugar produced by the liver.
- These actions help improve blood sugar control and reduce appetite

- Medical Uses of Ozempic
  - Ozempic is FDA-approved to help manage blood sugar levels (A1C) in adults with type 2 diabetes.
  - It is used along with lifestyle changes such as a healthy diet and regular exercise.
  - Ozempic helps lower the risk of heart attack, stroke, and death from heart or blood vessel problems in adults with type 2 diabetes and heart disease.
  - It is approved to reduce the risk of kidney function decline in adults with type 2 diabetes and chronic kidney disease (CKD).
  - Semaglutide has been shown in clinical trials to support weight loss and help maintain weight loss.
  - Weight loss occurs because Ozempic controls appetite and promotes prolonged feelings of fullness.

Battery Pack Aadhaar Number (BPAN)

News: The Union Ministry of Road Transport and Highways is proposing a mandatory identification system for electric vehicle batteries through a unique 21-character "Battery Pack Aadhaar Number" (BPAN).

About Battery Pack Aadhaar Number (BPAN)



Source – ET Now

- Battery Pack Aadhaar Number (BPAN) is a 21-character unique number to be provided to each battery introduced in the market or used for self-consumption.
- Aim: It aimed at ensuring end-to-end traceability across the battery lifecycle.
- Implementing Ministry: Ministry of Road Transport and Highways (MoRTH)
- Under the proposed framework, every electric vehicle battery pack will be assigned a BPAN that will track it from the sourcing of raw materials and manufacturing through usage, repurposing and final disposal.
- Batteries covered: The proposed system will apply to batteries already governed under the Battery Waste Management Rules, 2022. These include:
  - Electric vehicle batteries for L category vehicles
  - Electric vehicle batteries for M and N category vehicles

    - Industrial batteries with a capacity of more than 2kWh
    - This ensures that both mobility-related and large-capacity batteries are covered under a single traceability framework.
- Information stored in BPAN: Each Battery Pack Aadhaar will store detailed technical and environmental data, including:
    - Battery Manufacturer Identifier
    - Battery Descriptor and Identifier details
    - Battery material composition
    - Battery carbon footprint
    - Dynamic data related to battery performance and usage
- Information stored in BPAN: Each Battery Pack Aadhaar will store detailed technical and environmental data, including:
    - Battery Manufacturer Identifier
    - Battery Descriptor and Identifier details
    - Battery material composition
    - Battery carbon footprint
    - Dynamic data related to battery performance and usage
- Significance
    - The move is intended to bring greater transparency, accountability and sustainability to India's rapidly expanding electric mobility ecosystem.
    - It system will help address growing concerns around battery safety, environmental impact and improper disposal as EV adoption accelerates across the country.
    - It will function as a digital identity for batteries, enabling regulators, manufacturers and recyclers to access verified information on origin, chemistry, ownership history and end-of-life status.
    - The proposal also aligns with broader policy goals around circular economy practices and responsible resource management.

Remote Sensing

News: Remote sensing has transformed how scientists study the Earth, enabling them to map forests, water bodies, crops, and mineral deposits without ever setting foot on the ground.

About Remote Sensing

- Meaning: Remote sensing is a technology that allows scientists and engineers to study the earth's surface and subsurface without physical contact.
- Working Principle: It uses satellites, aircraft, and drones equipped with sensors to collect information from a distance.
    - The Sun emits visible as well as invisible electromagnetic radiation such as infrared and ultraviolet light. Different materials on Earth, including plants, water, soil, and rocks, reflect and absorb this energy in unique ways.
    - These unique patterns are called spectral signatures and act like fingerprints for identifying materials. Sensors analyse reflected energy to determine the type, condition, and composition of objects on the ground.
- Uses of Remote Sensing Technique

