Prelim Bits 30-05-2023 | UPSC Daily Current Affairs

Neuralink

Elon Musk's brain chip firm, Neuralink wins US approval for human study.

- Neuralink Corporation is an American neuro-technology company that is developing implantable brain–computer interfaces.
- Neuralink hopes to use its microchips to treat conditions such as paralysis and blindness, and to help certain disabled people use computers and mobile technology.
- The chips, which have been tested in monkeys, are designed to interpret signals produced in the brain and relay information to devices via Bluetooth.
- The company plans to use its microchips to treat conditions such as paralysis.
- Its initial aim was to start planting chips in human brains in 2020, in order to honour a pledge made the year before and it later vowed to get started in 2022.
- Mr Musk also suggested that the proposed technology could help ease concerns about humans being displaced by AI.
- Experts have cautioned that Neuralink's brain implants will require extensive testing to overcome technical and ethical challenges if they are to become widely available.

> *A paralysed man from the Netherlands was able to walk simply by thinking about it, because of a system of implants which wirelessly transmit his thoughts to his legs and feet.*

References

1. Business Standard | What is Neuralink?
2. BBC | Elon Musk's brain chip firm wins US approval for human study

Babool

Features

- Babool is also known as gum arabic (Acacia nilotica).
- This perennial tree, whose pods grow abundantly in the months of April and May.
- It can thrive on marginal land, which is unsuitable for agriculture, and can survive both droughts and floods.
- Babool seeds are highly nutritious and are also rich in minerals such as potassium, phosphorus, magnesium, iron and manganese.
- The tree works as a windbreak and haven for biodiversity where it is planted.
- As a nitrogen-fixing legume, it also helps in reclamation of areas degraded by mining or erosion.

- **Negative –** Excess consumption of babool seeds may affect milk yield in cows.

Health Benefits

- The babool tree is packed with medicinal properties.
- Babool pods have antibacterial activity.
- They are effective against gram-positive bacteria such as Bacillus cereus and Staphylococcus aureus.

Bacillus cereus is a food-borne pathogen that causes gastro-intestinal illnesses, and Staphylococcus aureus can infect soft tissue in the body.

- Extracts of the pods can be used to replace synthetic food preservatives that have negative impact on health.
- The pods and seeds are used as feed after grinding them up for easy digestion and better absorption of nutrition.
- People chew on its young leaves to improve digestion, and on the woody stems to keep teeth clean and gums healthy.
- Farmers also use the leaves and pods of babool as animal feed, and say that the feed prepared using babool seeds is comparable to cottonseed meal in terms of nutrition.
- The bark is used to treat burns, skin diseases and clean infected wounds and is a common ingredient in toothpastes.
- Its resin helps deal with skin diseases, oral inflammation and indigestion.

Status of India

- Though native to Africa, the Arabian Peninsula and the Indian subcontinent, babool is found in almost all tropical and subtropical areas of the world.
- India is home to at least three of nine subspecies of the tree, with natural babool forests found in Maharashtra, Gujarat, Andhra Pradesh, Rajasthan, Haryana and Karnataka.
- Historically in India, the bitter babool has been used as famine food in arid and semi-arid regions like Rajasthan.
- Even now, people in these regions consume its seeds both raw and roasted, or grind them and mix with sorghum or pearl millet flour.
- Some also use the young babool pods or phali, which look like a string of beads with flat, elliptical seeds separated by constrictions, as vegetable.
- As part of the natural vegetation of Madhya Pradesh and Uttar Pradesh, the tree has been extensively for the reclamation of the Chambal ravines.

Reference

1. Down To Earth | Babool

GSLV-F12 & NVS-01

The GSLV-F12/NVS-01 mission was launched from the second launch pad at the Satish Dhawan Space Centre SHAR, Sriharikota.

- The Indian Space Research Organisation (ISRO) successfully placed the NVS-01 navigation satellite, weighing about 2232 kg, into Geosynchronous Transfer Orbit (GTO).
- The GSLV-F12 is the 15th flight of India's GSLV and the 9th flight with indigenous cryostage.
- This is the 6th operational flight of GSLV with indigenous cryogenic stage.
- The NVS-01 carried navigation payloads L1, L5 and S bands.
- The satellite would ensure the continuity of navigational (NavIC) services and also provide new service in L1 band.
- Interestingly, for the first time, an indigenous atomic clock was flown in NVS-01.

An atomic clock is an extremely accurate type of clock which is regulated by the vibrations of an atomic or molecular system such as caesium or ammonia.

