1. Scramjet Engine Development: DRDO successfully conducted a 1,000-second ground test of its actively cooled scramjet combustor, marking a major milestone in India's hypersonic weapons programme.

- The latest test was conducted at the newly established Scramjet Connect Test Facility of the Defence Research & Development Laboratory (DRDL) in Hyderabad, a premier institution under DRDO.

- **About Scramjet Engine**: Stands for Supersonic Combusting Ramjet is an advanced air-breathing engine that enables supersonic combustion and operates efficiently at hypersonic speeds (above Mach 5 or 6,100 km/h).
  - It uses atmospheric oxygen for combustion, reducing the need for onboard oxidizers and improving fuel efficiency at high speeds.
  - **About DRDO:** Established in 1958 by merging the Technical Development Establishment (TDEs) of the Indian Army, Directorate of Technical Development & Production (DTDP), and the Defence Science Organisation (DSO).
  - **Headed by:** Secretary, Department of Defence R&D, and Director General (DG) of DRDO.
  - **Assistance:** The DG is assisted by Chief Controllers, who manage various technology domains.

2. River Cities Alliance (RCA): The **National Mission for Clean Ganga (NMCG)** has approved an ambitious Action Plan 2025 for the **River Cities Alliance (RCA),** focusing on enhancing urban river rejuvenation efforts across India.

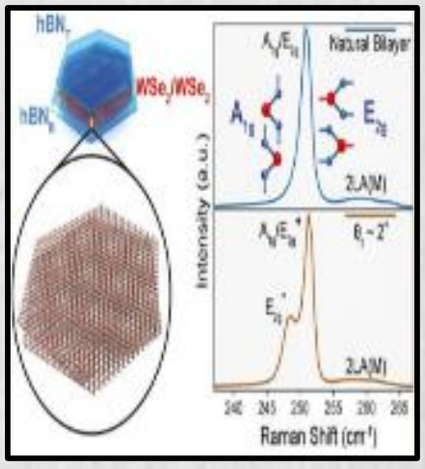
- **About RCA :** Aims to promote a comprehensive approach to managing urban rivers, foster inter-city collaboration, and develop Urban River Management Plans (URMPs).
  - **Launched by:** Ministry of Jal Shakti and Ministry of Housing and Urban Affairs.
  - **Membership:** 145 member cities.
- **About NMCG:** It is a flagship program launched by the Government of India, aiming to rejuvenate the Ganga River.
  - **A society:** It was registered as a society on 12th August 2011 under the Societies Registration Act 1860.
  - **Formation:** Created as the implementation arm of the National Ganga River Basin Authority (NGRBA) under the Environment (Protection) Act, 1986.

3. Revive Our Ocean Initiative: Recently, the global initiative 'Revive Our Ocean' was launched with the aim of expanding effective, community-led **Marine Protected Areas (MPAs)** through local efforts.

- It will initially focus on **seven countries**: the **UK**, **Portugal**, **Greece**, **Turkey**, **the Philippines**, **Indonesia**, and **Mexico**.

- **Need for Marine Protected Areas (MPAs)**
  - **30X30 Target:** The Kunming-Montreal Global Biodiversity Framework aims to protect 30% of the world's oceans by 2030.
  - **Current Status:** Over 16,000 MPAs exist globally, covering 8% of oceans, but only 3% are fully protected (Protected Planet Report 2024).
  - **Management Issues:** Many MPAs are poorly managed or still allow harmful activities like bottom trawling, which damages ecosystems and increases carbon emissions.
  - **Benefits:** MPAs help regenerate marine biodiversity, stimulate local economies through tourism and jobs, ensure food security, and play a critical role in combating climate change by capturing carbon.

4. Phonon: Recently, researchers at the Indian Institute of Science (IISc), Bangalore, discovered a novel method to control the behavior of phonons, marking a major leap for future quantum and photonic technologies.



- **About Phonon:** Are energy waves that travel through a material's crystal lattice during atomic vibrations.
  - They are collective excitations in the elastic structure of condensed matter, similar to ripples in a pond.
  - Play a crucial role in determining a material's thermal, optical, and electronic properties.
  - Essential for developing advanced optoelectronic devices and emerging quantum technologies.
- **IISc's New Method:** Researchers at IISc have found that by slightly twisting two layers of Tungsten Diselenide (WSe_2), a two-dimensional material, they can control how phonons behave.

- Their study, published in **ACS Nano**, shows that **moiré patterns** (overlap structure) formed by twist angles between 1° and 7° cause the phonon modes to split, offering new ways to tune material properties.

5. Heat Stress in the Western Ghats: A recent study conducted in Karnataka revealed alarming findings about the impact of **extreme heat on the leaves of tropical forest and agroforestry species** in the Western Ghats.

- Researchers found that many species, crucial for ecology and local economies, are facing leaf temperatures exceeding critical thresholds, risking irreversible damage.

