UPSC CSE (Main) 2022

General Studies Paper-III

Q1. Why is Public Private Partnership (PPP) required in infrastructure projects? Examine the role of PPP model in the redevelopment of Railway Stations in India.

(150 words) [10]

Approach to question:

1. Public Private Partnership (PPP) is required in infrastructure projects to leverage the strengths of both the public and private sectors.
2. PPP model ensures the participation of the private sector in the development of infrastructure projects, leading to better quality of infrastructure and timely completion.
3. The PPP model in the redevelopment of Railway Stations in India has been successful in attracting private investment and improving the amenities at railway stations.

Answer:

Public Private Partnership (PPP) is essential in infrastructure projects due to its potential to leverage the strengths of both the public and private sectors. PPP allows for efficient resource allocation, risk sharing and innovative financing models, making it an attractive option for complex and capital-intensive projects.

Role of PPP in Redevelopment of Railway Stations in India:

1. **Investment:** PPP attracts private investments, easing the financial burden on the government and facilitating timely execution of railway station redevelopment projects.
2. **Expertise:** Private partners bring technical expertise, modernization skills and customer-centric approaches, enhancing the quality of infrastructure and services.
3. **Revenue Generation:** PPP allows monetization of non-core assets, generating revenue streams to fund infrastructure improvements.
4. **Fast-Track Development:** PPP models expedite the redevelopment process, improving passenger amenities and overall railway station experience.

PPP has emerged as a critical mechanism in infrastructure development and its application in the redevelopment of railway stations in India showcases how public-private collaboration can transform public services, drive economic growth and enhance the overall infrastructure landscape.

Q2. Is inclusive growth possible under market economy? State the significance of financial inclusion in achieving economic growth in India. **(150 words) [10]**

Approach to question:

Yes, inclusive growth is possible under a market economy if appropriate policies and measures are taken to ensure that the benefits of economic growth are shared by all sections of society.

1. Financial inclusion plays a significant role in achieving inclusive economic growth by providing access to financial services to all segments of society, especially to the marginalised and disadvantaged.
2. It can lead to increased savings and investment, access to credit and employment opportunities, which in turn can lead to poverty reduction and overall economic development.

Answer:

The question of whether inclusive growth is possible under a market economy is a subject of ongoing debate. A market economy is driven by supply and demand and there are concerns about income inequality and exclusion. However, financial inclusion plays a crucial role in promoting inclusive growth and addressing these challenges.

Significance of Financial Inclusion in Achieving Economic Growth in India:

1. **Access to Banking Services:** Financial inclusion ensures that all segments of society, including the marginalized, have access to banking and financial services, fostering economic participation.
2. **Credit Access:** It enables easier credit availability to small businesses and individuals, promoting entrepreneurship and job creation.

3. **Poverty Reduction:** Financial inclusion empowers the poor with savings and investment opportunities, contributing to poverty alleviation.
4. **Inclusive Development:** Inclusive finance helps bridge regional and social disparities, promoting equitable economic growth.

Financial inclusion is instrumental in achieving inclusive growth under a market economy. In India, promoting financial inclusion is critical for addressing income inequality, empowering the poor and ensuring that economic growth benefits all segments of society.

Q3. What are the major challenges of the Public Distribution System (PDS) in India? How can it be made effective and transparent?
(150 words) [10]

Approach to question:

Some of the major challenges of Public Distribution System (PDS) in India are:

1. **Targeting errors:** The identification of beneficiaries is not always accurate, resulting in some deserving households being excluded and some non-deserving ones being included in the PDS.
2. **Leakages:** The food grains meant for distribution through the PDS are syphoned off by middlemen and corrupt officials, leading to reduced availability of subsidised food grains to the poor.

To make the PDS effective and transparent, the following steps can be taken:

1. **Use of technology:** The use of technology such as biometric identification, GPS tracking and e-procurement can help in reducing targeting errors and leakages.
2. **Strengthening of accountability mechanisms:** The establishment of grievance redressal mechanisms and social audits can help in ensuring accountability of officials and reducing corruption.

Overall, effective implementation of these measures can help in making the PDS more effective and transparent.

Answer:

The Public Distribution System (PDS) is a vital social welfare program in India, aiming to provide subsidized food grains to the economically vulnerable population. However, the system faces several challenges that hinder its effectiveness in reaching the intended beneficiaries.

Challenges of the PDS in India:

1. **Leakage and Corruption:** PDS suffers from leakages and corruption at various stages, leading to diversion of subsidized food grains.
2. **Targeting Errors:** Inaccurate identification of beneficiaries results in exclusion of needy families and inclusion of ineligible ones.

Making PDS Effective and Transparent:

1. **Digitization:** Implementing technology-driven solutions like biometric authentication and digitized ration cards to ensure transparency and eliminate duplication.
2. **Aadhaar Linkage:** Linking PDS with Aadhaar enables direct benefit transfer, reducing leakage and ensuring targeted delivery.

To enhance the efficacy and transparency of the Public Distribution System in India, the government must adopt technology-enabled solutions, ensure proper beneficiary targeting and establish effective monitoring and accountability mechanisms. These measures can help in addressing the major challenges faced by the PDS and ensure that subsidized food grains reach the deserving population efficiently.

