

UPSC CSE 2021 MAINS PAPER 4 JANUARY 09, 2022 GENERAL STUDIES III ANSWER KEY
Question 1: Explain the difference between computing methodology of India's Gross Domestic Product (GDP) before the year 2015 and after the year 2015.

Answer : The Gross Domestic Product (GDP) is the market value of all final goods and services produced within an economy in a given period. The GDP data is calculated by National Statistical office (NSO).

GDP Calculation Before 2015	GDP Calculation After 2015
The earlier base year for calculation of GDP was 2004-05. GDP was calculated at factor cost. Index of Industrial Production (IIP) was used to measure manufacturing and trading activity. In the older system, GDP was first estimated by using the IIP data and then updated using the ASI data (Annual Survey of Industries). ASI accounted only for those firms which were registered under the Factories Act.	The government moved to a new base year of 2011-12 for GDP calculation. GDP is now calculated at Market Price. The international practice of valuing industry-wise estimates as gross value added (GVA) at basic prices was adopted. The government adopted MCA-21 database, which allows the firms/companies to electronically file their financial results.

Question 2: Distinguish between Capital Budget and Revenue Budget. Explain the components of both these Budgets.

Answer: Budget is an Annual Financial Statement of yearly estimated receipts and expenditures of the government in respect of every financial year.

Capital Budget	Revenue Budget
Capital budget is a statement of the government's estimated capital receipts and capital expenditure. Capital budget covers capital items which are of non-recurring nature.	Revenue budget is a statement of the government's estimated revenue receipts and revenue expenditure for a period of one financial year. Revenue budget covers revenue items which are of recurring nature and are nonredeemable.

Capital Budget has two components: Capital receipt and Capital expenditure.	Revenue Budget has two components: Revenue receipt and Revenue expenditure.
Capital receipts are receipts of the government which create liabilities or reduce financial assets, e.g., market borrowing, recovery of loan, etc.	The revenue receipts include both tax revenue like income tax, excise duty and non-tax revenue like interest receipts, profits.
Capital expenditure is the expenditure of the government which either creates assets or reduces liability like creation of an asset, investment.	Revenue expenditure is expenditure for normal running of the government department and various services, interest charges on debt incurred by government, subsidies etc.

Question 3: How did land reforms in some parts of the country help to improve the socio-economic conditions of marginal and small farmers.

Answer: Land reform refers to efforts to reform ownership, operation, leasing, sales, and property rights of land in India. Post Independent India has seen movements like Bhoodan and Gramdan which were persuasive in nature. Apart from that State sponsored initiatives like Operation Barga tried towards land reforms.

How Land Reform improved socio-economic conditions of marginal and small farmers:

1. **Abolition of Intermediaries:** It included abolition of Zamindari, Ryotwari and Mahalwari systems checking the debt trap and dispossession of land of small farmers. It further led to emergence of middle class of peasants with strong political voice.
2. **Tenancy Reform:** It ensured Rent Regulation, Security of land tenure and conferment of ownership rights on tenants. This helped in enhancing food security and investment in irrigation seeds and fertilizers. (e.g. Operation Barga benefited 14 lakh share croppers in West Bengal).
3. **Ceiling on Landholdings:** Ceiling laws ensured redistribution of land from big landlords to landless laborers ensuring land ownership, access to credit, food security etc.
4. **Consolidation of Holdings:** This helped in pooling of village lands followed by distribution blocks (chaks) ensuring higher input efficiency, usage of modern implements and generating relatively higher income.

5. Cooperative Farming: Here farmers pool their resources and distribute the income as per their share. This reduced input cost, allowed scaling of cultivation and access to large credit while minimizing risk in case of crop failure (Kudumbashree model in Kerala)
6. Land Records: The updation and now the Digitization of Land Records helps in reducing litigation, security for land owner in case of opting for tenancy, better credit availability to small farmers and better policy making for agriculture. (e.g. Digital India Land Records Modernization Programme (DILRMP)).