- Vegetation, forest health, and carbon mapping: Remote sensing can distinguish between different plant communities and tree species across large forest areas.
    - Scientists use the Normalised Difference Vegetation Index (NDVI) to assess plant health using spectral signatures.
    - High NDVI values indicate healthy vegetation, while low values may indicate stress, disease, or lack of water.
- Mapping surface water and monitoring water quality: Satellites use optical indexing and synthetic aperture radar (SAR) to map rivers, lakes, wetlands, and floods.
    - Water reflects visible green light but absorbs near-infrared and shortwave infrared radiation.
    - Scientists use the Normalised Difference Water Index (NDWI) to identify water bodies in satellite images.
    - The Modified NDWI (MNDWI) is especially useful in urban areas to distinguish water from building shadows.
- Mineral detection and hyperspectral remote sensing: Hyperspectral sensors split reflected sunlight into hundreds of narrow wavelength bands.
    - These sensors generate detailed spectral signatures for every pixel in an image.
    - Hyperspectral data can identify specific minerals, rock types, and even nutrient deficiencies in plants.
- Oil and gas exploration from space: Oil and gas sometimes leak slowly upward through cracks in the Earth, a process known as micro-seepage.
    - This seepage alters soil chemistry and slightly stresses vegetation, causing subtle colour changes.
    - Satellites can detect these changes to identify potential drilling locations.
- Groundwater mapping using gravity: Underground water increases the gravitational pull of an area.
    - Example – NASA's GRACE mission measured tiny changes in gravity using two satellites flying in formation.

Mishmi takin

News: The Mishmi takin is an elusive mountain ungulate found in the mist-covered Mishmi Hills of Arunachal Pradesh. It holds cultural, ecological, and symbolic importance for local communities.

About Mishmi Takin

Source: DTE

- The Mishmi takin is a goat-antelope native to Asia.
- It is a subspecies of takin.
- Habitat: The Mishmi takin thrives in diverse ecosystems, including pine scrub, subtropical forests, and alpine meadows.
- Distribution: The Mishmi takin is found in Northeast India, especially in eastern Arunachal Pradesh.
    - It also occurs in northern Myanmar and in parts of China, including regions near Tibet.
- Appearance: The Mishmi takin has a stocky body and a deep chest, which gives it a strong and powerful appearance.
    - It has a large head with a long, arched nose that makes the animal distinctive.
    - Both males and females possess stout horns that are ridged at the base and curve upward to a short point.
    - It has a long, shaggy coat that is oily in nature and helps protect it from cold and fog in mountainous regions.
- Behaviour: It usually lives in small family groups consisting of about twenty individuals.
    - Older males often lead a solitary life outside the herd.
    - During summer, large herds of up to three hundred individuals gather on high mountain slopes where food and mineral resources are available.
    - It is a diurnal animal and feeds mainly during the early morning and late afternoon.
    - It can stand on its hind legs to reach leaves that are more than three meters high.
    - In spring, Mishmi takins migrate upward into the mountains, while in winter they move down to lower, forested areas to survive harsh conditions.
    - When threatened, the Mishmi takin gives a cough-like alarm call, and the herd retreats into thick bamboo thickets for camouflage and safety.
- Diet: The Mishmi takin is a herbivorous animal that feeds mainly on bamboo and willow shoots.
- Threat: The Mishmi takin faces major threats from overhunting and habitat loss caused by deforestation.
- IUCN Status: At present, the Mishmi takin has not been evaluated by the IUCN Red List, and its population size remains unknown.

Somnath Temple

News: Prime Minister Narendra Modi has said that the Somnath temple's survival over the past thousand years reflects the country's indomitable civilisational spirit.