Q4. Elaborate on the scope and significance of the food processing industry in India.
(150 words) [10]

Approach to question:

Scope and Significance of the Food Processing Industry in India:

1. The food processing industry in India is a crucial sector that accounts for 32% of the country's total food market.
2. It includes various sub-sectors such as fruits and vegetables, dairy, meat and poultry, fisheries and packaged food.
3. The industry has significant potential for growth due to the abundance of raw materials and a large consumer base.
4. It creates job opportunities, particularly in the rural areas and generates income for farmers and other stakeholders.

Answer:

The food processing industry plays a vital role in India's economy and has immense scope and significance due to its potential to add value to agricultural produce, create employment and contribute to economic growth.

Scope and Significance of the Food Processing Industry in India:

1. **Value Addition:** The industry processes raw agricultural produce into value-added products, increasing their shelf life and market value.
2. **Employment Generation:** Food processing provides employment opportunities, particularly

in the rural areas, contributing to rural development and poverty alleviation.

3. **Export Potential:** Processed food products have significant export potential, contributing to foreign exchange earnings.
4. **Food Security:** The industry enhances food security by reducing post-harvest losses and ensuring a steady supply of processed and packaged food items.
5. **Technological Advancements:** The sector drives innovation and technology adoption in food preservation, packaging and safety.

The food processing industry in India has a vast scope and significant socio-economic importance. Encouraging its growth through policy support, investment and infrastructure development can boost agricultural value chains, generate employment and contribute to the nation's overall economic prosperity.

Q5. The increase in life expectancy in the country has led to newer health challenges in the community. What are those challenges and what steps need to be taken to meet them? (150 words) [10]

Approach to question:

Some of the health challenges emerging due to the increase in life expectancy in India are:

1. Non-Communicable Diseases (NCDs) such as diabetes, cardiovascular diseases and cancer are becoming more prevalent due to lifestyle changes.
2. Mental health issues such as depression, anxiety and dementia are also on the rise.

Steps that can be taken to address these challenges are:

1. Increasing awareness about healthy lifestyle choices and preventive measures through campaigns and education programs.
2. Increasing investment in mental health infrastructure and services.
3. Targeted nutritional interventions and programs to address malnutrition and under-nutrition.

Answer:

The increase in life expectancy in India is a testament to improved healthcare and living standards. However, it has also brought forth newer health challenges for the community, demanding strategic interventions to ensure a healthy and productive aging population.

Health Challenges:

1. **Non-Communicable Diseases (NCDs):** With aging, the prevalence of NCDs like diabetes, cardiovascular diseases and cancer rises, necessitating focused prevention and management.
2. **Geriatric Health:** Age-related health issues, including dementia, mobility limitations and social isolation, require specialized geriatric care.
3. **Mental Health:** The elderly often face mental health challenges like depression and anxiety, necessitating accessible mental health services.

Steps to Meet Challenges:

1. **Geriatric Health Programs:** Developing specialized geriatric health programs with a focus on preventive care and rehabilitation.
2. **Integrated Care:** Promoting integrated care models that address physical, mental and social well-being of the elderly.
3. **Health Awareness:** Enhancing health awareness and education about healthy aging and NCD prevention.

Meeting the health challenges of an aging population requires comprehensive and inclusive healthcare strategies, emphasizing preventive care, specialized services and social support. By implementing these steps, India can effectively address the health needs of its growing elderly population and promote healthy aging.

Q6. Each year a large amount of the plant material, cellulose, is deposited on the surface of Planet Earth. What are the natural processes this cellulose undergoes before yielding carbon dioxide, water and other end products? (150 words) [10]

Approach to question:

Some possible points that can be included in the answer are:

1. Cellulose is the primary component of plant cell walls and one of the most abundant organic compounds on Earth. It is a polymer of glucose molecules linked by beta-1, 4-glycosidic bonds.
2. When plant material dies or is shed, it becomes part of the organic matter pool in soil, where it is decomposed by microorganisms such as bacteria and fungi. This process is called mineralization or decomposition and it involves the breakdown of cellulose and other organic molecules into simpler compounds such as carbon dioxide, water, ammonia and mineral nutrients like nitrogen and phosphorus.

Answer:

Each year, a substantial quantity of plant material known as cellulose is accumulated on the surface of Planet Earth. This cellulose undergoes several natural processes before

eventually yielding carbon dioxide, water and other end products. These processes include:

1. **Decomposition by Microorganisms:** Microscopic organisms such as bacteria and fungi play a crucial role in breaking down cellulose. They secrete enzymes that digest cellulose, converting it into simpler compounds.
2. **Aerobic Respiration:** During decomposition, aerobic microorganisms utilize oxygen to further break down cellulose, producing carbon dioxide and water as byproducts.
3. **Anaerobic Respiration:** In oxygen-depleted environments like waterlogged soils, anaerobic microorganisms carry out the decomposition process, leading to the production of methane in addition to carbon dioxide and water.
4. **Humification:** In some cases, cellulose may not entirely decompose but instead transform into a more stable substance called humus, which is rich in carbon and provides vital nutrients for plants.