However, certain challenges remain with Land reforms:

- a. Under Land Ceiling, Benami transaction ensured control of landlords. Also, the plantation gardens, religious and charitable institutions were exempted
- b. Land consolidation has been
 - i. a lengthy and cumbersome process.
 - ii. Additionally, Farmers are emotionally attached to their ancestral land.
 - iii. Led to large scale litigation
 - iv. The inheritance laws led to further division and fragmentation

Thus, Land Reforms have been a mixed experience with right direction but ineffective implementation. With land availability at 0.12 per-capita, India should now move towards second generation of land reforms focused on digitization and financial inclusion and ownership by women and marginalized communities.

Question 4: How and to what extent would micro irrigation help in solving India's water crisis?

Answer: A large population, needs of agricultural economy and urbanization have created situation of water stress in India. The irrigation needs of agriculture are at the heart of the problem of water stress. In this perspective, micro-irrigation is seen as a solution.

Micro-irrigation can help in solving India's water crisis in following ways:

1. It can address needs of dryland farming in regions with depleting groundwater aquifers. For example, in Punjab.
2. It can help reduce over-dependence on monsoon and vulnerability to drought. For example, less than 50% agriculture is irrigated at present.
3. Efficient use of water through micro-irrigation can help reduce the agricultural demand of water. This will help reduce inter-state river water disputes.
4. It will help move away from unsustainable irrigation practices like flood irrigation which also lead to ecological issues like ground water pollution, salinity, eutrophication etc.

However, micro-irrigation' impact in solving India's water crisis will be limited due to following reasons:

1. Affordability of micro-irrigation systems would be a challenge for small and marginal farmers.

2. Micro-irrigation cannot ameliorate water-stress due to poor agro-climatic choices in crops. Such as sugarcane and paddy cultivation in Rajasthan.

Micro-irrigation is a progressive solution to improve water-use efficiency and agricultural yield. But solution to problem of water-stress in India require across-the-board interventions.

Question 5: How is S-400 air defence system technically superior to any other system presently available in the world?

Answer: The S-400 (Triumf) is a mobile long range surface-to-air missile (LR-SAM) system developed by Russia. It is considered as one of the world's most advanced air defence systems that can simultaneously track and neutralize a range of incoming aerial threats. India has engaged with Russia for the purchase of 5 S-400, missile defence system.

S-400 are superior to other missile defence system available in the world as:

1. The S-400 system comes with a multifunction radar, autonomous detection and targeting system, anti-aircraft missile systems and a command-and-control Centre.
2. It is capable of engaging any target over a long range of 400kms at 27kms altitude. It also, has the capacity to simultaneously engage 36 targets.
3. S-400 can be deployed in 5 mins, as compared to 25 minutes taken by Patriot. The highest speed of S-400 at 4.8 km/sec. surpasses Patriot's 1.38 km/sec.
4. While, its radars are capable of detecting low-signature targets, it comes with an electronic counter-countermeasures to thwart any jamming attempts by the enemies
5. While it is a fraction of the cost of its western counterparts such as THAAD or patriot, it can protect a much larger area, as compared to Iron Dome used by Israel.
6. It has an edge over US made THAAD, in terms of range and hitting targets beyond the horizon.
7. While, being an anti-ballistic missile defence system, S-400 is also capable of engaging other aerial targets, like UAVs etc.

With India facing two inimical neighbors in its western and eastern borders, a possibility of two-front engagement cannot be denied. In this light even though, purchase of S-400 runs the risk of attracting US sanctions under CAATSA, it is indispensable for India's strategic/tactical needs.

Question 6: Explain the purpose of the Green Grid Initiative launched at World Leaders Summit of the COP26 UN Climate Change Conference in Glasgow in November, 2021. When was this idea first floated in the International Solar Alliance (ISA)?

Answer: The Green grid/OSOWOG initiative announced at COP-26, Glasgow by India and UK, is an international initiative to create an interconnected global power grid for reliable, resilient and affordable supply of clean energy for all.