About Somnath Temple

Source – Temple Diary

- Location: The Somnath temple is located along the coastline in Prabhas Patan, Veraval, Saurashtra region of Gujarat.
- Meaning: Somnath means "Lord of the Soma" or "moon".
    - The site is also called Prabhasa ("place of splendor").
- Significance: Somnath temple has been a jyotirlinga site (out of 12) for the Hindus, and a holy place of pilgrimage (tirtha).
    - It is one of five most revered sites on the seacoast of India, along with the nearby Dwaraka in Gujarat, Puri in Odisha, Rameswaram and Chidambaram in Tamil Nadu.
- History
    - The site of Somnath has been a pilgrimage site from ancient times on account of being a Triveni Sangam: the confluence of three rivers namely Kapila, Hiran and Saraswati.
    - The Gurjara-Pratihara king Nagabhata II recorded that he has visited tirthas in Saurashtra, including Someshvara, an alternative name for the temple.
    - According to an inscription written in Sanskrit on one of the towers in temple campus, one can travel to the south pole unobstructed by following the straight path from the tower in the south direction.
- Islamic invasions
    - In 1026, during the reign of Bhima I, the Turkic Muslim ruler Mahmud of Ghazni raided and plundered the Somnath temple, breaking its jyotirlinga.
        - He took away a loot of 20 million dinars.
    - Kumarapala (r. 1143–72) rebuilt the Somnath temple in "excellent stone and studded it with jewels," according to an inscription in 1169. He replaced a decaying wooden temple.
    - During its 1299 invasion of Gujarat, Alauddin Khalji's army, led by Ulugh Khan, defeated the Vaghela king Karna, and sacked the Somnath temple.
    - The temple was rebuilt by Mahipala I, the Chudasama king of Saurashtra in 1308 and the lingam was installed by his son Khengara sometime between 1331 and 1351.
    - In 1395, the temple was destroyed for the third time by Zafar Khan, the last governor of Gujarat under the Delhi Sultanate and later founder of Gujarat Sultanate.
- Reconstruction
    - The Iron Man of India and Deputy Prime Minister Vallabhbhai Patel came to Junagadh on 12 November 1947 at which time he ordered the reconstruction of the Somnath temple.

- Accordingly, The Somnath Trust was established to collect funds and oversee the construction of the temple.
- The new structure was built by the traditional Somapuri builders of temples in Gujarat.
- Architecture: The present temple is a Māru-Gurjara architecture (also called Chaulukya or Solanki style) temple.
  - It has a "Kailash Mahameru Prasad" form.
- On 11 May 1951, Rajendra Prasad, the President of India performed the installation ceremony for the temple.
- Currently, the chairman of the trust is the Prime Minister of India.

CAG releases 'State Finances 2023-24' Report

News: In January 2026, the Comptroller and Auditor General released the second edition of the State Finances 2023-24 report covering all States.

CAG releases 'State Finances 2023-24' Report

Figure 6. Source – ANI

- The State Finances 2023-24 Report presents a consolidated and audited overview of the finances of all 28 States.
- Released by: The report was released by the Comptroller and Auditor General of India.
- Aim: The publication aims to provide comparable audited fiscal data of all States in one volume to support inter-State and inter-temporal analysis over a ten-year period.
  - It is intended to assist policymakers, public financial managers, researchers, academia, and other stakeholders through accessible and standardised fiscal information.
- January, 2026 Edition: This is the second edition of the publication, following the first edition released in September 2025.
- Key Findings
  - Revenue Receipts Composition: In FY 2023–24, total revenue receipts of States were ₹93 lakh crore, with States' Own Tax Revenue (SOTR) at about 50 percent, Union tax share at 30 percent, grants-in-aid at 12 percent, and SNTR at 8 percent.
  - States' Own Tax Revenue (SOTR): SOTR was 6.49 percent of GSDP in FY 2023–24, with a buoyancy ratio of 0.92, and showed wide variation across States.
  - States' Non-Tax Revenue (SNTR): SNTR constituted 8.22 percent of total revenue receipts and 1.08 percent of combined GSDP in FY 2023–24, with improvement after the Covid period.
  - Share in Union Taxes: The share of Union Taxes and Duties increased to 29.77 percent of States' revenue receipts in FY 2023–24, reflecting higher tax devolution over the decade.
  - Expenditure Pattern: Total expenditure of States was ₹81 lakh crore in FY 2023–24, equal to 16.15 percent of combined GSDP, with revenue expenditure forming 83.25 percent.
  - Capital Expenditure: Capital expenditure was ₹84 lakh crore, accounting for 16.75 percent of total expenditure, and remained within 13–20 percent over the decade.

- Committed Expenditure and Subsidies: Committed expenditure, subsidies, and Grants-in-Aid Salary together formed 59.90 percent of revenue expenditure in FY 2023–24.
- Public Debt and Liabilities: As on 31 March 2024, combined public debt was 23.42 percent of GSDP and total liabilities were 28.28 percent of GSDP, with wide variation across States.

