SCIENCE AND TECHNOLOGY

❖ **Voice deepfakes**

➢ **CONTEXT: Recently several users of the social media platform 4chan, used "speech synthesis" and "voice cloning" service provider, ElevenLabs, to make voice deepfakes of celebrities like Emma Watson, Joe Rogan, and Ben Shapiro. Those deepfake audios made racist, abusive, and violent comments. Making deepfake voices to impersonate others without their consent is a serious concern that could have devastating consequences.**

➢ **What are voice deepfakes?**

- A voice deepfake is one that closely mimics a real person's voice. The voice can accurately replicate tonality, accents, cadence, and other unique characteristics of the target person.
- People use AI and robust computing power to generate such voice clones or synthetic voices. Sometimes it can take weeks to produce such voices, according to Speechify, a text-to-speech conversion app.

➢ **How are voice deepfakes created?**

- Creating deepfakes needs high-end computers with powerful graphics cards, leveraging cloud computing power. Using powerful computing hardware can accelerate the process of rendering, which can take hours, days, and even weeks, depending on the process.
- Besides specialised tools and software, generating deepfakes needs training data to be fed to AI models. This data is often original recordings of the target person's voice. AI can use this data to render an authentic-sounding voice, which can then be used to say anything.

➢ **What are the threats arising from the use of voice deepfakes?**

- Attackers are using such technology to defraud users, steal their identity, and to engage in various other illegal activities like phone scams and posting fake videos on social media platforms.
  - ✓ According to report in 2020, a manager from a bank in the U.A.E., received a phone call from someone he believed was a company director. The manager recognised the voice and authorised a transfer of $35 million. The manager had no idea that the company director's voice was cloned.
  - ✓ In an other instance, fraudsters used AI to mimic a business owner's voice directing the CEO of a UK-based energy firm to immediately transfer around $243,000 to the bank account of a Hungarian supplier of the company. The voice belonged to a fraudster who spoofed the CEO.
- Voice deepfakes used in filmmaking have also raised ethical concerns about the use of the technology.
  - ✓ Morgan Neville's documentary film on the well-known late chef Anthony Bourdain used voice-cloning software to make Bourdain say words he never spoke. This sparked criticism.
- Gathering clear recordings of people's voices is getting easier and can be obtained through recorders, online interviews, and press conferences. Voice capture technology is also improving, making the data fed to AI models more accurate and leading to more believable deepfake voices. This could lead to scarier situations, Speechify highlighted in their blog.

➢ **What tools are used for voice cloning?**

- OpenAI's Vall-e, My Own Voice, Resemble, Descript, ReSpeecher, and iSpeech are some of the tools that can be used in voice cloning.
  - ✓ ReSpeecher is the software used by Lucasfilm to create Luke Skywalker's voice in the Mandalorian.

➢ **What are the ways to detect voice deepfakes?**

- Detecting voice deepfakes needs highly advanced technologies, software, and hardware to break down speech patterns, background noise, and other elements. Cybersecurity tools have yet to create foolproof ways to detect audio deepfakes, Speechify noted.
- Research labs use watermarks and blockchain technologies to detect deepfake technology, but the tech designed to outsmart deepfake detectors is constantly evolving.
- Programmes like Deeptrace are helping to provide protection. Deeptrace uses a combination of antivirus and spam filters that monitor incoming media and quarantine suspicious content.
- In 2022, researchers at the University of Florida developed a technique to measure acoustic and fluid dynamic differences between original voice samples of humans and those generated synthetically by computers. They estimated the arrangement of the human vocal tract during speech generation and showed that deepfakes often model impossible or highly unlikely anatomical arrangements.
- According to voice recognition engineers call centres can also take steps to mitigate the threat from voice deepfakes. Callback functions can end suspicious calls and request an outbound call to the account owner for direct confirmation.
- Multifactor authentication (MFA) and anti-fraud solutions can also reduce deepfake risks. Pindrop mentioned factors like devising call metadata for ID verification, digital tone analysis, and key-press analysis for behavioural biometrics.