Purpose of the Green Grid Initiative can be highlighted as:

1. To speed up the process to decarbonize energy production, which is the largest source of global GHG emissions.

2. To help in increasing investment in Research and development centers by pooling skill, technology and financial resources.
3. To transport solar power to different countries by creating a three phase 2600 GW of interconnection by connecting Asia, Africa and rest of the world by 2050.
4. To create international network of global interconnected solar power grid, to ensure 24×7 supply of green power.
5. To operate by building and scaling inter-regional energy grids, leveraging the difference of time zones, seasons, resources, and prices between the country and region.

The idea for the single global grid for solar was first outlined at the first assembly of International Solar Alliance in the late 2018 by the Indian Prime Minister to:

1. Initiate a collaborative effort to minimize cost, maximize efficiency and attract investments to build a global green grid.
2. Envision a sustainable and impactful change to lift millions out from poverty through green energy.

However, the implementation of Green Grids will face the challenges of:

1. Financing, for creation of global transmission infrastructure.
2. Global cooperation between the countries, for connecting with the green grid.
3. As the grid will pass through several geographical locations, it will be sensitive to the security risks emanating from terror organizations.

Green grid initiative has the potential to create avenues for scalable green energy source, which could be the answer to the rising global temperatures.

Question 7: Describe the key points of the revised Global Air Quality Guidelines (AQGs) recently released by the World Health Organisation (WHO). How are these different from its last update in 2005? What changes in India's National Clean Air Programme are required to achieve these revised standards?

Answer: The WHO recently released an updated version of the Global Air Quality Guidelines (AQGs). The guidelines recommend new air quality levels to protect the health of populations, by reducing levels of key air pollutants.

Key Points:

1. WHO's new guidelines recommend air quality levels for six pollutants — particulate matter (PM 2.5 & PM10), ozone (O₃), nitrogen dioxide (NO₂) sulfur dioxide (SO₂) and carbon monoxide (CO).
2. The annual average for PM2.5 should not exceed 5 micrograms per cubic metre of air, while the 24-hour average should not exceed 15 micrograms per cubic metre
3. The annual average for PM 10 should not exceed 15 micrograms per cubic metre of air, while the 24-hour average should not exceed 45 micrograms per cubic metre
4. The ozone levels average should not exceed 100 micrograms per cubic metre over a 24-hour period
5. The nitrogen oxide levels should not exceed 25 micrograms per cubic metre over a 24-hour period

6. The sulphur dioxide levels should not exceed 40 micrograms per cubic metre over a 24-hour period
7. The carbon monoxide levels should not exceed 4 micrograms per cubic metre over a 24-hour period

Global Air Quality Guidelines 2021 vs Global Air Quality Guidelines 2005

Recommended 2021 AQ Levels Compared to 2005 Guidelines			
Pollutant	Averaging Time	2005 AQGs	2021 AQGs
PM _{2.5} , µg/m ³	Annual	10	5
	24-hour	25	15
PM ₁₀ , µg/m ³	Annual	20	15
	24-hour	50	45
O ₃ , µg/m ³	Peak season	-	60
	8-hour	100	100
NO ₂ , µg/m ³	Annual	40	10
	24-hour	-	25
SO ₂ , µg/m ³	24-hour	20	40
CO, µg/m ³	24-hour	-	4

The centre has launched National Clean Air Programme (NCAP) to tackle air pollution in 122 cities by aiming for a 20-30 percent reduction in PM₁₀ and PM_{2.5} concentrations by 2024, compared to 2017.

Changes required in India's NCAP

1. India's air pollution standards are more relaxed in comparison to WHO's prescribed guidelines. Thus, efforts are needed to make the guidelines more stringent with revised targets.
2. Under the proposed new Mission – Clean Air for All, government tends to make targets of PM_{2.5} & PM₁₀ more stringent.
3. There is a need to adopt an airshed approach to take measures to deal with air pollution. Under this approach, the policymakers will have to plan actions keeping in view geographical, meteorological and other common factors which pollute air within the airshed.

Question 8: Discuss about the vulnerability of India to earthquake related hazards. Give examples including the salient features of major disasters caused by earthquakes in different parts of India during the last three decades.

Answer: Earthquake is sudden shaking of earth surface, while earthquake hazard is anything associated with an earthquake that can affect people's day-to-day life. Earthquake hazards can range across ground shaking, surface rupture, landslide, liquefaction, tectonic deformation, tsunami etc.