In conclusion, the natural processes of decomposition, respiration, humification, combustion, weathering and digestion collectively contribute to the breakdown of cellulose, ultimately leading to the release of carbon dioxide, water and other end products into the environment.

Q7. Discuss in detail the photochemical smog emphasising its formation, effects and mitigation. Explain the 1999 Gothenburg Protocol. (150 words) [10]

Approach to question:

Formation and Effects of Photochemical Smog:

Photochemical smog is formed by the reaction of sunlight, nitrogen oxides (NOx) and volatile organic compounds (VOCs) emitted by vehicles, industries and natural sources.

Mitigation of Photochemical Smog:

Reducing emissions of NOx and VOCs is the key to mitigating photochemical smog.

Gothenburg Protocol:

The Gothenburg Protocol is an international treaty signed in 1999 to reduce emissions of air pollutants that cause acidification, eutrophication and ground-level ozone.

Answer:

Photochemical smog is a type of air pollution that results from the interaction of sunlight with certain air pollutants. It poses serious health and environmental concerns due to its harmful effects on human health and ecosystems.

Formation and Effects of Photochemical Smog:

1. **Formation:** It forms when nitrogen oxides (NOx) and volatile organic compounds (VOCs) react with sunlight to produce ground-level ozone and other secondary pollutants.
2. **Effects:** Photochemical smog causes respiratory problems, eye irritation and exacerbates asthma and other respiratory conditions. It damages crops, forests and aquatic ecosystems.

Mitigation and the 1999 Gothenburg Protocol:

1. **Mitigation:** Reducing emissions of NOx and VOCs from vehicles, industries and other sources through strict regulations and advanced technologies can mitigate photochemical smog.
2. **Gothenburg Protocol:** The 1999 Gothenburg Protocol is an international agreement under the United Nations Economic Commission for Europe (UNECE) that aims to reduce emissions of air pollutants, including NOx, VOCs, sulfur dioxide (SO_2) and ammonia (NH_3) from various sources in participating countries.

Effective mitigation strategies and international cooperation, as demonstrated by the Gothenburg Protocol, are essential in combatting photochemical smog and safeguarding human health and the environment from its adverse effects.

Q8. Explain the mechanism and occurrence of cloudburst in the context of the Indian subcontinent. Discuss two recent examples. (150 words) [10]

Approach to question:

Mechanism and Occurrence of Cloudburst in the Indian Subcontinent:

1. Cloudburst is an extreme weather event characterised by an abrupt and heavy precipitation from a convective cloud, often associated with thunderstorms.
2. In the Indian subcontinent, cloudbursts are most common during the monsoon season, particularly in the mountainous regions of Uttarakhand and Himachal Pradesh.

Effects and Mitigation of Cloudburst:

The effects of cloudbursts can be devastating, causing flash floods, landslides and loss of life and property.

Recent Examples:

In July 2021, a cloudburst occurred in the Kishtwar district of Jammu and Kashmir.

Answer:

Cloudbursts are intense and localized weather phenomena characterized by heavy rainfall over a short

duration. In the Indian subcontinent, cloudbursts occur during the monsoon season, often in hilly regions and can lead to devastating flash floods and landslides.

Mechanism and Occurrence of Cloudburst:

Jammu and Kashmir, 2021: In July 2021, a cloudburst occurred in the Kishtwar district of Jammu and Kashmir, resulting in flash floods and landslides that claimed the lives of at least 20 people.

1. **Mechanism:** Cloudbursts occur when warm, moist air rises rapidly into colder atmospheric layers, leading to rapid condensation and the formation of massive cumulonimbus clouds.
2. **Monsoon Season:** Cloudbursts are common during the monsoon season, particularly in regions with complex terrain, as moist air masses collide and ascend.

Two Recent Examples in India:

1. **Jammu and Kashmir, 2021:** In July 2021, a cloudburst occurred in the Kishtwar district of Jammu and Kashmir, resulting in flash floods and landslides that claimed the lives of at least 20 people.
2. **Uttarakhand, 2013:** A catastrophic cloudburst hit Uttarakhand in June 2013, resulting in flash floods and landslides, causing significant loss of life and infrastructure damage.
3. **Leh, Ladakh, 2010:** In August 2010, Leh in Ladakh experienced a devastating cloudburst that led to flash floods, claiming many lives and causing extensive destruction.

Cloudbursts are natural disasters with severe impacts on human lives and infrastructure. Early warning systems, disaster preparedness and sustainable land use planning are essential to minimize the risks associated with cloudbursts in the Indian subcontinent.

Q9. Discuss the types of organised crime. Describe the linkages between terrorists and organised crime that exist at the national and transnational levels. (150 words) [10]

Approach to question:

Types of Organized Crime:

1. **Drug trafficking:** The illegal production, transportation and sale of drugs such as cocaine, heroin and marijuana.
2. **Human trafficking:** Involves the illegal movement of people across borders for forced labour or sexual exploitation.