INDIAN ECONOMY

❖ **Fiscal deficit targets**

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➢ **CONTEXT: In the Union Budget for 2023-24, Finance Minister Nirmala Sitharaman chose the path of relative fiscal prudence and projected a decline in fiscal deficit to 5.9% of gross domestic product (GDP) in FY24, compared with 6.4% in FY23.**

- The government planned to continue on the path of fiscal consolidation and reach a fiscal deficit below 4.5% by 2025-26. To finance the fiscal deficit in 2023-24, the net market borrowings from dated securities are estimated at ₹11.8 lakh crore, and that the balance financing is expected to come from small savings and other sources. The gross market borrowings are estimated at ₹15.4 lakh crore.

➢ **What is the direction on fiscal deficit given in the Budget?**

- In Union Budget 2023-24, the fiscal deficit to GDP is pegged at 5.9% in FY24. This ratio has declined from 6.4% in 2022-23 (revised estimate) and 6.7% in 2021-22 (actual)
- In the revenue budget, the deficit was 4.1% of GDP in 2022-23 (revised estimate). In Union Budget 2023-24, revenue deficit is 2.9% of GDP. If interest payments are deducted from fiscal deficit, which is referred to as primary deficit, it stood at 3% of GDP in 2022-23 (RE).
- The primary deficit, which reflects the current fiscal stance devoid of past interest payment liabilities, is pegged at 2.3% of GDP in Union Budget 2023-24.

The fiscal deficit road map (as a % of GDP)

Years	Budget estimates	Actual
2017-18	3.2	3.5
2018-19	3.3	3.4
2019-20	3.3	4.6
2020-21	3.5	9.2
2021-22	6.8	6.7
2022-23	6.4	-
2023-24	5.9	-

➢ **Are allocations lower for some sectors?**

- The major allocations that have been pared down are food, fertilizer and petroleum subsidies.
  - ✓ The food subsidy in 2022-23 (RE) was ₹2,87,194 crore. In 2023-24, it has been reduced to ₹1,97,350 crore.
  - ✓ Similarly, the fertilizer subsidy in 2022-23 was ₹2,25,220 crore (RE); it has been reduced to ₹1,75,100 crore for FY24.
  - ✓ The petroleum subsidy in 2022-23 was ₹9,171 crore (RE); it has declined to ₹2,257 crore in 2023-24 (Budget estimate/BE).
- However, the point to be noted is that compared with BE 2022-23, the decline is not that sharp. In BE 2022-23, food subsidy was ₹2,06,831 crore; fertilizer subsidy was ₹1,05,222 crore, which was less than what has been allocated in BE 2023-24.
- It is a laudable decision to extend food security to the poor for one more year amid rising inflation. However, rationalisation of subsidies is important so that the government can move towards reaching a fiscal deficit target of 4.5% by 2025-26.

➢ **What needs to be done for growth?**

- The interest rate management by the RBI through inflation targeting alone cannot effectively control inflation, given the supply side shocks. Therefore, fiscal policy measures are crucial to tackle mounting inflation. Policy coordination between RBI and Government is crucial for a sustained growth recovery process.
- The RBI has been increasing policy rates to tackle mounting inflation. But a high interest rate regime can hurt the economic growth process. So, the fiscal policy needs to remain "accommodative" with focus on gross capital formation in the economy with enhanced capital spending, especially infrastructure investment.
- In Budget 23-24, capital spending is expected to rise to 3.3% of GDP. The interest-free loan of ₹1.3 lakh crore for 50 years provided to States should help them spend and boost growth. Infrastructure investment has a larger multiplier effect on economic growth and employment.