Vulnerability of India to Earthquake-related hazards:

1. According to BIS, more than 58.6 percent of the landmass is prone to earthquakes of moderate to very high intensity. The occurrence of the Killari earthquake in 1993 resulted in revision of the seismic zoning in India with the low hazard zone or Seismic Zone I being merged with Seismic Zone II.
2. Densely populated areas, extensive unscientific constructions and unplanned urbanization have increased risks associated with earthquake hazards.
3. Andaman & Nicobar Islands frequently experience damaging earthquakes due to being situated on an inter-plate boundary.
4. Increasing use of high-technology equipment, susceptible to small vibrations, in industry and academia, or underground utilities for electricity, internet etc. have increased susceptibility to disruption from relatively moderate ground shaking
5. Regions in Himalayan foothills are vulnerable to liquefaction and landslides due to earthquakes.

Salient features of major disasters caused by earthquakes over last 3 decades:

1. 1993 Latur: 6.2 magnitude; relatively shallow depth caused large surface damage; causes remain debatable due to lack of plate boundaries in the region.
2. 1999 Chamoli: Caused by thrust fault; resulted in landslides, changes in surface water flow, surface rupture and disconnected valleys.
3. 2001 Bhuj: Associated with a reactivated fault, which was previously unknown; Great loss of life and property due to unmindful construction.
4. 2004 Indian Ocean Tsunami: Created by under-water seismic activity, created massive waves which flooded coastal areas and Islands, causing long-term changes.
5. 2005 Kahmir: 7.6 magnitude; Caused by severe upthrust of Indian plate against Eurasian plate, it created multiple after-shocks. Infrastructure and communication were disrupted.

India's vulnerability to various earthquake hazards requires astute handling and long-term planning. The reconstruction at Bhuj after the 2001 earthquake is an instructive example.

Question 9: Discuss how emerging technologies and globalization contribute to money laundering. Elaborate measures to tackle the problem of money laundering both at national and international levels.

Answer: Money laundering is disguising the identity of illegally obtained money so that it would appear to have originated from legitimate sources. Money laundering is generally used by criminals to disguise their illicit funds, terrorists to dodge tracking or tax evaders.

Emerging technologies contribute to money laundering in following ways:

1. Use of cryptocurrencies and alternate finance that are unregulated by governments
2. Encrypted conversations facilitate exchange of information about money laundering
3. Large volume of digital transactions at online market places is used to disguises the structured chunks of layered money.
4. Identity theft through hacking of credit card information etc. Is used to layer illegitimate money under untraceable identities.

Globalization contributes to money laundering in following ways:

1. Placement of money in global financial system creates problems of coordination between multiple jurisdictions.
2. Tax haven countries like Cayman Island, Panama etc. have structured their economies around assistance in tax evasion.
3. Distribution of assets across countries prevents punitive action by authorities.

Following national and international measures have been enacted to tackle money laundering:

1. Prevention of Money Laundering Act (PMLA), 2002 established the legal framework to prevent money laundering. It criminalizes money laundering as a cognizable, non-bailable offence.
2. The Smugglers and Foreign Exchange Manipulators (Forfeiture of Property) Act, 1976 and Narcotic Drugs and Psychotropic Substances Act, 1985 provides for the penalty of property derived from smuggling or illegal traffic in narcotic drugs.
3. Financial Intelligence Unit – India (FIU-IND) coordinates efforts of national and international intelligence, investigation and enforcement agencies against money laundering
4. RBI regulations and KYC norms issued from time to time try to keep up with evolving threats and methods of money laundering.
5. The Vienna Convention makes it obligatory for signatory states to criminalize the laundering of money from drug trafficking.
6. The financial action task force (FATF) sets standards and promotes effective implementation of legal, regulatory and operational measures against money laundering; terror financing.
7. The OECD forum has adopted convention against money laundering. It supports appropriate safeguards, access to tax administration in suspicious transaction based on information received from FIUs.

Money Laundering is a global menace which require global effort to curb it. Mutual cooperation among Nations, financial institutions along with use of technological counter-measures such as big data and artificial intelligence is required to curb the menace of money laundering.