L1, L5 and S bands

- The GPS L1 band (1575.42 MHz) has turned to be the most important band for navigation purposes.
- The two sorts of services given by the Indian Regional Navigational Satellite System (IRNSS) satellites are Standard Positioning Service (SPS) and Restricted Service (RS).
- Both services will be given at two frequencies of L5 (1164.5 MHz) and S (2472.5 MHz) band.

References

1. The Hindu | ISRO's GSLV-F12
2. Economic Times | GSLV-F12 successfully places 2G navigation satellite

Deep ocean currents in Antarctica

Deep ocean currents in Antarctica are slowing earlier than predicted.

- Antarctica sets the stage for the world's greatest waterfall, where the action takes place beneath the surface of the ocean.
- Trillions of tonnes of cold, dense, oxygen-rich water cascade off the continental shelf and sink to great depths.
- This Antarctic bottom water then spreads north along the sea floor in deep ocean currents, before slowly rising, thousands of kilometres away.
- In this way, Antarctica drives a global network of ocean currents called the overturning circulation that redistributes heat, carbon and nutrients around the globe.
- The overturning is crucial to keeping the earth's climate stable and is the main way oxygen reaches the deep ocean.

Recent findings

- There are signs this circulation is slowing down and it's happening decades earlier than predicted.

- This slowdown has the potential to disrupt the connection between the Antarctic coasts and the deep ocean.
- Melting of Antarctic ice is disrupting the formation of Antarctic bottom water.
- The meltwater makes Antarctic surface waters fresher, less dense, and therefore less likely to sink.
- This puts the brakes on the overturning circulation.
- As the flow of bottom water slows, the supply of oxygen to the deep ocean declines.
- The shrinking oxygen-rich bottom water layer is then replaced by warmer waters that are lower in oxygen, further reducing oxygen levels.

Implications

- Ocean animals, large and small, respond to even small changes in oxygen.
- Deep-ocean animals are adapted to low oxygen conditions but still have to breathe.
- Losses of oxygen may cause them to seek refuge in other regions or adapt their behaviour.
- The overturning circulation carries carbon dioxide and heat to the deep ocean, where it is stored and hidden from the atmosphere.
- As the ocean storage capacity is reduced, more carbon dioxide and heat are left in the atmosphere.
- This feedback accelerates global warming.
- Reductions in the amount of Antarctic bottom water reaching the ocean floor also increases sea levels because the warmer water that replaces it takes up more space (thermal expansion).

References

1. The Hindu │ Deep ocean currents in Antarctica
2. The Guardian │Slowing ocean current by melting Antarctic ice

Foucault's Pendulum

The pendulum hangs from a skylight at the top of the Constitution Hall at the new Parliament building.

- The original Foucault's pendulum, named after 19th century French scientist Leon Foucault, is an experiment to demonstrate the earth's rotation.
- When Foucault carried out this experiment for the public in 1851, it was the first direct visual evidence of the fact that the earth rotates on its axis.
- The experimental set-up involves a heavy object hung from a height with a string, free to swing in any direction.
- Once set in to-and-fro motion, the pendulum is seen to change its orientation slowly over time.
- For example, if the initial motion imparted to it was in the north-south direction, after a few hours it could be seen moving in the east-west direction.
- Actually, it is not the pendulum that changes its plane of motion, but the ground beneath it.

- Observers standing on the ground do not notice the earth's rotation, because they too are rotating with the earth, but can notice the change in orientation of the pendulum.

Working

- At the north and south poles, when the pendulum is aligned with the axis of rotation of the earth, the pendulum's back-and-forth motion comes back to its original plane in exactly 24 hours.
- That is, if it starts swinging in the north-south direction, it then slowly turns in the northeast-southwest direction, then in the east-west direction.
- It keeps on changing its orientation, till it is back in its original orientation after 24 hours.
- At other latitudes, it takes longer for the pendulum to return to its original orientation of swinging.
- That is because the pendulum is not aligned with the axis of rotation of the earth.
- At the equator, the pendulum is perpendicular to the axis of rotation, and hence it never changes its orientation of the swing.
- Meaning, a Foucault's pendulum at the equator would not show any deviation from its original course.
- At other latitudes it will, and would return to the original course after fixed time periods.

India

- The pendulum signifies the integration of the idea of India with the idea of the cosmos.
- Created by the National Council of Science Museum (NCSM) in Kolkata, the pendulum is being dubbed as the largest such piece in India, 22 metre in height, and weighing a staggering 36 kg.
- On the ground, a circular installation has been created to allow the pendulum's movement.
- At the latitude of the Parliament, it takes 49 hours, 59 minutes, and 18 seconds for the pendulum to complete one rotation.

References

1. The Indian Express │What is a Foucault's Pendulum?
2. The Hindu │ A Foucault pendulum inside the new Parliament

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