➢ **Can the govt. stick to fiscal consolidation?**

- The Government has not deviated from the path of fiscal consolidation. In Union Budget 2023, the medium-term fiscal consolidation framework stated that there is a need to reduce fiscal deficit-GDP ratio to 4.5% by 2025-26 from the current 6.4%.
- There are revenue uncertainties in post-pandemic times and also geopolitical risks, mounting inflation, supply chain disruptions and energy price volatility. At the same time, the Government has kept the fiscal policy "accommodative", and has undertaken capital spending to support economic growth recovery.
- The predominant mode of financing fiscal deficit in India is through internal market borrowings. It is also to be financed through securities against small savings, provident funds and an insignificant component of external debt.
- In Union Budget 2023, India's external debt is pegged at ₹22,118 crore of the total fiscal deficit of ₹17,86,816 crore in 2023-24 (BE), which is approximately about 1%.

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- In Union Budget 2023, it is also stated that the States will have to maintain a fiscal deficit of 3.5% of GSDP of which 0.5% will be tied to power sector reforms.

➢ **What are rating agencies saying?**

- The Government plans to substantially increase spending on infrastructure, while cutting personal income taxes, and providing capital support for the oil sector. The Budget plans are credit positive for renewable energy companies, cement and steel producers, oil marketing companies and automakers in particular.
- While continued gradual fiscal consolidation contributes to the stabilisation of the government's debt burden and supports credit quality, authorities remain unlikely to achieve their ambitious target to narrow the deficit to 4.5% of GDP by FY26.
- The slow fiscal consolidation process in the wake of the pandemic could leave public finances exposed in the event of further major economic shocks.

➢ **What lies ahead?**

- The Government is focusing on economic growth recovery through capex. It contends that infrastructure investment will boost private investment. In the fiscal deficit-GDP ratio, if the denominator GDP expands, it will reduce the overall fiscal deficit-GDP ratio. Government's focus is on economic growth recovery to strengthen GDP.

PRELIMS

1. Earthquake Measurements

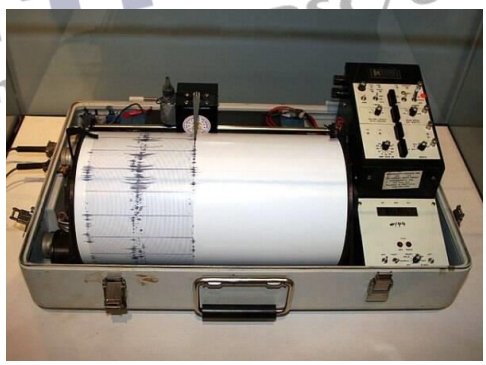
➢ **CONTEXT: An earthquake of magnitude 7.8 struck south-central Turkey and Northwest Syria. Buildings across the region were seen tumbling down, sparking a mad scramble to find survivors in the rubble and amidst an ongoing snow storm in many places.**

➢ **The magnitude of the quake**

- A magnitude of 7.8 on the Moment Magnitude scale is indeed really strong. According to experts, the quake is the joint largest on record (since roughly 1900) in Turkey. It has the same magnitude as one that killed about 30,000 people in December 1939 in northeast Turkey.
- The U.S. Geological Survey (USGS) said the quake was centred about 33 km from Gaziantep, around 18 km deep. This is a highly populous region, exponentially increasing the likelihood of casualties.
- The effects of the quake were felt across West Asia, Northern Africa and South Eastern Europe with residents of Lebanon, Cyprus, Greece, Israel and Egypt also reporting tremors.

➢ **Measuring a quake's magnitude**

- The earth's crust is broken up into tectonic plates that are constantly moving, slowly, often getting stuck at their edges due to friction. When the stress on the edge overcomes the friction, there is an earthquake that releases energy in waves that travel through the earth's crust, resulting in the vibration felt.



- A network of seismographs are used to record earthquakes with each individual seismograph recording and measuring the movement of the ground in its location. A seismograph is securely mounted onto the surface of the earth so that when the earth shakes, the entire unit shakes with the exception of the mass on the spring, which remains in its place because of inertia.
- During shaking, the recording device on this mass records the relative motion between itself and the rest of the instrument, thus recording the ground motion. According to the USGS, these mechanisms are no longer manual, but instead work by measuring electronic changes produced by the motion of the ground with respect to the mass.