Question 10: Keeping in view India's internal security, analyse the impact of cross border cyber-attacks. Also discuss defensive measures against these sophisticated attacks.

Answer: Cyber threats are anonymous and borderless. Thus, it makes the tracking of criminals difficult and cybersecurity a national security issue.

Impact of cross border cyber attack

1. It will have debilitating impact on Critical Information Infrastructure (Power Plants, nuclear Plants, telecommunications etc.)
2. Cross border cyber-attacks can be used to threaten national security by indulging in contemporary forms of cross-border terrorism
3. It can be used to disrupt social harmony through radicalization. Terrorists may use social media to plan and execute terror attacks and for “virulent propaganda” to incite hatred and violence, recruit youth and raise funds.
4. It can be used as spyware to get sensitive information.(e.g India banning Chinese mobile applications)

Defensive Measures

1. Institutional Measures
 - a. National Cyber Security Coordinator (NCSC) – to coordinate with different agencies at the national level for cyber security matters.
 - b. Indian Computer Emergency Response Team (CERT-In) – to issue alerts and advisories regarding latest cyber threats and countermeasures on regular basis to various concerned agencies.
 - c. National Critical Information Infrastructure Protection Centre (NCIIPC) has been establishedThe post of Chief Information Security Officer (CISO) has been created in various organisations to deal with cyber security issues.
 - d. Cyber Swachhta Kendra (Botnet Cleaning and Malware Analysis Centre) has been launched for detection of malicious programs and provide free tools to remove the same.
 - e. National Cyber Coordination Centre (NCCC) has been set up for timely sharing of information with individual entities to enable them to undertake preventive and protective actions against existing and potential cyber security threats.
2. Legislative Measures
 - a. Information Technology Act, 2000 to provide legal recognition for electronic communication, electronic commerce and cyber-crimes. IT Act has deterrent provisions to deal with cyber threats and cyber-attacks.

Question 11: Do you agree that Indian economy has recently experienced V – shaped recovery? Give reasons in support of their answer.

Answer: A V-shaped recovery is characterized by a quick and sustained recovery in measures of economic performance after a sharp economic decline

Indian Economy has recently experienced V shaped recovery

1. As per official data, country’s GDP grew by 20% in Q1 of FY 2021-22 in comparison to Q1 of FY 2020-21.
2. The Economic Survey has also projected a strong V shaped recovery with an 11% growth in FY22.

3. In the last four quarters' numbers during the Covid pandemic, India is the only country that has registered two consecutive quarters of growth
4. The Indian economy has shown resilient and V shaped recovery will be due to mega vaccination drive, robust recovery in the services sector, and robust growth in consumption and investment.

However, some experts are also hinting at a K shaped recovery.

1. Non-uniform spread of COVID-19: The spatial and temporal spread of the pandemic has varied with varied impact on different regions and different sectors of economy. For instance, non-aggressive spread in eastern states helped sustain growth of agriculture.
2. More vulnerabilities of some sectors: Sectors like supply chain, logistics, hospitality are dependent on human interactions which remain limited due to social distancing constraints.
3. Role of technology: Expansion of digital economy and society through 4G, smart phones etc. have helped the service and knowledge sector to continue their economic activities, while limiting the activity in manufacturing.
4. External factors: Strong integration of the Indian economy with the global economy in addition to skewed import dependence of Indian economy has impacted domestic recovery in different sectors in peculiar ways, such as disruptions from slowdown in import of raw goods and export of finished products.

With the rise of omicron variant, and expectation of subsequent lockdown, some also feel that India may also see W based recovery.

Question 12: “Investment in infrastructure is essential for more rapid and inclusive economic growth.” Discuss in the light of India’s experience.

Answer: Basic infrastructure facilities in the country provide the foundation of growth. In the absence of adequate infrastructure the economy operates at suboptimal levels and remains distant from its potential and frontier growth trajectory.