Linkages between terrorists and organised crime:

1. **Financing of terrorism:** Terrorist groups often engage in organised crime to raise funds for their activities.
2. **Arms trafficking:** Terrorist groups may rely on organised crime networks to obtain weapons and ammunition.

Recent Examples:

In 2019, the National Investigation Agency (NIA) uncovered a link between a drug trafficking ring in Punjab and a terrorist group based in Pakistan.

Answer:

Organized crime refers to criminal activities that involve a group of individuals operating in a systematic and structured manner. These criminal groups engage in various types of organized crime and their linkages with terrorist organizations pose significant security challenges at national and transnational levels.

Types of Organized Crime:

1. **Drug Trafficking:** Illicit production, transportation and distribution of drugs.
2. **Human Trafficking:** Smuggling of people across borders for forced labor or exploitation.
3. **Arms Smuggling:** Illegal trade and trafficking of firearms and weapons.

Linkages between Terrorists and Organized Crime:

1. **Funding:** Terrorist groups often collaborate with organized crime networks to fund their activities through illicit activities like drug trafficking and extortion.
2. **Arms Supply:** Organized crime provides terrorists with access to illegal arms and weaponry.
3. **Safe Havens:** Terrorists may find refuge and support within the territories controlled by criminal organizations.

The linkages between terrorists and organized crime pose significant challenges to national and international security. Combating these threats requires enhanced intelligence sharing, coordinated law enforcement efforts and international cooperation to disrupt the financial and operational networks of these criminal organizations.

Q10. What are the maritime security challenges in India? Discuss the organisational, technical and procedural initiatives taken to improve the maritime security. (150 words) [10]

Approach to question:

Organisational initiatives:

Formation of Indian Navy and Indian Coast Guard to maintain and safeguard India's maritime interests.

Technical initiatives:

Deployment of surveillance systems like radars, Automatic Identification System and satellite imaging for real-time monitoring of India's maritime domain.

Procedural initiatives:

Establishment of Standard Operating Procedures for coordinated response to maritime threats.

Maritime security challenges in India:

1. Piracy and armed robbery at sea.
2. Terrorism and smuggling through the sea route.

Linkages between terrorists and organised crime:

1. Terrorists often rely on organised crime groups for financing, arms smuggling and logistics support.
2. Criminal groups may exploit instability and conflict in regions affected by terrorism to expand their operations.

Answer:

India faces various maritime security challenges due to its extensive coastline and strategic location. Protecting maritime interests and securing sea lanes is crucial for economic growth and national security.

Maritime Security Challenges in India:

1. **Piracy:** Incidents of piracy in the Indian Ocean region threaten maritime trade and security.
2. **Terrorism:** Terrorist activities, like smuggling and infiltration, pose risks to coastal security.
3. **Illegal Fishing:** Unregulated fishing by foreign vessels depletes marine resources and affects livelihoods.
4. **Maritime Boundary Disputes:** Territorial disputes with neighboring countries raise security concerns.

Initiatives to Improve Maritime Security:

1. **Organizational:** Setting up the Indian Coast Guard and National Maritime Domain Awareness to enhance surveillance and response capabilities.
2. **Technical:** Deploying coastal radars, AIS and satellite surveillance for better maritime domain awareness.
3. **Procedural:** Conducting regular coastal security exercises and joint patrols with neighbouring navies to deter threats.

India's maritime security challenges demand a comprehensive approach involving robust organizations, advanced technology and coordinated procedures to safeguard its maritime interests and ensure regional stability.

Q11. "Economic growth in the recent past has been led by an increase in labour productivity". Explain this statement. Suggest the growth pattern that will lead to creation of more jobs without compromising labour productivity.
(250 words) [15]

Approach to question:

1. Economic growth refers to the increase in the country's production of goods and services over time.
2. Labour productivity measures the output produced per worker in a given time period.
3. The statement suggests that the recent economic growth in India has been driven by an increase in labour productivity, which means that each worker is producing more goods and services than before.
4. This has been made possible by the adoption of technology, better training and improved working conditions.

Answer:

Economic growth in recent times has been primarily driven by an increase in labor productivity, where workers produce more output per unit of labor input. This enhanced efficiency leads to higher GDP growth and improved living standards.

Explanation of the Statement:

1. **Technological Advancements:** Adoption of advanced technologies and automation enhances productivity, allowing businesses to produce more with fewer labor resources.
2. **Skill Development:** Investment in skill development programs improves workers' capabilities, enabling them to perform tasks efficiently and effectively.
3. **Specialization:** Labor specialization in specific industries or sectors leads to better utilization of skills and resources, contributing to productivity gains.

Growth Pattern for Job Creation without Compromising Labor Productivity:

1. **Labor-Intensive Sectors:** Focusing on labor-intensive sectors like agriculture, construction and services can create more job opportunities while maintaining labor productivity through skill enhancement.
2. **Entrepreneurship and SMEs:** Encouraging entrepreneurship and supporting small and medium-sized enterprises (SMEs) fosters job creation with relatively lower capital requirements.
3. **Infrastructure Development:** Investment in infrastructure projects generates employment and creates a multiplier effect on other industries.
4. **Inclusive Growth:** Ensuring equitable access to education, training and job opportunities

for marginalized communities contributes to sustainable job creation.