Suryastra Rocket Launcher System

News: The Indian Army signed a ₹293 crore emergency procurement contract for the Suryastra long-range universal rocket launcher system.

About Suryastra Rocket Launcher System

Figure 7. Source – Money9

- Suryastra is India's first Made in India universal multi-calibre rocket launcher.
- Manufactured by: It is manufactured by Pune-based private defence firm NIBE Limited.
- Technology Partner: It is developed in collaboration with Israel's Elbit Systems under a Technology Collaboration Agreement signed in July 2025.
- Procurement Mode: It is acquired under the Ministry of Defence's Emergency Procurement powers, approved by the Defence Acquisition Council.
- Key Features
  - Range: It is capable of precision surface-to-surface strikes up to 300 km.
  - Precision: During trials, the system achieved a circular error probable of less than five metres.
  - Multi-Calibre Versatility: A single launcher can integrate and fire multiple rocket types.
  - Loitering Munitions: The launcher can fire loitering munitions up to a range of 100 km.
  - Combat Mobility: The system is designed to engage multiple targets simultaneously at different ranges.
- Strategic Significance: The acquisition enhances deep-strike artillery firepower, extends operational reach, and supports domestic production of high-precision long-range rocket systems under emergency operational requirements.

Popocatépetl Volcano

News: Over five years, UNAM scientists used 22 seismographs and AI to analyse seismic data and produce the first 3D image of Popocatépetl's interior, extending 18 km below the crater.

About Popocatépetl Volcano

Source: virtualuppermantle

- Location: Popocatépetl volcano is located on the border of the states of México and Puebla, central Mexico.
- Type: It is a steep-sided active stratovolcano located in the central part of the Mexican volcanic belt,
- Formation: It is formed by subduction of the Cocos and Rivera plates beneath the North American plate.
    - Popocatépetl took its present form over 20,000 years ago within the remnants of older volcanoes and has remained active since 1994, releasing smoke, gas, and ash almost daily.
- Eruptions: Its eruptions occur when a lava dome forms over the main vent and later collapses, the most recent such eruption taking place in 2023.
    - That's why it is also known as the "Smoking Mountain"
- It is regarded as one of the most dangerous volcanoes within the Pacific Ring of Fire, posing significant risks due to its high level of activity and proximity to densely populated areas.

e-Production Investment Business Visa (e-B-4 Visa)

News: India has introduced the e-Production Investment Business Visa to facilitate Chinese business travel as part of recent people-centric steps.

About e-Production Investment Business Visa (e-B-4 Visa)