➢ **The scales of measurement for magnitude**

- There are many measures of an earthquake's magnitude, with the most famous (and outdated according to USGS) being the Richter Scale.
- Devised in 1935 by Charles Francis Richter, the Richter Scale (denoted as ML) is a logarithmic scale, where each step represents a tenfold increase in magnitude. Thus, an earthquake measured 7 on the Richter Scale has 10 times the magnitude of one measured 6.
- The scale was calibrated by defining a magnitude 0 shock as one that produces (at a distance of 100 km) a maximum amplitude of 1 micron using the Wood-Anderson seismograph.
- According to the USGS, as more seismograph stations were installed around the world, it became apparent that the method developed by Richter was strictly valid only for certain frequency and distance ranges. Consequently, the Moment Magnitude Scale (denoted as Mw) was developed.
- According to the USGS, a Moment is a physical quantity proportional to the slip on the fault multiplied by the area of the fault surface that slips. Thus, it is related to the total energy released in the earthquake. This scale provides a more accurate estimate of magnitude, especially as one goes higher up the scale. Like the Richter Scale, this too is a logarithmic scale.

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➢ **Measuring the intensity**

- In many ways, the intensity is an even more important measure of an earthquake as it is related to the tangible impact a quake has. Intensity scales, like the Modified Mercalli Scale and the Rossi-Forel scale, measure the amount of shaking at a particular location.
- An earthquake causes many different intensities of shaking, depending on how deep it is located on the earth's crust and how far it is from its epicentre. Earthquakes of lower magnitude can be more intense if they are located in more shallow ground or if the area where they occur has more loose soil, etc.
- The Modified Mercalli Scale, the most commonly used intensity scale, ranks earthquake intensity on a scale of I. (not felt) to XII. (extreme).
- The maximum intensity measured in recent Turkey earthquake is IX. or violent.

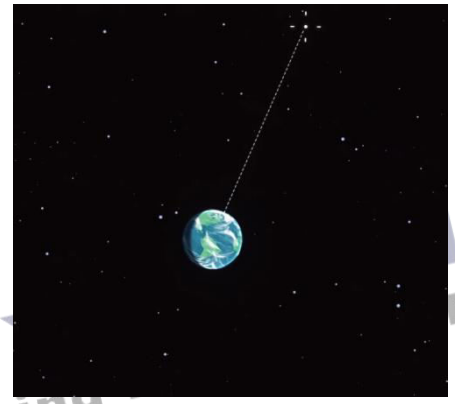
2. <u>North star</u>

➢ **CONTEXT: Vice President Jagdeep Dhankhar on Friday said Parliament is the "North Star" of democracy, "a place of discussion and deliberation to realise the aspirations and dreams of the people".**

- Chief Justice of India D Y Chandrachud had described the basic structure of the Constitution, laid down by the Supreme Court in the 1973 Kesavananda Bharati judgment, as the "North Star" that "guides and gives certain direction to the interpreters and implementers of the Constitution when the path ahead is convoluted".

➢ **Guide to navigation**

- Polaris, known as the North Star or Pole Star, is a very bright star — around 2,500 times more luminous than the Sun. It is part of the constellation Ursa Minor, and is around 323 light years away from the Earth.



- Since Polaris is less than 1° away from the north celestial pole, almost in direct line with the Earth's rotational axis, it appears to sit motionless in the northern sky, with all the other stars appearing to rotate around it.
- Its position and brightness have allowed humans to use it for navigation since late antiquity. Simply the elevation of the star above the horizon gives the approximate latitude of the observer. In the northern hemisphere, if you can spot Polaris, you can tell the north — and by extension, the other three directions as well. Upon crossing the equator to the south, however, the North Star is lost over the horizon, and hence stops being a useful navigational aid.

➢ **Ptolemy and Columbus**

- Polaris seems to have been first charted by the Roman mathematician and astronomer Ptolemy, who lived from about 85 to 165 BC. While there is some evidence that the star was used for navigation in late antiquity, it was during the 'Age of Exploration' that it became a central part of human history.
- Christopher Columbus, on his first trans-Atlantic voyage of 1492, "had to correct (his ship's bearings) for the circle described by the pole star about the pole", and the star became an invaluable aid to the European colonists seeking out far-off lands across the seas.