Balancing job creation and labor productivity is essential for inclusive economic growth. A growth pattern that emphasizes labor-intensive sectors, supports SMEs, invests in infrastructure and promotes inclusive development can create more jobs without compromising labor productivity, benefiting both the economy and the workforce.

Q12. Do you think India will meet 50 percent of its energy needs from renewable energy by 2030? Justify your answer. How will the shift of subsidies from fossil fuel to renewables help achieve the above objective? Explain.

(250 words) [15]

Approach to question:

India has set an ambitious target of meeting 50% of its energy needs from renewable energy by 2030. However, achieving this target is a challenging task. Here's how to answer the given question:

Introduction:

Briefly mention India's renewable energy target and the challenges involved in achieving it.

Body:

1. Discuss the current status of renewable energy in India, including the installed capacity, the sources of renewable energy and the growth rate of renewable energy in recent years.
2. Analyse the factors that could hinder India's progress towards the renewable energy target, such as financing issues, inadequate infrastructure, transmission and distribution issues and the low efficiency of renewable energy systems.

Conclusion:

Summarise the key points of the essay and provide a balanced and informed opinion on India's renewable energy target.

Answer:

The target of meeting 50 percent of India's energy needs from renewable energy by 2030 is ambitious and feasible, given the country's growing focus on renewable energy sources and policy initiatives to promote their adoption.

Justification for India's Renewable Energy Target:

1. **Policy Support:** The Indian government has introduced various policies and schemes to promote renewable energy deployment, such as the National Solar Mission and Wind Energy Policy.
2. **Capacity Expansion:** India has witnessed a significant increase in renewable energy capacity, including solar, wind and biomass in recent years.
3. **International Commitments:** India is a signatory to global climate agreements like the Paris Agreement, driving its commitment to renewable energy adoption for climate change mitigation.
4. **Technological Advancements:** Advancements in renewable energy technologies and declining costs make them more competitive with conventional sources.

Shift of Subsidies from Fossil Fuels to Renewables:

1. **Incentive for Investment:** Redirecting subsidies from fossil fuels to renewables encourages private investment in renewable energy projects.
2. **Cost Competitiveness:** Subsidies can help bridge the cost gap between renewable and fossil fuel-based energy, making renewables more competitive and attractive to consumers.
3. **Environmental Benefits:** Shifting subsidies promotes the transition to cleaner energy sources, reducing greenhouse gas emissions and mitigating climate change impacts.

India's target of meeting 50 percent of its energy needs from renewable sources by 2030 is achievable with continued policy support, capacity expansion and technological advancements. Redirecting subsidies from fossil fuels to renewables will accelerate the adoption of clean energy and contribute to India's sustainable energy future.

Q13. What are the main bottlenecks in upstream and downstream process of marketing of Agricultural products in India?

(250 words) [15]

Approach to question:

1. One of the main bottlenecks in the upstream process of marketing agricultural products is the lack of modern infrastructure such as cold storage, warehouses and transportation facilities.
2. Farmers face issues related to limited access to formal credit, inadequate market information and high transaction costs, leading to their exploitation by middlemen.
3. Inefficient agricultural supply chains lead to losses in transit, lack of proper grading and standardization and high levels of fragmentation that make it difficult to ensure quality and traceability.

To overcome these bottlenecks, the government needs to focus on developing robust infrastructure, promoting investment in the sector, improving access to credit and market information and strengthening regulations to ensure fair prices and transparency in the system.

Answer:

The marketing of agricultural products in India involves both upstream (production to wholesaler/processor) and downstream (wholesaler/processor to retailers/consumers) processes. However, there are several bottlenecks in each stage that hinder the efficient marketing of agricultural products.

Bottlenecks in Upstream Process:

1. **Input Availability:** Limited access to quality inputs like seeds, fertilizers and irrigation facilities affects agricultural productivity.
2. **Fragmented Land Holdings:** Small and fragmented land holdings lead to inefficiencies and hinder economies of scale.
3. **Post-Harvest Losses:** Inadequate storage and transportation facilities result in significant post-harvest losses.
4. **Lack of Market Information:** Farmers often lack timely and accurate market information, leading to suboptimal decision-making.

Bottlenecks in Downstream Process:

1. **Inefficient Supply Chain:** Weak linkages between wholesalers, processors and retailers result in inefficiencies and higher costs.
2. **Quality Control:** Inadequate quality control measures can affect the shelf life and marketability of agricultural products.
3. **Infrastructure:** Inadequate infrastructure for storage, transportation and processing impacts the overall supply chain.

Addressing the bottlenecks in the upstream and downstream processes of marketing agricultural products is essential to ensure smooth and efficient supply chains, enhance farmer income and reduce food wastage. Improving input availability, infrastructure, market information and supply chain efficiency are critical steps to modernize India's agricultural marketing sector.