- **Major Findings:** The study, conducted in Hosagadde village, Karnataka, over 4.5 months in 2023, monitored leaf temperatures of 13 agroforestry species and 4 native forest species.
  - **T_{50} parameter** is used which indicates the temperature at which a leaf's photosynthetic efficiency declines by 50%, marking the point where irreversible heat damage occurs to plants.
  - Agroforestry Species like cardamom, cashew, and coffee frequently exceeded critical leaf temperatures.
  - Native species like kindal and ironwood showed visible damage, including blackened leaf areas.

6. Goods and Services Tax Appellate Tribunal(GSTAT): Recently, the government officially notified the GSTAT(Procedure) Rules, 2025, introducing several key reforms to the dispute resolution process under the Goods and Services Tax (GST) framework.

- **About GSTAT**: It serves as the second level of appeal within the GST framework, available for challenging any unsatisfactory rulings issued by the First Appellate Authorities under the CGST and SGST.
  - **Establishment by**: Section 109 of the CGST Act 2017 ; **HQ**: New Delhi
  - **Composition**: Two judicial members and two technical members.
  - **Headed by** : Former Supreme Court judge or a former Chief Justice of a High Court.
  - **Aim**: To provide swift, fair GST dispute resolution, reduce higher court burdens, and enhance system efficiency and transparency.
- **Key Features of GSTAT Rules:** Mandatory e-filing, hybrid hearings, urgent matters listed quickly, fixed working hours, 31 state benches for accessibility, clear document procedures, standardized forms, and ongoing member appointments.

7. Iran's Nuclear Programme: Recently, China, Russia, and Iran held a joint meeting with the International Atomic Energy Agency (IAEA) to discuss Iran's nuclear programme.

- **About IAEA:** The IAEA was created in 1957 in response to the deep fears and expectations generated by the discoveries and diverse uses of nuclear technology.
  - The Agency was set up as the world's "Atoms for Peace" organization within the United Nations family**.**
  - **Headquartered**: Vienna, Austria.
  - **The objectives:** Dual mission: To promote and control the Atom i.e., scientific and technical cooperation on the peaceful use of nuclear technology and nuclear power worldwide.
  - **Independence:** Though **established independently of the United Nations** through its own international treaty, the IAEA Statute, the IAEA **reports to both** the United Nations General Assembly and Security Council.

8. Dr. Krishnaswamy Kasturirangan: Recently, Dr. Krishnaswamy Kasturirangan, the former ISRO Chairman, passed away, leaving behind an indelible legacy in the fields of science, technology, and education.



- **Major Contributions:**
  - **Chairmanship of ISRO (1994-2003):** Led ISRO's transition to operational space programs and commercialized India's space program, including leasing transponders for cable TV.
  - **Visionary Space Missions:** EDUSAT for tele-education, INSAT/GSAT for telemedicine and communication, RESOURCESAT for earth resources, METSAT for meteorology OCEANSAT for oceanography, CARTOSAT for cartography, Meghatropique for earth science, ASTROSAT for space science and Chandrayaan-1 for lunar exploration.
  - **National Natural Resource Management System (NNRMS):** Introduced to apply space technology in agriculture, forestry, town planning, and water resource management.
  - **Launch Vehicle Development:** Oversaw the operationalization of PSLV and GSLV, enhancing India's space capabilities.
  - **Contributions to Education:** Played a key role in the development of NEP 2020, served in the Rajya Sabha, and chaired the Karnataka Knowledge Commission.



9. Rafale-Marine (Rafale-M) Fighter Jet: Recently, India and France confirmed the conclusion of the ₹63,000-crore government-to-government (G-to-G) deal for 26 Rafale-Marine (Rafale-M) fighter jets.

- **About Rafale-M Fighter Jet:** Naval variant of the Dassault Rafale, a 4.5-generation, twin-engine, delta-wing and multirole fighter aircraft.
  - Performs multiple roles: air superiority, ground support, reconnaissance, and anti-ship missions.
  - Equipped with advanced systems like RBE2 AESA radar, SPECTRA electronic warfare suite, front sector optronics, and omnidirectional warning systems.
  - Powered by two SNECMA M88 turbofan engines, enabling supercruise (supersonic flight without afterburners).
  - Capable of speeds up to Mach 1.8, a combat radius over 1,000 km, and carrying up to 9,500 kg of payload across 14 hardpoints.
  - Other Rafale variants include Rafale C (single-seat) and Rafale B (twin-seat for training and combat).
  - India's deal includes **22 single-seater carrier-operable Rafale-M jets** and **4 twin-seater trainers** (land-based only).

10. Human Papillomavirus (HPV): Recently, the Department of Biotechnology (DBT) announced the successful scientific review and validation of India's first indigenously developed Human Papillomavirus (HPV) test kits for cervical cancer screening.

- **About Human Papillomavirus (HPV**): A common sexually transmitted infection affecting the skin, genital area, and throat.
  - In most cases, the immune system clears the virus, but persistent high-risk HPV can lead to cancer.
  - HPV can affect both women and men, causing genital warts and cancers in areas such as the cervix, vulva, vagina, penis, anus, and throat.
  - HPV is responsible for approximately 5% of all cancers globally.