SCIENCE AND TECHNOLOGY

1. OSIRIS REx & OSIRIS-APEC

- Context: NASA's Spacecraft returned after seven years
- On September 24, 2023, NASA's spacecraft successfully brought back a sample collected from the asteroid Bennu after a 7-year mission.
- This sample holds valuable information about the formation of the sun and planets approximately 4.5 billion years ago.
- The mission, named OSIRIS-REx, commenced on September 8, 2016, and the spacecraft delivered the sample without physically landing on Earth.
- Releasing the sample capsule approximately one lakh km above the Earth, the capsule landed in the Utah desert using a parachute.
- The mission has now embarked on a new journey toward the 'Apophis Asteroid,' with an anticipated arrival in the year 2029.
- The OSIRIS-REx mission has been renamed OSIRIS-APEC.

Objectives and Significance of the Mission:

- The Bennu asteroid sample collected by this mission will enable scientists to gain insights into the formation of the early solar system and the origins of life.
- Additionally, it has the potential to enhance our understanding of asteroids that might pose a threat to Earth in the future.

Asteroids:

- Asteroids are rocky celestial objects that orbit the Sun, being significantly smaller than planets and often referred to as minor planets.
- NASA reports a count of 994,383 known asteroids, remnants from the solar system's formation over 4.6 billion years ago.
- Asteroids are categorized into three classes:
    - Main asteroid belt asteroids found between Mars and Jupiter.
    - Trojans, a group of asteroids sharing an orbit with a larger planet.
    - Near-Earth Asteroids (NEA), with orbits that bring them close to Earth, and those crossing Earth's orbit are termed Earthcrossers.

2. India, Russia ink key pacts related to Kundankulam nuclear power plant

- Context: Russia has offered advanced fuel for the operation of the plant
    - Russia's nuclear fuel division, TVEL Fuel Company, has proposed an advanced fuel option for the Kudankulam Nuclear Power Project (KKNPP). This update involves transitioning from the current TVS – 2 M fuel to the more modern Advanced Technology Fuel (ATF) with a 24-month fuel cycle.
    - Currently TVEL Fuel Company supplies TVS – 2 M fuel for the two VVER 1,000 MWe reactors at KKNPP.
    - The existing fuel has an 18-month fuel cycle, necessitating reactor shutdown for fresh fuel loading every one-and-a-half years.
    - Now the TVEL has offered the Advanced Technology Fuel (ATF) with a 24-month fuel cycle.
    - Its benefits include enhanced efficiency, additional power generation through prolonged reactor operation, and significant savings in foreign exchange spent on purchasing fresh fuel from Russia.

What is Nuclear Energy?

- Nuclear energy is derived from splitting atoms in a reactor to generate electricity.
- Reactors and their equipment control chain reactions, usually fueled by Uranium-235, producing heat through fission.
- Nuclear power generation is zero-emission, devoid of greenhouse gases or air pollutants.

Emissions and Land Usage

- Nuclear power is a zero-emission source.
- A 1,000-megawatt nuclear plant requires substantially less land than wind or solar farms, according to US government data.

Significance for India

- Leadership in Thorium
    - India leads in Thorium resources, considered the future nuclear fuel.
- Thorium availability positions India to potentially become the first fossil fuel-free nation.
- Economic Impact

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- Nuclear energy could reduce India's annual import bills by approximately $100 billion spent on importing petroleum and coal.

- Benefits of Thorium
  - Thorium is abundant and widely distributed in the Earth's crust, offering advantages over Uranium.
  - Thorium fuel produces less harmful waste, with waste consisting mainly of Uranium-233, challenging to weaponize.

Stable and Reliable Source

- Nuclear power provides a stable and reliable source of high-density, clean energy, contrasting with the intermittent nature of solar and wind power.

India's Initiatives Regarding Nuclear Energy

- India's pursuit of nuclear energy for power generation dates back to the 1950s.
- The Atomic Energy Act, 1962, laid the foundation for using Uranium and Thorium as nuclear fuel in Indian reactors.
- The Government of India, in December 2021, announced plans for ten indigenous Pressurised Heavy Water Reactors (PHWRs) and granted "in principle approval" for 28 additional reactors.
- Approval was given for setting up six nuclear power reactors at Jaitapur in Maharashtra, a key component of India's strategic partnership with France.

GOVERNANCE

1. Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan (PM JANMAN)

- CONTEXT: The Ministry of Tribal Affairs has launched Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan (PM JANMAN).
- The Ministry of Tribal Affairs has launched an impactful Information, Education, and Communication campaign, focusing on the Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan (PM JANMAN).
- The campaign aims to elevate awareness and ensure the comprehensive implementation of Government schemes within Particularly Vulnerable Tribal Groups (PVTGs) concentrated in tribal habitations.
- During the campaign, essential documents such as Aadhar cards, community certificates, and Jan Dhan accounts will be provided, acting as prerequisites for obtaining crucial services like the Ayushman card, PM Kisan Samman Nidhi, and Kisan credit card.