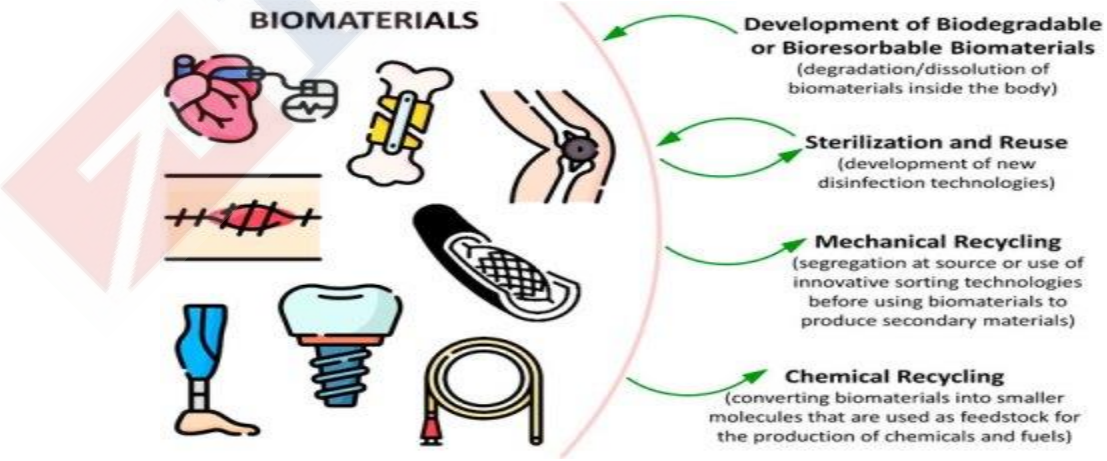
Source – FE

- The e-B-4 Visa is an online business visa for foreign professionals undertaking production-related activities in India.
- Launched by: It was launched by the Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry.
- Objective: The objective is to simplify business visa procedures and support production, manufacturing, and investment-linked activities by foreign professionals in India.
- Operational date: The e-B-4 Visa was introduced on January 1.
- Validity and stay: The visa permits a stay in India for up to six months.
- Processing Time: The visa is issued in about 45 to 50 days after online application.
- Application Process : The application process is fully digital and does not require visiting an embassy or using intermediaries.
- Mandatory registration: Indian companies must generate a digital sponsorship letter through the National Single Window System before visa application.
    - The foreign professional then applies on the Indian e-Visa portal using the sponsorship letter number and uploads the required documents.
- Visa approval is decided separately by the Ministry of External Affairs and the Ministry of Home Affairs.
- Eligible Activities include
    - Installation and commissioning of equipment
    - Quality check and essential maintenance
    - Production activities
    - IT systems and ERP ramp-up
    - Training and knowledge transfer
    - Supply chain development for empanelling vendors
    - Plant design and bring-up
    - Senior management and executive visits

Biomaterials

News: As India moves toward cleaner manufacturing methods for products like plastics and textiles, biomaterials are emerging as the next frontier in materials engineering.

About Biomaterials



Source: Frontiers

- Biomaterials are materials derived wholly or partly from biological sources or engineered using biological processes.
- They are designed to replace or interact with conventional materials.
- Types of Biomaterials:
    - Drop-in Biomaterials: Drop-in biomaterials are chemically identical to conventional fossil-based materials.
        - They can be used in existing manufacturing and recycling systems without modification. Bio-PET is a common example of a drop-in biomaterial.
    - Drop-out Biomaterials: Drop-out biomaterials are chemically different from conventional materials.
        - They require new processing methods and dedicated end-of-life systems. Polylactic acid (PLA) is a widely used drop-out biomaterial.
    - Novel Biomaterials: Novel biomaterials offer new properties not found in traditional materials.
        - These include self-healing materials, bioactive implants, and advanced bio-composites.
- Applications of Biomaterials
    - Biomaterials are used in orthopedic implants such as hip and knee replacements to restore mobility and reduce pain.
    - They are used in dental implants, providing strong support for artificial teeth
    - Cardiovascular stents made from biomaterials help keep arteries open and improve blood flow
    - Biomaterials are essential in prosthetics, enabling the development of artificial limbs and joint replacements.
    - They are used in drug-delivery systems to ensure controlled and targeted release of medicines.
    - In tissue engineering, biomaterials act as scaffolds for tissue and organ regeneration.
    - Biomaterials are incorporated into medical devices and diagnostics, such as biosensors and contact lenses.

SHINE Scheme

News: The 79th Bureau of Indian Standards(BIS) Foundation Day was celebrated in New Delhi with the launch of SHINE and other key initiatives.

About SHINE Scheme

Source – PIB

- Full Form: SHINE, meaning Standards Help Inform and Nurture Empowered Women, is a new scheme that focuses on women-led quality awareness.
- Launched by: It has been launched by the Bureau of Indian Standards (BIS).
- Objective: To empower women with knowledge about safety, quality, and standards so they can act as "change agents" in their households and communities.
- Implementation: The scheme uses structured training and partnerships with NGOs and Self-Help Groups (SHGs) to spread awareness about authentic vs. counterfeit products.

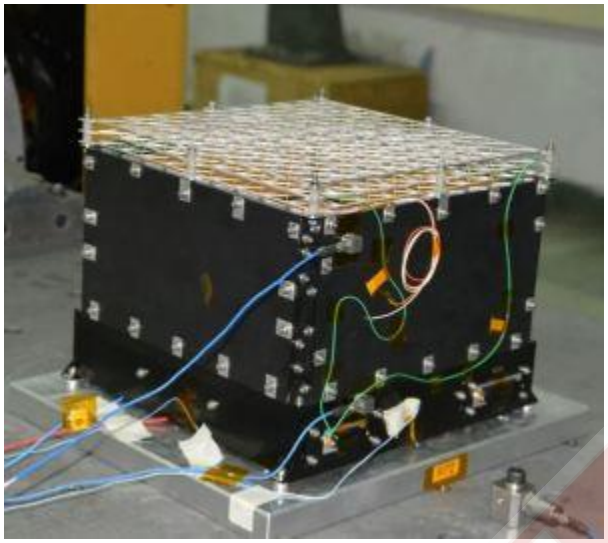
About Bureau of Indian Standards (BIS)

