1. ASEAN – INDIA Trade Agreement in Goods

Why in News?
The 4th Joint Committee meeting for the review of AITIGA (ASEAN-India Trade in Goods Agreement) was held in Putrajaya, Malaysia from 7-9 May 2024.

About ASEAN-India Trade in Goods Agreement:

- It is a trade deal between the ten member states of ASEAN and India.
- It was signed at the 7th ASEAN Economic Ministers-India Consultations in Bangkok, Thailand in 2009.
- The agreement, which came into effect in 2010, is sometimes referred to as the ASEAN-India Free Trade Agreement.
- The Agreement covers trade in physical goods and products; it does not apply to trade in services.
- ASEAN and India signed a separate ASEAN-India Trade in Services Agreement in 2014.

What is ASEAN?

- It is a group of the Association of Southeast Asian Nations, which was established in 1967 with the signing of the Bangkok declaration.
- Founding members: Indonesia, Malaysia, Philippines, Singapore and Thailand.
- Presently ASEAN comprises 10 member states namely Indonesia, Malaysia, Philippines, Singapore, Thailand, Brunei, Laos, Myanmar, Cambodia and Vietnam.
- It promotes intergovernmental cooperation and facilitates economic, political, security, military, educational, and sociocultural integration between its members and other countries in Asia.

2. What is Leopard Cat?

Why In News?
A leopard cat has been spotted in Maharashtra's Pench Tiger Reserve for the first time, a senior forest official said recently.

About Leopard Cat:

- It is a species of **forest-dwelling cat**, of the family Felidae.

- **Scientific Name**: *Prionailurus bengalensis*
- It is noted for its **leopard-like colouring**.
- **Distribution**:
  o They are the most **widely distributed Asian small cats**.
  o Their range **extends from** the **Amur region in** the **Russian Far East** over the **Korean Peninsula**, **China**, **Indochina**, the **Indian Subcontinent,** to the West in northern **Pakistan**, and to the south in the **Philippines** and the **Sunda Islands of Indonesia**.
- **Habitat**:
  o They are found in agriculturally used areas but **prefer forested habitats**.
  o They live in **tropical evergreen rainforests and plantations** at sea level, in **subtropical deciduous** and **coniferous forests** in the **foothills of the Himalayas** at altitudes above 1000 m.
- **Features**:
  o They vary widely in size and appearance across their range. The colouration ranges from **pale tawny, to yellow, red, or grey above**, with the **underparts white, and spotted.**
  o There are usually **four black stripes running down the forehead to the nape**, breaking up into short bands and elongate spots on the shoulders.
  o The length of the animal ranges from 45 to 75 cm (18 to 30 inches), excluding the 23–35-cm (9–13.8-inch) tail.
  o They are **solitary**, **nocturnal carnivores**.
- **Conservation Status:**
  o **IUCN Red List: Least Concern**

Key Facts about Pench Tiger Reserve:
- **Location**: It is located in the southern reaches of the Satpura hills in the Seoni and Chhindwara districts in **Madhya Pradesh** and continues in Nagpur district in **Maharashtra** as a separate Sanctuary.
- It is named after the **Pench River,** which flows from north to south through the Reserve.
- It comprises the Indira Priyadarshini Pench National Park, the Pench Mowgli Sanctuary, and a buffer.
- The area of the Pench Tiger Reserve and the surrounding area is the **real story area of** Rudyard **Kipling's famous "The Jungle Book"**.
- **Vegetation**: The undulating topography supports a mosaic of vegetation ranging from a **moist, sheltered valley to an open, dry deciduous forest.**
- **Flora**: The reserve boasts a diverse range of flora, including **teak, saag, mahua, and various grasses** and **shrubs**.
- **Fauna:**
  o The area is especially famous for large herds of **Chital, Sambar, Nilgai, Gaur** (Indian Bison), and wild boar.
  o The **key predator** is the **tiger**, followed by the leopard, wild dogs, and wolf.
  o There are over 325 species of **resident and migratory birds**, including the **Malabar Pied Hornbill, Indian Pitta**, Osprey, Grey Headed Fishing Eagle, White Eyed Buzzard, etc.

3. National Technology Day

Why in News?

- Recently, the Technology Development Board (TDB) of the Department of Science and Technology (DST) celebrated the National Technology Day (2024).

About

- It is celebrated annually on 11th May, dedicated to honouring the relentless efforts of scientists, engineers, and innovators who work tirelessly to advance technology and simplify our lives.
- The Rashtriya Vigyan Puraskar Awards, akin to the prestigious Padma awards, are announced annually on National Technology Day.
- Theme for 2024: 'Promoting Clean and Green Technologies for a Sustainable Future'.