➢ **Literary metaphor**

- The first well known instance of the North Star appearing in literature outside of a technical treatise on astronomy or a biography of an explorer is in Shakespeare's Julius Caesar, where the eponymous emperor describes himself as being "as constant as the Northern Star".
- However, the "constant" North Star was probably not known to the real Caesar (reign 49-44 BC). Also, as the NASA page on Polaris points out, "North Star" is "a title that passes to different stars over time".
- As the Earth's axis of rotation wobbles in the same way as a spinning top, the celestial pole "wanders in a slow circle over the eons, sweeping past different stars". About 14,000 years ago, the celestial pole pointed towards the bright star Vega, and "it will again point to Vega in about 12,000 years".

3. <u>World Wetlands Day</u>

➢ **CONTEXT: The State Governments and Union Territory administrations celebrated World Wetlands Day (WWD) at all 75 Ramsar sites with over 200 events.**

- The World Wetlands Day is observed on 2nd February every year all over the world to commemorate the signing of Ramsar Convention on Wetlands of International Importance in 1971. India is a party to the Convention since 1982 and has so far declared 75 wetlands as Ramsar sites covering 23 states and Union Territories.
- The 2023 theme for World Wetlands Day is 'Wetland Restoration' which highlights the urgent need to prioritize wetland restoration. It is a call on an entire generation to take proactive action for wetlands, by investing financial, human and political capital to save the wetlands from disappearing and to revive and restore those that have been degraded.
- India has the largest network of Ramsar Sites in Asia, making these sites a critical ecological network for conservation of global biological diversity and supporting human well-being.

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- The Ministry of Environment, Forest and Climate Change (MoEFCC) launched Mission Sahbhagita in 2022 with a mission of 'a healthy and effectively managed network of 75 wetlands of national and international significance which support water and food security; buffer from floods, droughts, cyclones and other extreme events; employment generation; conservation of species of local, national and international significance; climate change mitigation and adaptation actions; and recognition, conservation and celebration of cultural heritage.

ANSWER WRITTING

Q. In an emerging economy like India, capital expenditure is necessary to stimulate economic growth, however, it also impacts fiscal discipline and macroeconomic stability. Critically analyse.

Capital expenditure (capex) refers to the money spent to create or acquire fixed assets such as machinery, equipment, land, building, investment in shares, health facilities, education, purchase of new weaponry, etc. The creation of assets for the long term allows the economy to generate revenue for many years by adding or improving production facilities and boosting operational efficiency.

Importance of capital expenditure in stimulating economic growth:

- **Strengthens aggregate demand:** Capex by the government puts money in the hands of people leading to the creation of aggregate demand in the economy.
- **Crowding in private investment:** Government capex also contributes to increased investments from the private sector. In the post-COVID economic recovery, Capex by the Corporate sector is driven by heavy investments in electricity, steel, chemicals, auto and pharmaceuticals sectors.
- **Multiplier effect:** Capital expenditure has a multiplier effect on the economy. According to the **economic survey 2023**, the economic output of the country will increase by at least four times the amount of capex.
- **Macroeconomic Stabiliser:** Capex also acts as a tool for countercyclical fiscal policy and acts as a macroeconomic stabilizer.
- **Leads to innovation:** Without capital investment, innovation is not possible, including the discovery of new reserves of natural resources or technological advances. High economic growth is generally prompted by discoveries and breakthroughs in technology. For example, e-commerce completely revolutionised the way most firms conduct business.

Impact of increased capital expenditure on fiscal discipline and macro-economic stability:

- **Risk of increased fiscal deficits:** Increased borrowing to fund the capital expenditure also comes with the risk of widening of fiscal deficit. This will have an impact on fiscal discipline.
- **Trade-off between macroeconomic objectives:** Higher spending may boost economic growth however it may also lead to inflationary pressures. Reducing spending to control inflation may impact economic growth in the short term.
- **Temporal spread:** The costs, as well as benefits related to the capital expenditure, are usually stretched over a relatively long period of time for both industrial projects and infrastructure projects. This may lead to uncertainty. Further, the rate of return from such expenditure in India is impacted by time and cost overrun.
- **Impact on current account deficit (CAD):** High capex is associated with the risk of CAD as high inflation erodes the value of money and depreciates currency. This makes imports costlier and increases the burden on the current account.