Q14. What is Integrated Farming System? How is it helpful to small and marginal Farmers in India? (250 words) [15]

Approach to question:

1. Integrated Farming System (IFS) is a sustainable agricultural production system that integrates various components of farming, such as crops, livestock, poultry, fishery and agroforestry, to maximize output and minimize costs.
2. IFS is helpful to small and marginal farmers in India in several ways:
   (a) **Diversification of income sources:** By integrating various components of farming, farmers can diversify their income sources and reduce their dependence on a single crop or livestock.
   (b) **Efficient use of resources:** IFS enables efficient use of resources such as land, water and nutrients by utilizing the waste of one component as an input for another. For example, livestock waste can be used as manure for crops and crop residues can be used as fodder for livestock.
3. However, the adoption of IFS by small and marginal farmers in India is limited due to several challenges, such as lack of knowledge, inadequate credit, lack of market linkages and insufficient government support.

Answer:

Integrated Farming System (IFS) refers to a sustainable agricultural production system that integrates different components of farming such as crops, livestock, fishery, forestry and agroforestry, with a goal of efficient resource utilisation and increased productivity. Here are some points that highlight the significance of IFS for small and marginal farmers in India:

1. **Resource optimization:** IFS involves the efficient utilisation of resources such as land, water and labour. It allows farmers to make the most of their limited resources, thus maximising their productivity and income.
2. **Diversification of income:** IFS promotes the diversification of income sources for farmers by incorporating multiple farming activities in a single unit. This can help to reduce the dependence of farmers on a single crop or activity, which can be risky in case of crop failures or market fluctuations.
3. **Soil health:** IFS practices such as crop rotation, intercropping and agroforestry can help to improve soil health, thereby enhancing the overall productivity of the farm.
4. **Livestock management:** IFS integrates livestock management with crop production, thus enabling farmers to use animal waste as a source of organic fertiliser for crops. This also helps to generate additional income from milk, meat and other livestock products.

In conclusion, the Integrated Farming System can prove to be an effective approach for small and marginal farmers in India. It not only maximises the use of limited resources but also helps to diversify income sources and promote sustainable agricultural practices.

Q15. Launched on 25th December, 2021, the James Webb Space Telescope has been much in news since then. What are its unique features which makes it superior to its predecessor space telescopes? What are the key goals of this mission? What potential benefits does it hold for the human race? (250 words) [15]

Approach to question:

1. The James Webb Space Telescope (JWST) is the largest and most powerful space telescope ever built, with a mirror that is over 6 times larger than that of the Hubble Space Telescope.
2. It is designed to observe the universe in the infrared wavelength range and will be able to see back in time to the first galaxies that formed after the Big Bang.
3. JWST's primary scientific goals include the study of the formation and evolution of galaxies, stars and planetary systems, as well as the search for life on other planets.

Answer:

The James Webb Space Telescope (JWST) is a next-generation telescope set to launch in December 2021. Its unique features that make it superior to its predecessor Space Telescopes are:

1. **Larger mirror:** The JWST has a 6.5-meter primary mirror, which is more than double the size of the Hubble Space Telescope's mirror. This larger mirror will allow the telescope to observe distant galaxies and stars with much greater clarity.
2. **Infrared capabilities:** The JWST is designed to observe in the infrared spectrum, which will allow it to see through cosmic dust and observe the formation of stars and galaxies that are obscured from optical telescopes.

The key goals of the JWST mission are:

1. **To study the formation and evolution of galaxies:** The JWST will be able to see back in time to when the first galaxies were formed and study how they evolved over time.
2. **To study the formation and evolution of stars:** The JWST will be able to see through clouds of dust and observe how stars form, as well as study how they evolve and die.

The potential benefits of the JWST for the human race are:

1. **Advancing scientific knowledge:** The JWST will provide new insights into the formation and evolution of galaxies, stars and planets, as well as the early universe.
2. **Inspiring future generations:** The JWST is a symbol of humanity's quest for knowledge and exploration, which can inspire future generations to pursue careers in science and technology.

In conclusion, the James Webb Space Telescope has unique features that make it superior to its predecessor Space Telescopes and its key goals include studying the formation and evolution of galaxies, stars, exoplanets and the early universe. Its potential benefits include advancing scientific knowledge, inspiring future generations and technological advancements.

Q16. What is the basic principle behind vaccine development? How do vaccines work? What approaches were adopted by the Indian vaccine manufacturers to produce COVID Vaccines? (250 words) [15]

Approach to question:

1. Vaccines are developed by exposing the immune system to a weakened or inactivated pathogen or its components, so that the body can recognize and respond to the pathogen in case of future exposure.
2. Vaccines work by triggering an immune response in the body, which leads to the production of antibodies that can neutralise the pathogen or its toxins.
3. Indian vaccine manufacturers, including Bharat Biotech and Serum Institute of India, used different approaches to produce COVID vaccines.
4. Bharat Biotech's Covaxin is an inactivated virus vaccine, while Serum Institute's Covishield is a viral vector vaccine that uses a weakened version of a different virus to deliver the genetic code of the COVID virus spike protein.

Answer:

Vaccine development is based on the principle of introducing a weakened or inactivated form of a pathogen or its components into the body to trigger an immune response. Vaccines work by stimulating the immune system to recognize and remember the pathogen, allowing it to mount a rapid and effective response if exposed to the actual infection in the future.