PM JANMAN Scheme

- The PM JANMAN Scheme targets the development of 75 Particularly Vulnerable Tribal Groups (PVTGs) that have been historically underserved by various Ministries and Departments.
- With a substantial outlay of Rs. 24,104 crore (Central Share: Rs.15,336 crore and State Share: Rs.8,768 crore), the scheme focuses on 11 critical interventions through 9 line Ministries.
- The primary objective is to saturate PVTG households and habitats with basic facilities, including safe housing, clean drinking water, sanitation, improved access to education, health and nutrition, road and telecom connectivity, and sustainable livelihood opportunities.
- The Ministry responsible for PM-JANMAN, consisting of Central Sector and Centrally Sponsored Schemes, collaborates with 9 Ministries, including the Ministry of Tribal Affairs.
- The Ministry of Ayush and the Ministry of Skill Development and Entrepreneurship play crucial roles by establishing Ayush Wellness Centres and facilitating skill and vocational training in PVTG habitations, respectively.

Particularly Vulnerable Tribal Groups (PVTGs)

- PVTGs represent a subset of tribal groups in India characterized by primitive traits, geographical isolation, low literacy, zero to negative population growth rate, and overall backwardness.
- India is home to 75 PVTGs, spanning 18 states and the Union Territory of Andaman & Nicobar Islands, with Odisha having the largest PVTG population followed by Madhya Pradesh.

Recognition to PVTGs

- In 1973, the Dhebar Commission recognized Primitive Tribal Groups (PTGs) as a separate category.
- In 1975, the Indian government initiated the identification of the most vulnerable tribal groups, officially designating them as PVTGs, initially comprising 52 groups. An additional 23 groups were later included in this category in 1993.

2. Good Governance

- Context- India has recently observed Good Governance Day recently.

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- India observes Good Governance Day on December 25, coinciding with the birth anniversary of former Prime Minister Atal Bihari Vajpayee.
  - The annual event aims to enhance citizen awareness regarding accountability in governance and governmental procedures.
  - On this occasion, three new features were launched on the iGOT (integrated government online training) Karmayogi platform: My iGOT, blended programmes, and curated programmes.

Governance and Good Governance

- Governance involves the processes, systems, and structures directing, controlling, and managing organizations, societies, or groups.
- Good governance is defined by a set of values guiding public institutions in conducting public affairs and managing public resources, respecting human rights, the rule of law, and societal needs.
- The World Bank defines good governance in terms of the traditions and institutions exercising authority in a country, covering the selection and monitoring of governments, government effectiveness, regulatory quality, rule of law, and control of corruption.

Worldwide Governance Indicators

- World Bank Evaluation
  - The Worldwide Governance Indicators project evaluates over 200 countries based on six fundamental measures of governance.
  - The six indicators are
    - Voice and Accountability
    - Political Stability and Absence of Violence
    - Government Effectiveness
    - Regulatory Quality
    - Rule of Law
    - Control of Corruption.

Major Issues Related to Governance in India

- Corruption and Bureaucratic Inefficiency
  - India's ranking of 85th out of 180 countries in the Corruption Perception Index 2022 highlights concerns about bribery and misuse of public funds.
- Inequality and Social Exclusion
  - Despite economic growth, the Oxfam report of 2022 indicates a persistent wealth gap, with the richest 1% holding over 40% of the country's wealth.
- Ineffective Implementation of Policies and Schemes
  - Poor execution of well-intentioned government programs, as seen in irregularities in the Ayushman Bharat Scheme and pension transfer issues in Jharkhand.
- Inadequate Judicial Infrastructure
  - Over 80,000 pending cases in the Supreme Court in 2023 raise concerns about timely access to legal recourse, particularly for marginalized populations.
- Environmental Degradation and Climate Change
  - Challenges such as air pollution, water scarcity, and deforestation, with weak enforcement of environmental regulations.
- Political Polarization and Weakening Accountability
  - Increasing partisanship and a focus on electoral gains sometimes overshadow long-term policy planning and public welfare.

Major Initiatives Related to Good Governance in India

- Transparency and Accountability
  - Right to Information Act (2005), CPGRAMS, and E-Governance Initiatives for increased transparency and reduced corruption.
- Citizen Participation and Empowerment
  - MyGov platform, Gram Sabhas, and Right to Education Act (2009) to engage citizens, promote feedback, and empower communities.
- Decentralization and Local Governance
  - 73rd and 74th Constitutional Amendments, Aspirational Districts Program, and Smart Cities Mission promoting local democracy and socio-economic development.