Therefore, while the current impetus on capital expenditure is necessary for economic growth there is also a need to follow a cautious approach to ensure fiscal discipline and macroeconomic stability. India's fiscal deficit of 6.4 % of GDP due to increased spending during the pandemic requires a steady move towards fiscal consolidation.

MCQs

1. If a wetland of international importance is brought under the 'Montreux Record', what does it imply?
   a) Changes in ecological character have occurred, are occurring or are likely to occur in the wetland as a result of human interference.
   b) The country in which the wetland is located should enact a law to prohibit any human activity within five kilometers from the edge of the wetland
   c) The survival of the wetland depends on the cultural practices and traditions of certain communities living in its vicinity and therefore the cultural diversity therein should not be destroyed.
   d) It is given the status of 'World Heritage Site'
2. Consider the following statements about North Star
   1. It helps in finding direction as it always remains in the same position in the sky
   2. It is a part of the Ursa Major Constellation

   Which of the above statements is NOT correct?
   a) 1 only
   b) 2 only
   c) Both 1 and 2
   d) Neither 1 nor 2
3. There has been a persistent deficit budget year after year. Which of the following actions can be taken by the government to reduce the deficit?
   1. Reducing revenue expenditure
   2. Introducing new welfare schemes

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3. Rationalizing subsidies
4. Expanding industries

Select the correct answer using the code given below:

a) 1 and 3 only
b) 2 and 3 only
c) 1 only
d) 1, 2, 3 and 4

4. With reference to Deepfake technology consider the following statements::
   1. It is a type of artificial intelligence used to create convincing images, audio and video hoaxes.
   2. It has benefits in criminal forensics.
   3. It possesses threats to security of the nation.

Which of the statements given above are correct?

a) 1 and 2 only
b) 2 and 3 only
c) 1 and 3 only
d) 1,2 and 3

5. With reference to World Wetlands Day consider the following
   1. It celebrated annually on 2 February, aims to raise global awareness about the vital role of wetlands for people and planet.
   2. This day also marks the date of the adoption of the Convention on Wetlands on 2 February 1971, in the Iranian city of Ramsar.
   3. The theme for year 2023 World Wetlands Day is 'It's Time for Wetlands Restoration,'

Choose the correct statement/s using the codes given below/

a) 1 and 2 only
b) 2 and 3 only
c) 1 and 3 only
d) 1,2 and 3

6. Visva-Bharati University is going to get the 'heritage' tag from UNESCO to take the distinction of world's first living heritage university, with reference to this consider the following
   1. It was founded by Rabindranath Tagore in 1921.
   2. In 1922, Visva-Bharati was inaugurated as a Centre for Culture with exploration into the arts, language, humanities, music.

Which of the above statement/s is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

7. With reference to Paris Club, consider the following statements:
   1. It promotes itself as a forum where official creditors meet to solve payment difficulties faced by debtor countries.
   2. All 22 are members of the group called Organisation for Economic Co-operation and Development (OECD).

Which of the above statements is/are correct?

a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2

8. Mission Sahbhagita often mentioned in news is related to which of the following?
   a) Wetlands
   b) Coastal economy
   c) Delhi pollution
   d) World Heritage Agriculture
9. Recently, global Climate Resilience Fund joined with Which Indian organisation to tackle challenges faced due to climate change-
   a) Self Employed Women's Association (SEWA)
   b) PRATHAM foundation
   c) TATA steel foundation
   d) Steel Authority of India
10. Additional surveillance mechanism (ASM) seen in news relates to which of the following?
   a) Defense and Security
   b) Artificial Intelligence and Cyber Security
   c) Share prices and Market volatility
   d) Space debris mechanism

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