Working of Vaccines:

1. **Antigen Presentation:** Vaccines contain antigens (weakened or inactivated pathogens) that mimic the actual pathogen. When administered, they stimulate immune cells to recognize these antigens as foreign invaders.
2. **Immune Response:** The immune system responds by producing antibodies and activating specialized immune cells to fight the antigens.

3. **Memory Cells:** After the immune response, memory cells are created, which "remember" the pathogen's antigens. This memory provides long-term protection against future infections.

Indian Vaccine Manufacturers' Approaches for COVID Vaccines:

1. **Covaxin (Bharat Biotech):** Inactivated virus vaccine based on the killed SARS-CoV-2 virus, inducing an immune response against the virus.
2. **Covishield (Serum Institute of India):** Viral vector vaccine based on a weakened adenovirus carrying the genetic material of the spike protein, triggering an immune response.

Vaccine development and working principles have been pivotal in the fight against COVID-19. Indian vaccine manufacturers adopted different approaches to produce COVID vaccines, contributing significantly to vaccination efforts in India and globally.

Q17. Discuss global warming and mention its effects on the global climate. Explain the control measures to bring down the level of greenhouse gases which cause global warming, in the light of the Kyoto Protocol, 1997. (250 words) [15]

Approach to question:

1. Global warming refers to the gradual increase in the Earth's surface temperature, primarily caused by the release of greenhouse gases like carbon dioxide, methane and nitrous oxide due to human activities.
2. The effects of global warming include melting of polar ice caps, rising sea levels, increase in the frequency and intensity of extreme weather events, droughts, wildfires and ocean acidification.
3. The Kyoto Protocol is an international agreement signed in 1997, aimed at reducing greenhouse gas emissions. The Protocol mandates developed countries to reduce their greenhouse gas emissions by an average of 5.2% below their 1990 levels by the end of 2012.
4. Control measures to reduce greenhouse gases include promoting energy efficiency, using renewable energy sources, improving public transport, promoting afforestation, promoting sustainable agriculture practices and using clean technologies.

Answer:

Global warming refers to the gradual increase in the Earth's average surface temperature caused by greenhouse gases. The main greenhouse gases responsible for global warming are carbon dioxide, methane, nitrous oxide and fluorinated gases. The effects of global warming on the global climate include:

1. Rising sea levels due to melting glaciers and polar ice caps.
2. More frequent and severe weather events such as hurricanes, droughts and heatwaves.
3. Changes in precipitation patterns leading to floods and water scarcity.

To control the level of greenhouse gases, the Kyoto Protocol was signed in 1997 by countries worldwide. The Protocol established legally binding emissions reduction targets for industrialised countries. Some of the control measures that can bring down the level of greenhouse gases include:

1. Promotion of renewable energy sources such as solar, wind and hydro power.
2. Increasing energy efficiency in buildings, transportation and industries.
3. Reducing deforestation and promoting afforestation and reforestation.

India has played a significant role in the control of greenhouse gas emissions. Some of the measures taken by India include:

1. Increasing the share of renewable energy sources in the energy mix.
2. Promoting energy efficiency in industries, buildings and transportation.
3. Introducing electric vehicles and promoting the use of biofuels.

In conclusion, global warming is a serious threat to the environment and human well-being. The Kyoto Protocol and other international agreements provide a framework for countries to reduce greenhouse gas emissions and mitigate the effects of global warming. India has taken various measures to control greenhouse gas emissions and promote sustainable development.

Q18. Explain the causes and effects of coastal erosion in India. What are the available coastal management techniques for combating the hazard? (250 words) [15]

Approach to question:

Causes and effects of coastal erosion in India:

Causes: Natural factors like tides, storms, sea level rise and human activities like sand mining, construction of ports and structures on beaches.

Coastal management techniques:

Hard engineering: Building of seawalls, groynes, breakwaters and revetments to prevent or reduce erosion.

Answer:

Coastal erosion is a natural process that occurs due to various factors and has significant effects on coastal regions in India, threatening human settlements and infrastructure.

Causes and Effects of Coastal Erosion in India:

1. **Natural Factors:** Wave action, tidal currents and storm surges contribute to coastal erosion, particularly during monsoons and cyclones.
2. **Human Interventions:** Sand mining, construction activities and improper coastal development disrupt natural sediment flow, exacerbating erosion.
3. **Sea Level Rise:** Global warming and climate change lead to sea level rise, intensifying coastal erosion and inundation of low-lying areas.
4. **Effect on Ecosystems:** Erosion negatively impacts coastal ecosystems, including mangroves and coral reefs, affecting biodiversity and fisheries.

Coastal Management Techniques:

1. **Coastal Protection Structures:** Building seawalls, groynes and breakwaters to dissipate wave energy and prevent erosion.
2. **Beach Nourishment:** Adding sand to eroding beaches to restore natural sediment and stabilize the shoreline.
3. **Dune Restoration:** Replanting and restoring natural dune systems to act as natural barriers against erosion.
4. **Managed Retreat:** Relocating infrastructure away from eroding coasts to minimize risk and protect natural ecosystems.