Investment in infrastructure is essential for more rapid and inclusive economic growth

1. Creation of Jobs – Infrastructure development such as road construction, real estate, railway construction, etc. is labour intensive, leading to increase in employment opportunities in formal and informal sectors and thus, fuelling domestic demand.
2. Farmer Income – Investment in infrastructure would play critical role in ensuring doubling of farmers income through focus on increased irrigation infrastructure and storage, processing and marketing infrastructure.
3. Health and Well-being: Infrastructure development of superior healthcare facilities, electronic health records and better equipped health infrastructure at primary levels. (Telemedicine)
4. Logistic Cost – Building world class roads, railways, ports, inland water ways, will cut down logistic costs and improve competitiveness and promote exports. This would bring more revenues to government and may promote socio – economic development.

Government efforts to promote world class infrastructure – NIP, PM Gati Shakti Master Plan etc are in right direction.

Question 13: What are the salient features of the National Food Security Act 2013? How has the Food security Bill helped in eliminating hunger and malnutrition in India?

Answer: The National Food Security Act, 2013 aims to provide subsidized food grains to approximately two-third of the country's population. The enactment of this landmark legislation, brought a paradigm shift in approach to food security, from welfare to rights-based approach. The salient features of the act are as:

1. Coverage and entitlement: Up to 75% of rural and 50% of the urban population will be covered under TPDS, with uniform entitlement of 5kg/person/month ration.
2. Identification of households: The work of identification of eligible households is to be done by States/UTS.
3. Maternity benefit: Pregnant Women and Lactating Mothers (PWLM) are entitled to receive maternity benefits of not less than 6000 rupees.
4. Nutritional support: PWLM and children in the age group of 6 months to 14 years will be entitled to meals as per prescribed nutritional norms under ICDS, MDM (PM-Poshan).
5. Women empowerment: Eldest women of the household of age 18 years or above to be deemed as head of the household for the purpose of issuing ration cards.
6. Grievance Redressal: Act calls for dedicated mechanism for grievance redressal at district and state level.
7. Transparency/Accountability: Provisions regarding social audits, setting up of vigilance committees, disclosure of PDS records etc.
8. Food security allowance: It is entitled to the beneficiaries in case of non-supply of entitled food grains or meals.

Role of NFSA in eliminating hunger and malnutrition:

1. According to a UN report number of undernourished people in India has declined by 60 million between 2006 to 2019.
2. Improved access to food grains have improved the hunger outcomes amongst the poor and underprivileged.
3. Wide coverage of the 2/3rd population have increased resilience in the poor against income shocks.
4. Stunting in children under 5 years of age, according to the UN report have decreased from 47.8% in 2012 to 34.7% in 2019.
5. Monetary compensation has compensated against wage loss during pregnancy. PWLM can now access to healthier food options like fruits, vegetables etc.
6. The awareness generated by the Asha workers have increased the number of infants who were exclusively breastfed from 11.2 million in 2012 to 13.9 million in 2019.

However, there is still a long way for India to reach nutritional sufficiency as:

1. Number of women in reproductive age suffering from anaemia grew from 165.6million in 2012 to 175.6 million in 2019.
2. The CNNS have highlighted prevalence of hunger/malnutrition in India children.

3. The number of obese adults in India grew from 25.2 million in 2012 to 34.3 million in 2016.
4. Institutional infrastructure for delivering the provisions of the food bill is poor.
5. Widespread corruption has siphoned off the benefits to ghost beneficiaries and middlemen.

The food bill has revolutionized the access to food grains; however, the need is to move towards nutritional security and not just food security. Further the structural bottlenecks in the implementation food bill should be corrected by leverage of technology.

Question 14: What are the present challenges before crop diversification? How do emerging technologies provide opportunity for crop diversification?

Answer: Crop diversification refers to the addition of new crops or cropping systems to agricultural production on a particular farm taking into account the different returns in socio-economic and environmental terms. Due to diverse set of climates, soil types and cultures, India has diverse range of cropping systems.