- BIS: It came into existence in 1986 under BIS Act,1986 and was established as the National Standard Body of India under the BIS Act 2016.
- Earlier version: The organisation was formerly the Indian Standards Institution (ISI) set up under the Department of Industries and Supplies and was registered under the Societies Registration Act, 1860.
- Nodal Ministry: Ministry of Consumer Affairs, Food and Public Distribution.
- Nodal agency: It functions as the nodal agency for standardization, marking, and quality certification of goods.
- Objective: Its objective is the harmonious development of standardization and quality certification activities.
- Headquarter : It is headquartered in New Delhi.
- It represents India in the International Organization for Standardization and the International Electrotechnical Commission.

Dust EXperiment (DEX)

News: ISRO confirmed that the Dust Experiment (DEX), India's first indigenous dust detector, recorded interplanetary dust particles entering Earth's atmosphere every thousand seconds.

About Dust EXperiment (DEX)



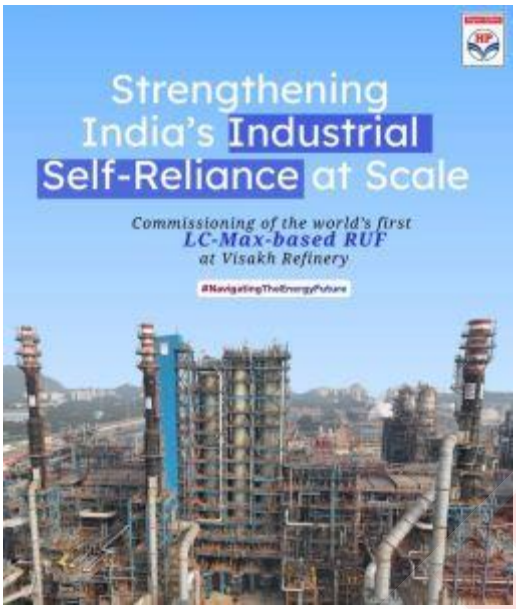
Source – ISRO

- Dust EXperiment (DEX) is India's first home-made instrument designed to detect high-speed interplanetary dust particles in Earth orbit.
- Developed by: It was developed by the Physical Research Laboratory under Indian Space Research Organisation.
- Aim: The main aim of DEX is to detect and measure impacts of microscopic interplanetary dust particles to understand the space environment.
- Mission: It was flown onboard the PSLV Orbital Experimental Module (POEM) of the PSLV-C58 XPoSat mission launched on January 1, 2024.
- Key technical details
    - The instrument has a weight of about three kilograms and operates at a power consumption of 4.5 watts.
    - It was placed at an altitude of around 350 km while skimming Earth's atmosphere at a 9.5 degree inclination.
    - The detector has a wide field of view of about 140 degrees.
    - It works on the hypervelocity detection principle by recording high-speed dust impact signals.
- Major findings
    - Constant bombardment: The observations confirmed that Earth's atmosphere faces continuous bombardment by interplanetary dust particles.
    - Dust flux: DEX measured a dust flux of up to 6.5×10^{-3} per square metre per second, indicating a high impact rate.
- Significance: The experiment provides critical data for monitoring space environment risks and supporting future satellite, human spaceflight, and planetary missions.

Residue Upgradation Facility (RUF) and Hydrocracking Technology

News: The Prime Minister lauded the commissioning of HPCL's Residue Upgradation Facility at Visakh Refinery as a significant step for energy security.