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Way Forward

- Reforming Bureaucracy
  - Streamlining administrative processes, reducing red tape, and enhancing professionalism and accountability, with the introduction of VIKAS (Variable and Immersive Karmayogi Advanced Support).
- Fast-track Judicial Reforms
  - Addressing the backlog of cases, improving infrastructure, and ensuring speedy access to justice, with initiatives such as e-courts and live streaming of court proceedings.
- AI-powered Grievance Redressal
  - Developing an AI-driven system for efficient analysis of public complaints, identifying patterns, and directing them to relevant authorities for swift resolution.

ENVIRONMENT

Illegal Sand Mining

- CONTEXT: Bihar police carried out a major crackdown against illegal sand mining, resulting in the arrest of sand smugglers near the Sone River.

Sand Mining

- Sand mining involves the removal of primary natural sand and sand resources for extracting valuable minerals, metals, crushed stone, and gravel from various natural environments.
- This activity, influenced by multiple factors, poses serious threats to ecosystems and communities.

Source of Sand in India

- Sustainable Sand Mining Management Guidelines (SSMMG) 2016 outline various sources of sand in India.
- Sources
  - River (riverbed and floodplain)
  - Lakes and reservoirs
  - Agricultural fields
  - Coastal/marine sand
  - Palaeo-channels
  - Manufactured Sand (M-Sand)

Factors Contributing to Illegal Sand Mining

- Regulatory Challenges
  - Lack of Regulation and Enforcement: Inadequate frameworks and weak enforcement mechanisms contribute to the proliferation of illegal sand mining.
- Industry Demand
  - High Demand for Construction Materials: The construction industry's demand fuels illegal extraction, intensifying pressure on riverbeds and coastal areas.
- Corruption and Mafia Influence
  - Corruption and Mafia Influence: Organized sand mafias and corrupt practices contribute to the continuation of illegal mining.
- Lack of Sustainable Alternatives
  - Limited adoption of sustainable alternatives like manufactured sand (M-Sand) contributes to overreliance on riverbed sand.
- Weak Environmental Impact Assessment (EIA) Implementation
  - Ineffective EIA implementation allows for unauthorized extraction, with insufficient public awareness and monitoring mechanisms.

Consequences of Sand Mining

- Erosion and Habitat Disruption: Unregulated sand mining alters riverbeds, leading to increased erosion and disruption of aquatic habitats.
- Flooding and Increased Sedimentation: Depletion of sand contributes to increased flooding and altered flow patterns, negatively impacting aquatic ecosystems.
- Groundwater Depletion: Deep pits from sand mining cause a drop in the groundwater table, leading to water scarcity.
- Biodiversity Loss: Habitat disruption and degradation result in a significant loss of biodiversity, affecting aquatic and riparian species.

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Initiatives to Prevent Sand Mining in India

- Mines and Mineral Development and Regulation Act, 1957 (MMDR Act): Classifies sand as a "minor mineral," with the recent amendment to curb illegal mining.
- 2006 Environment Impact Assessment (EIA): Requires approval for all sand mining activities, addressing the severe impact on the ecosystem.
- Sustainable Sand Management Guidelines (SSMG) 2016: Issued by the Ministry of Environment, Forests, and Climate Change, aiming for environmentally sustainable and socially responsible mining.

ANSWER WRITTING

Discuss the potential of digitization in harnessing the untapped potential of the food processing Sector and resolving the challenges that it faces. (Answer in 250 words)

India, being a leading producer of a diverse array of agricultural products, presents an extremely lucrative opportunity to turn the country into a potential hub for food processing. The sector is one of the largest employment-generating industries in India and contributes 8% of the GDP of the nation. It is estimated to be worth $380 billion and is projected to grow at a CAGR of 11% to reach $540 billion by 2025. Further, in FY22 alone India exported agricultural and processed food products worth US$ 25.6 billion, and the export of processed vegetables and fruits increased by 59.1%.

Several schemes such as Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME) Scheme, Pradhan Mantri Kisan Sampada Yojana, Production Linked Incentive Scheme for Food Processing Industry, etc. have been implemented to enhance the productivity and competitiveness of the sector.

However, despite its growth, there are several challenges faced by the food processing industry, which hinder it from harnessing its untapped potential, such as:

- Lack of cutting-edge infrastructure: Many food processing businesses operate in the small and medium enterprises (SMEs) sector, which often lacks the resources needed to upgrade their facilities and machinery to the latest technology.
- Post-harvest loss: Inefficient supply chains due to insufficient cold storage facilities and transportation networks result in significant post-harvest losses.
- Lack of access to working capital: Traditional banks and financial institutions often have stringent lending criteria, making it difficult for SMEs involved in the food processing sector to access funding. Moreover, the loan approval process can be time-consuming and cumbersome. This results in cash flow issues, which can hinder their ability to grow and invest in new technologies.
- Competition from international players: The food processing industry in India faces competition from international players, that have access to better technology, more efficient supply chains, and lower costs.
- Lack of skilled manpower: There is a shortage of skilled workers and a lack of training facilities tailored to the specific needs of the sector posing challenges in adopting advanced processing techniques, implementing food safety practices, and optimizing production processes.
- Issue in exports: Compliance with international quality standards and regulations is essential to access export markets. The presence of pesticide residues and lack of awareness on policy requirements for global markets impact food processing exports from India.