The challenges before crop diversification:

1. Impact of Green Revolution: There has been shift towards Mono cropping of wheat and rice at cost of coarse grains (Government policy of MSP).
2. Monsoon Dependence: Around 55% of India's Cultivable Land is Rain-fed with heavy dependence on monsoon.
3. Fragmented land holding: It makes it difficult to use efficient modern technology on large scale, raises cost of land boundary management, land disputes etc.
4. Shift from Food crops to Commercial Crops: This especially includes Cotton in Deccan belt; and Sugarcane in Green revolution belt and Krishna-Godavari basin.
5. Other Factors:
 - a. Human factors: Heavy Population Pressure on agriculture and continuation of subsistence farming
 - b. Technical Factors: Lack of High Yielding Varieties (HYV) of seeds, usage of old implements, lack of weather forecasting usage amongst others.
 - c. Institutional factors: It includes defective land tenure system (leading to land fallowing), improper marketing and processing of perishable products (e.g vegetables, fruits).
 - d. Infrastructural Factors: Poor basic infrastructure like rural roads, power, transport, communications etc. Along with inadequate post-harvest processing infrastructure.

Emerging Technologies and opportunities provided by them:

1. IT Revolution: It is helping to connect farmers directly with grocery-customers (farm to fork model) leading to cultivation of high value perishable products (e.g Big Basket, BlinkIt startup platforms)

2. **Aquaponics and Urban Farming:** To meet the heavy urban demand for Perishable items, this technique of controlled environment cultivation is helping in crop diversification.
3. **Financial Inclusion and Digitization:** It has helped small farmers, women SHGs to ensure crop diversification through credit supply.
4. **Irrigation:** PM Krishi Sinchai Yojna has ensured access to micro irrigation (Per Drop More Crop), drip irrigation, sprinklers etc.
5. **Dryland Agriculture:** Indo-Israel Agriculture Project has introduced technologies like Urea Deep Placement (UDP), Poly-bag Nursery farming etc in arid areas(e.g Rajasthan has seen cultivation of strawberries and olives).
6. **Soil Health Management:** It has helped ensuring right Fertilizer usage, developing Organic Farming, providing GIS based thematic mapping for soil.(e.g. Soil Health Card)

Thus, these emerging technologies should be made integral part of Mission to double farmer's income by 2022 as recommended by Ashok Dalwai Committee.

Question 15: What are the research and developmental achievements in applied biotechnology? How will these achievements help to uplift the poorer sections of the society?

Answer: Biotechnology is an interdisciplinary field that involves the use of live organisms or enzymes from organisms to produce products and processes useful to humans.

Achievement in Biotechnology:

1. Biotechnology is used to produce genetically modified crops that are resistant to pests, improve crop yield, and have higher nutritional value. For example, Bt Cotton, GM Soyabean, etc.
2. Recombinant DNA techniques are used to produce a number of medicines like Insulin, etc.
3. Biotechnology is also employed in waste management and reducing pollution. For example, Phytoremediation uses plants for the removal, degradation, or containment of contaminants in soils, groundwater, etc.
4. Biotechnology is used for the diagnosis of a number of diseases. For instance, RT-PCR is based on genetic amplification to detect the presence of viruses like Dengue, SARS, etc.
5. Development of RNA (mRNA) based vaccine is used to fight the COVID-19 pandemic.
6. Biotechnology is also at forefront of Assisted Reproductive Technologies like IVF, Test tube babies, etc.

Role of Biotech in Uplifting Poor's

1. Biotechnology is helping to increase the income of marginal farmers by increasing crop yield and making them climate and pest resilient.
2. The development of medicines using Biotech is reducing healthcare expenditure for the poor. E.g; the cost of Insulin has come down.

3. Biotechnology is also helping in the conversion of waste into assets for the poor. E.g.; Bio-composting turns waste into valuable fertilizer.
4. The poor suffer the most from pollution. Biotechnology also helps in reducing pollution and thus alleviates their suffering. E.g.; Bioremediation techniques help clean landfills around slums.
5. Biotechnology also helps in increasing the shelf life of food products which in turn keeps their price in check for the poor.

Biotechnology is a revolutionary field that has the potential to alleviate poverty and hunger. However, there is a need to equitably distribute its benefits among all strata of society.