Brief History
- The inception of National Technology Day dates back to May 11, 1998, when India successfully conducted Pokhran-II Nuclear Tests under the codename 'Operation Shakti'.
- The then Prime Minister, Atal Bihari Vajpayee, declared May 11 as National Technology Day, and since then, the day has been celebrated annually to highlight India's technological progress.
   a. The Indira Gandhi Centre for Atomic Research (IGCAR) and the Bhabha Atomic Research Centre (BARC) played pivotal roles in advancing nuclear science within the country.

Major Highlights of India's Technological Progress Since 1998

- Since 1998, India has continued steadily in its journey of technological developments.
- Among the visible examples of India's impactful technological progress are the digital payment gateways that have democratised financial transactions like never before, and exemplify India's leadership in the world in this area.
- Other lesser-known milestones that have quietly been achieved are making of indigenous BioJet fuels, mapping of subsurface water channels for sustainable use of water, making of indigenous light combat aircraft, development of variety of crops by traditional methods of breeding, digitisation of many aspects of trade, and moving firmly towards a Hydrogen economy.
- Supercomputing in India began in the mid-1980s when access to the CRAY supercomputer was denied.
  - The Centre for Development of Advanced Computing (C-DAC) launched PARAM 10,000 in 1998 that is capable of performing 100-gigaflop operations, demonstrating India's capacity to build high-performance computing systems.
- India is currently making progress in more advanced and sophisticated technologies such as neutrino, gravitational waves, scramjets, tokamak and sending human missions into space.

Technology Development Board (TDB)
- It was constituted in 1996 under the **Technology Development Board Act, 1995**, as a **statutory body**, to promote development and commercialization of indigenous technology and adaptation of imported technology for wider application.
  - It is the **first organisation** of its kind within the government framework with the **sole objective of commercialising the indigenous research.**
- It provides **equity capital or loans** *(at a simple interest rate of 5% per annum)* to industrial concerns and financial assistance to research and development institutions.

Importance of Clean and Green Technologies

- Clean and green technologies, often referred to as 'Greentech' or 'clean technology', are crucial for a sustainable future, offering innovative solutions that protect our environment while also providing economic and health benefits.
- Mitigating Climate Change Impacts: These technologies reduce greenhouse gas emissions, a major contributor to global warming.
  - By utilising renewable energy sources such as solar, wind, and hydro power, we can significantly cut down our reliance on fossil fuels, thereby reducing our carbon footprint.
- Conserving Natural Resources: These 'Greentech' promote the efficient use of resources.
  - For instance, water-saving technologies can help conserve water, a precious resource that is becoming increasingly scarce due to climate change and overuse.
- Economic Growth: Green technologies can contribute to economic growth.
  - They can create new industries and jobs, stimulate innovation, and provide opportunities for investment and trade.

Major Hurdles

- Funding Challenges: The level of investment in research and development in India is often insufficient to support cutting-edge scientific endeavours and technological innovations.
- Educational Variability: Disparities in the quality of science and technology education across the country hinder the development of a skilled workforce.
- Infrastructure Issues: Lack of adequate infrastructure can pose a significant challenge to technological progress.
- Navigating Synthetic Media: In an era dominated by synthetic media, discerning authenticity in a landscape inundated with manipulated content is a significant challenge.
- Technical Debt to Technical Wellness: The transition from managing technical debt to prioritising technical wellness emerges as a guiding principle, fostering sustainable technology ecosystems that can adapt and thrive in the face of evolving challenges.

Major Steps towards Clean and Green Technologies in India

- National Electric Mobility Mission Plan and Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) to promote electric mobility and manufacturing of electric & hybrid vehicles and their components, and to support the transport sector in adopting green technologies.
- Green Hydrogen Mission which focuses on using green hydrogen as an energy source, and India's journey towards a net-zero target by 2070.
- Carbon Capture Utilisation and Storage (CCUS) Technologies that involve the capture of CO2, generally from large point sources like power generation or industrial facilities that use either fossil fuels or biomass as fuel.
- Other major initiatives like Pradhan Mantri Ujjwala Yojana, Make in India program, Energy Transition and Energy Storage Projects, Renewable Energy Evacuation, Green Credit Program, PM-PRANAM and GOBARdhan Scheme, Bhartiya Prakritik Kheti Bio-Input Resource Centres, MISHTI, Amrit Dharohar, Coastal Shipping, and Vehicle Replacement are focusing on various aspects of green technology, including waste management, heritage conservation, maritime transport, and vehicle replacement.

4. ISRO Tests 3D-Printed Rocket Engine

Why In News?