In this context, digitization of the sector has the potential in harnessing its untapped potential and resolving the challenges it faces in the following ways:

- Digitization can help streamline the supply chain and help the sector become more efficient, productive, and competitive by enabling real-time tracking of inventory and delivery, reducing wastage and ensuring timely delivery of goods. For instance,
  - Internet of things (IoT) can help connect various parts of the supply chain, enabling realtime tracking and monitoring of inventory and delivery.
  - Artificial intelligence (AI) can help optimize production processes and improve the quality of products.
  - Blockchain can help ensure transparency and traceability in the supply chain, improving the efficiencies for processors by cutting out middlemen.
- The data produced by digitization would help smaller processing units in planning capacities and procurements more efficiently.
- Digitization can enable SMEs' to determine and analyze their creditworthiness and understand working capital solutions based on their financial history and potential.

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Thus, to achieve the target of $540 billion by 2025, the Indian food processing units need to become more competitive and innovative, and digitization can play a crucial role in this.

MCQs

1. Consider the following statements about OSIRIS-APEX
1. Statement 1 – OSIRIS-APEX aims to observe the physical changes induced by Earth's gravitational pull during Apophis' flyby.
2. Statement 2 – Apophiss a stony "S-type" asteroid made of silicate material that is classified as a near-Earth asteroid, as opposed to a main-belt asteroid.

Which one of the following is correct in respect of the above statements?
a) **Both Statement-I and Statement-II are correct and Statement II is the correct explanation for Statement-I**
b) Both Statement-I and Statement-II are correct and Statement II is not the correct explanation for Statement-I
c) Statement-I is correct but statement II is incorrect
d) Statement -I is incorrect but Statement -II is correct

2. Consider the following statements
1. The Sone River flows through Kerala.
2. It is the second largest tributary of Ganga.
3. It originates in the Nilgiri Hills,

How many above statements is/are correct?
a) Only one b) Only two
c) All the three d) None

3. Consider the following statements
1. It is the only landscape in the world that is home to melanistic tigers.
2. The STR is included as a part of the World Network of Biosphere Reserves by UNESCO.
3. Indravati, a tributary of Godavari flows through STR forming a Chitrakote Falls.

How many above statements is/are correct?
a) Only one **b) Only two**
c) All the three d) None

4. Consider the following statements
1. The Chenab River is formed by the confluence of two rivers, Chandra and Bhaga in Himachal Pradesh
2. The Chenab is the largest tributary of the Indus.
3. Salal Dam is a run-of-the-river hydropower project on the Chenab River in Jammu & Kashmir

How many above statements is/are correct?
a) Only one b) Only two
c) All the three d) None

5. Consider the following statements about MedTech Mitra portal.
1. It is an online portal that aims to assist medtech innovators in clinical evaluation, regulatory facilitation, and uptake of new products.
2. It is a joint initiative of Minister of Health and Family Welfare and Ministry of Ayush under the guidance of NITI Aayog's Atal Innovation Mission.

Which of the above statements is/are correct?
a) 1 Only b) 2 Only
c) Both d) None

6. Which of the following learning programme was launched recently by Government of India for government servants in line with good governance day?
a) VIKAS b) SAMARTH
c) YASASVI d) SAMRUDHI

7. Consider the following statements with reference to the UPI Tap and Pay policy:
1. The feature utilises near-field communication (NFC) technology to capture details about a payee's UPI ID or a Virtual Payment Address (VPA).
2. Users with a UPI LITE account do not require any PIN for transactions up to 2000 rupees.

Which of the statements given above are correct?
Which of the above statements is/are correct?
a) 1 Only b) 2 Only
c) Both d) None

8. 'Smart Lander for Investigating Moon (SLIM)' is launched by which one of the following space organisations?
a) European Space Agency
b) Indian Space Research Organisation
c) Japan Aerospace Agency
d) NASA

9. Consider the following statements with reference to the Jal Jeevan Mission:
1. It comes under the Ministry of Jal Shakti.
2. It will assist States in the creation of water supply infrastructure so that every rural household has a Functional Tap Connection by 2024.

Which of the above statements is/are correct?
a) 1 Only b) 2 Only
c) Both d) None

10. The Kudankulam Nuclear Power Plant is situated in
a) Kerala **b) Tamil Nadu**
c) Maharashtra d) Karnataka

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