About Residue Upgradation Facility (RUF) and Hydrocracking Technology



Source – HPCL

- The Residue Upgradation Facility (RUF) is a hydrogen-based residue hydrocracking unit that converts low-value residual oils into high-value petroleum products.
- Commissioned by: The facility has been commissioned by Hindustan Petroleum Corporation Limited (HPCL).
- Location: The facility is located at the Visakh Refinery in Andhra Pradesh.
- Capacity: The RUF has a capacity of 3.55 million metric tonnes per annum.
- Efficiency: The facility converts nearly 93 % of bottom oils into high-value petroleum products, making it highly efficient.
- Key features
    - Technology: The facility uses advanced LC-Max based residue hydrocracking technology for deep-conversion refining.
    - Complexity: It houses three LC-Max reactors weighing about 2,200 metric tonnes each, which are among the heaviest in the world and are indigenously manufactured.
    - Digital integration: HPCL has deployed the RUF (LC-Max) Digital Suite, which is an industry-first in Indian refineries and enables real-time monitoring, predictive analytics using proprietary thermodynamic models, and AI-driven optimization to ensure stable and efficient operations.

About Hydrocracking Technology

- Hydrocracking technology is a hydrogen-based process used for upgrading heavy residual oils into lighter and more valuable petroleum product.
- It enhances refinery complexity and improves gross refining margins by producing a superior product slate and improving overall operational efficiency.

Mayon Volcano

News: A series of mild eruptions at Mayon Volcano in the Philippines has prompted the evacuation of nearly 3,000 villagers in a permanent danger zone on its foothills.

About Mayon Volcano

Source – Britannica

- Location: It is located in Albay Province in the Bicol Region of Luzon, Philippines.
- Geology: It is located on a convergent boundary between the Eurasian and Philippine Plates.
    - It is part of the Pacific Ring of Fire.
- Type: It is classified as a stratovolcano active volcano, formed by alternating layers of lava and ash.
- It is one of the youngest in the volcanic chain in the Bicol volcanic chain.
    - The Bicol volcanic chain includes Bulusan in Sorsogon, and Iriga and Isarog, which are both active stratovolcanoes (made of layers of lava and ash) located in Camarines Sur.
- It has a base 130 km in circumference and rises to 2,462 m from the shores of Albay Gulf.
- Structure: It is famous for its nearly perfect cone shape and symmetrical structure.
    - The upper slopes are steep, with angles ranging between 35 and 40 degrees.
- Conservation area: It is the centre of Mayon Volcano National Park.
    - There are large abaca plantations on its lower slopes.
- Past Eruptions: The first recorded eruption occurred in July 1766.
    - Mount Mayon has erupted more than 50 times over the past 500 years.

Justice Mission 2025

News: Recently, military forces of the People's Republic of China conducted Justice Mission-2025 around Taiwan.

About Justice Mission 2025

Source: Global Taiwan

- Conducted by: People's Liberation Army (PLA) of China on 29–30 December 2025.
- Location: It was conducted in the air and maritime areas surrounding Taiwan.
- The exercise was the second named large-scale PLA maritime drill directed at Taiwan in 2025, following the Strait Thunder–2025A exercise earlier in the year.
- Objective: The exercise focused on sea and air combat readiness patrols, seizing comprehensive superiority, blockading key ports and territories and "three-dimensional external line deterrence" in the maritime region around Taiwan.
- Forces Involved: China deployed army, naval, air force, and artillery units, including fighter jets, bombers, unmanned aerial vehicles (UAVs), and long-range rockets.
    - PLA forces practiced striking mobile land-based targets while simulating a coordinated multi-directional assault on Taiwan.
    - The exercise placed greater emphasis on shore-based aviation, rocket forces, and amphibious assault ships rather than carrier strike group operations.
- Activities by PLA during the exercise: During the exercise, various Chinese military aircraft and ships were operated around Taiwan, with some vessels deliberately approaching the contiguous zone, 24 nautical miles from the island's coast.
    - Dozens of PLA boats and aircraft conducted maritime and air operations, including rehearsals for potential port blockades.
- Strategic Significance
    - The exercise marked the first time China publicly stated that its drills are aimed at deterring foreign intervention.
    - PLA actions demonstrated an increasing willingness to operate near Taiwan's territorial waters and signal the potential for escalation.
    - The combination of live-fire drills, amphibious rehearsal imagery, and propaganda posters underscores a dual strategy of military intimidation and political messaging.