- Indian Space Research Organisation (ISRO) successfully tested a liquid rocket engine made with the help of **Additive Manufacturing Technology** — **commonly known as 3D printing.**

About Rocket Engine

- The PS4 engine, designed for the fourth stage of the **Polar Satellite Launch Vehicle (PSLV)**, was redesigned by ISRO for production using 3D printing.
  - o The PS4 engine uses a bipropellant combination of nitrogen tetroxide as the oxidizer and monomethyl hydrazine as the fuel

- **Laser Powder Bed Fusion technique** used in the manufacturing process. **Laser Powder Bed Fusion (LPBF)** is a metal 3D printing technique where a laser selectively melts and fuses metal particles together, building up a **3D object layer by layer.**
- The technology helped ISRO bring **down the number of parts in the engine** from 14 to a single piece.

What is 3D Printing?

About:
- The term 3D printing is typically used to refer to all types of additive manufacturing.
- It refers to the transformation of a **digital CAD (Computer-Aided Design) file into a three-dimensional physica**l solid object or part.
- It typically does this by depositing material layer by layer in precise geometric shapes using a printhead, nozzle, or other printing technology.
  - It is an additive process, in which layers of a material like plastic, composites or bio-materials are built up to construct objects that range in shape, size, rigidity, and colour.

Process:
- The process of 3D printing a building involves the use of computer-aided design (CAD) software to create a digital blueprint.
  - This blueprint is then converted into a format the 3D printer can understand, typically a .STL or .OBJ file.
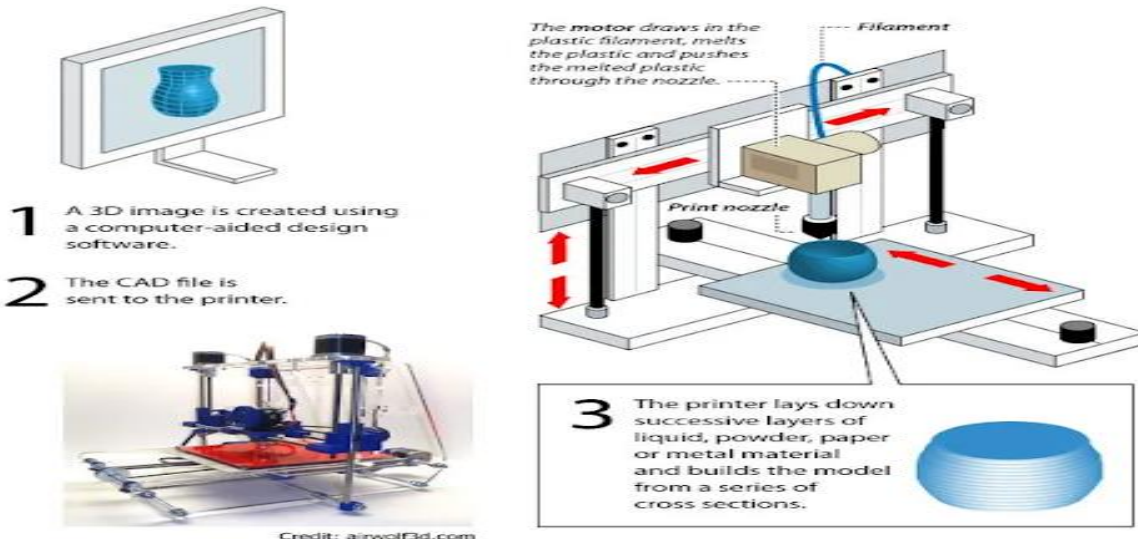
Application:
- It has widely been applied towards the agricultural, biomedical, automotive, and aerospace industries
- There are numerous applications of 3D printing technology for producing biomedical products such as drugs, artificial skin, bone cartilage, tissue, and organs, and in cancer research and education.
- It is used widely in the manufacturing industry and medical education field.
- It has been used to create complex walls , endodontic guides , sport shoes , engine parts for the aviation industry, and tumour reconstruction.

Benefits
- 3D printing technology, which has the potential to revolutionize the construction industry, offers unprecedented design freedom, reduces material waste, and significantly reduces construction time.

LIVE SCIENCE   www.LiveScience.com

How 3D Printing Works

3D printing, the process of making a three-dimensional solid object from a digital model, is set to revolutionize the way industries manufacture parts. Here's how 3D printing works:

The **motor** draws in the plastic filament, melts the plastic and pushes the melted plastic through the nozzle.

Filament

Print nozzle

1 A 3D image is created using a computer-aided design software.

2 The CAD file is sent to the printer.

3 The printer lays down successive layers of liquid, powder, paper or metal material and builds the model from a series of cross sections.