Coastal erosion poses significant challenges to India's coastal regions. Implementing appropriate coastal management techniques is essential to protect communities, ecosystems and valuable coastal assets from the hazards of erosion and ensure sustainable coastal development.

Q19. What are the different elements of Cyber security? Keeping in view the challenges in cyber security, examine the extent to which India has developed a comprehensive National Cyber Security Strategy.

(250 words) [15]

Approach to question:

1. Elements of Cybersecurity include:
   - (a) **Confidentiality:** Protecting sensitive information from unauthorised access
   - (b) **Integrity:** Ensuring the accuracy and completeness of data
   - (c) **Availability:** Ensuring the availability of data and systems
2. India's National Cyber Security Policy was released in 2013, which aims to Create a secure cyber ecosystem in the country
3. India has also established various organisations to promote cybersecurity, such as the National Cyber Security Coordinator, CERT-In and the National Critical Information Infrastructure Protection Centre.
4. However, India faces various challenges in cybersecurity, including:
   - (a) The large and diverse user base
   - (b) Strengthen the regulatory framework
   - (c) Limited awareness of cybersecurity among the public
5. India needs to adopt a more comprehensive approach to cybersecurity by:
   - (a) Investing in cybersecurity R&D and innovation
   - (b) Enhancing awareness among the public and businesses

Answer:

Cybersecurity encompasses various elements aimed at safeguarding digital assets, systems and networks from unauthorized access, attacks and damage.

Elements of Cybersecurity:

1. **Information Security:** Protecting sensitive data and information from unauthorized access and breaches.
2. **Network Security:** Ensuring the security of computer networks and preventing unauthorized access to network resources.
3. **Endpoint Security:** Protecting individual devices, such as computers and mobile devices, from cyber threats.
4. **Application Security:** Securing software applications from vulnerabilities and malicious attacks.
5. **Incident Response:** Developing strategies to respond to and mitigate cybersecurity incidents promptly.

Extent of India's National Cyber Security Strategy:

1. **Legal Framework:** India has established the National Cyber Security Policy in 2013, outlining the country's approach to cybersecurity.
2. **Capacity Building:** The Indian government has invested in cybersecurity skill development and capacity-building initiatives.

3. **Cyber Diplomacy:** India actively engages in cyber diplomacy and international cooperation to address global cyber threats.
4. **Cyber Resilience:** Initiatives to enhance the resilience of critical infrastructure against cyber attacks have been undertaken.

While India has made significant progress in developing a National Cyber Security Strategy, continuous efforts are required to address emerging cyber threats and strengthen cybersecurity measures across all sectors to ensure a safe and secure digital environment.

Q20. Naxalism is a social, economic and developmental issue manifesting as a violent internal security threat. In this context, discuss the emerging issue and suggest a multilayered strategy to tackle the menace of Naxalism. (250 words) [15]

Approach to question:

Naxalism, a left-wing extremist movement, is a social, economic and developmental issue manifesting as a violent internal security threat.

Emerging Issues

The emerging issue is that Naxalism is spreading to new regions and intensifying in existing ones, leading to increased violence and casualties.

Multilayered strategy to tackle Naxalism

To tackle the menace of Naxalism, a multilayered strategy needs to be implemented, including a focus on development and governance, intelligence gathering and targeted operations against the extremists. This should be combined with efforts to address the root causes of the issue, including poverty, inequality and social injustice. Additionally, a coordinated approach between the central and state governments and the involvement of local communities is necessary for long-term success.

Answer:

Naxalism is a persistent internal security threat in India that arises from social, economic and developmental issues. The following are the emerging issues and a multi-layered strategy to tackle the menace of Naxalism:

Emerging Issues:

1. **Exploitation of the tribal population:** Naxalism is fuelled by the exploitation of the tribal population who have been marginalised and denied access to basic resources such as land, water and forest produce.
2. **Weak governance:** Naxalism thrives in areas with weak governance and poor development indicators. Lack of basic infrastructure such as roads, schools and healthcare facilities further alienate the people from the mainstream.
3. **Inequality:** Inequality between different sections of society creates a breeding ground for extremism.

Multilayered Strategy:

1. **Developmental measures:** The government must prioritise development in Naxal affected areas. This includes building roads, schools and healthcare facilities. Developmental projects such as building dams, canals and irrigation projects must be taken up to provide employment and improve livelihoods.
2. **Economic opportunities:** The government must focus on creating job opportunities in the Naxal affected areas. This can be achieved through skill development, entrepreneurship programs and support for small and medium enterprises.
3. **Security measures:** The government must improve the security infrastructure in Naxal affected areas. This includes providing adequate training to the security forces, improving intelligence gathering and enhancing coordination between different security agencies.

In conclusion, the Naxalism problem in India is a complex issue that requires a multifaceted approach. The government must focus on developmental measures, economic opportunities, security measures, engagement with the local population, law and order measures and seek international cooperation to tackle the problem. The strategy must be implemented in a coordinated manner and with a long-term vision to bring lasting peace and prosperity to the Naxal affected areas.