Credit: airwolf3d.com

Types of additive processes

Several different 3D-printing processes have been invented since the late 1970s.

TYPE	PROCESS	MATERIAL
Extrusion; wire	Uses a plastic filament or metal wire that is wound on a coil and unreeled to supply material to an extrusion nozzle.	Thermoplastics, eutectic metals, edible materials, metal alloy
Granular	Uses selective fusing of materials in a granular bed. The technique fuses parts layer by layer until the object is built.	Metal alloy, titanium alloys, thermoplastics, metal powders, ceramic powders, plaster
Laminated	Laminates objects using layers of thin plastic, paper or metal sheets.	Paper, metal foil, plastic film
Light polymerized	Vat of liquid polymer is repeatedly exposed to light. The exposed liquid polymer hardens in small increments until the model has been built. The remaining liquid polymer is drained from the vat, leaving the solid model. Another system sprays photopolymer materials in ultra-thin layers until the model is completed.	Photopolymer

The next Industrial Revolution?

Intellectual-property issues and the quality of printed objects continue to be concerns, but 3D printing has already had a huge impact on manufacturing, industrial design and even medicine. Here are some potential uses for the technology:

A working gun
The world's first 3D-printed gun was successfully tested in March 2013.

Credit: Defense Distributed

Stem cell
The device works by creating uniform droplets of living embryonic stem cells, which researchers can use to test drugs or to build miniature scraps of tissue. The eventual goal is to grow whole organs from scratch.

Credit: National Institutes of Health

Bionic ear
The bionic ear – made from calf cells, a polymer gel and silver nanoparticles – can pick up radio signals beyond the range of human hearing.
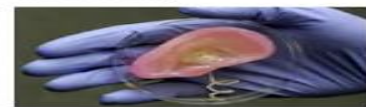
Credit: National Institutes of Health

Lunar base
The 3D-printing concept is being tested for more efficient lunar-base construction. The base would be 3D-printed from lunar soil.

Credit: European Space Agency

SOURCES: WIKIPEDIA.ORG, HOWSTUFFWORKS.COM   R. TORO / © LiveScience.com

AD PLACEMENT

- It enables the creation of complex architectural forms that would be challenging to achieve with traditional methods.
- It allows for the customization and optimization of building components.
- The layer-by-layer approach of 3D printing allows precise control over material distribution and structural integrity, resulting in highly efficient and robust structures.

Challenges
- The slow adoption in India can be attributed to the lack of understanding about 3D printing.
- In the 3D printing industry, parts to build the printer are still very expensive.
- Lack of investment and fewer R&D centres for 3D printing are some of the additional factors that are holding back large scale adoption.

Future Outlook
- 3D printing technology has emerged in recent years as a flexible and powerful technique in advanced manufacturing.
- The future demand for 3D printing lies in its capability to perform different print functions and "print-it-all" structures.
  o These functions are progressively perceived as the driving force for researchers and practitioners .
- A better understanding of 3D printing technology and its applications among users will definitely help increase its adoption
- The successful hot testing of the 3D printed PS4 engine is a significant step in leveraging additive manufacturing technology for rocket engines in the future.
  o This paves the way for the induction of the additively manufactured PS4 engine into the regular PSLV program, ushering in a new era of advanced manufacturing techniques for India's space endeavours

5. Vibrant Village Programme

Why in News?
- Recently, the Union **Ministry of Home Affairs (MHA)** informed that India is likely to spend over ₹2 crore on each kilometre of road to be constructed along the China border in Uttarakhand and Sikkim under the **Vibrant Village Programme.**

About the Vibrant Village Programme
- It is a **Centrally Sponsored Scheme** aimed at the comprehensive development of villages in **India's border regions** by improving the quality of life of people residing in select villages in the region.
- It focuses on **creating opportunities for livelihood generation** through the *promotion of tourism & cultural heritage, skill development & entrepreneurship, agriculture, horticulture and the development of cooperative societies.*

- Vibrant Village Programme covers select villages in 46 blocks across 19 districts in the states of Arunachal Pradesh, Himachal Pradesh, Sikkim, Uttarakhand, and the Union Territory of Ladakh.
- It has been allocated a financial outlay of ₹4800 crore for the financial years 2022-23 to 2025-26.

Impact of Programme

- Vibrant Village Programme is expected to have a transformative impact on the villages it covers and **expected to stop migration** in the population residing along the border.
- It aims to be integrated with the **Prime Minister Gati Shakti** mega project that brings major Ministries together for integrated planning and coordinated implementation of infrastructure connectivity projects.