Question 16: The Nobel Prize in Physics of 2014 was jointly awarded to Akasaki, Amano and Nakamura for the invention of Blue LEDs in 1990s. How has this invention impacted the everyday life of human beings?

Answer: The 2014 Nobel Prize for physics has been awarded to a trio of scientists Professors Isamu Akasaki, Hiroshi Amano and Shuji Nakamura for the invention of blue light emitting diodes (LEDs) in the early 1990s.

Importance of Blue LED

Although LED had been around for more than 50 years but these LED were monochromatic (one color) in nature. Only red and green color LED were available, the blue color LED was not invented which restricted the making of white LEDs. As white LED can only be made by a combination of the three primary colors LED, e., green, red, and blue. So, Gallium nitride was the key ingredient used by the Nobel laureates in their ground-breaking blue LEDs. The invention of blue LEDs opened floodgates for several applications.

Impact of LED on everyday Life

1. LED have replaced the traditional incandescent bulb, as the latter was only monochromatic and energy guzzler. While LED is available in different colors and energy efficient.
2. LED have become an essential component in digital screens because they offer higher contrast than their predecessor technologies and are also energy efficient.
3. The recent development in LED is o-LED or organic-LED which offers flexibility in shaping the screens. o-LED has now widely used in wearable devices, smartphones etc.
4. LED have a greater durability which up to 10 times more than the incandescent bulbs.
5. The amount of light from LED can be varied, i.e., LEDs can very easily be dimmed by modulating the input current which is not possible in the earlier light bulbs.
6. LED offers great variation in size, their size range from few millimeters to several feet. It makes compatible for wide range of application from circuit boards to home lighting.

Even the government has realized their importance in energy conservation and have encouraged their use by several schemes like UJJALA (Unnat Jyoti by Affordable

LEDs for All) and Street Light National Programme. Thus, it is apt to say that LED has revolutionized our lives.

Question 17: Describe the major outcomes of the 26th session of the Conference of Parties (COP) to the United Nations Framework Convention on climate change (UNFCCC). What are the commitments made by India in this conference? (Answer in 250 words)

Answer: The 26th UN Climate Change Conference of the Parties (COP26) was held in Glasgow, UK with the aim to finalise the rules and procedures for implementation of the Paris Agreement and to get all countries to commit to a net-zero target by a specific year.

Outcomes of COP-26

1. For the first time, COP agreed upon phasing down coal power. A pledge to end coal power generation by 2040 was taken.
2. Providing the long promised \$100 billion annual support towards developing countries' green transition.
3. Supporting electric vehicles and a phase out of gasoline and diesel-powered motor vehicles by 2040.
4. Reversing deforestation in an attempt to protect existing nature-based solutions to capturing emissions.
5. The Paris Agreement rulebook was completed which kept the Paris targets alive of limiting global warming to 1.5 degrees celsius.
6. The member countries agreed for the Glasgow Climate Pact, under which member countries will report their progress towards more climate ambition next year, at COP27 Egypt.
7. A methane pledge, led by the United States and the European Union, by which more than 100 countries agreed to cut emissions of this greenhouse gas by 2030.

India's commitment at COP-26

1. India announced that its net zero target is to be achieved by 2070.
2. The Government of India has launched 'E-Amrit', a web portal on electric vehicles (EVs), in COP-26. The portal will encourage adoption of EV and bust myth regarding it.
3. India did not join methane pledge as it would have negatively impacted India's agriculture.
4. India will fulfil 50% of its energy requirement through renewable energy by 2030.
5. India will reduce 1 billion tonnes of carbon emissions by 2030.

Although, COP-26 marked several breakthroughs in action towards climate change, yet the targets are not enough to control the rise of earth's temperature by 1.5 degree at the end of century. Therefore, the countries should constantly strive to improve upon targets and adopt newer carbon neutral technologies.

Question 18: Describe the various causes and the effects of landslides. Mention the important components of the National Landslide Risk Management strategy.

Answer: A landslip/landslide is defined as the rapid movement of a mass of rock, debris, or earth, down a slope under the influence of gravity. They are a natural phenomenon whose frequency has significantly increased due to anthropogenic causes.

Causes of Landslides

1. Climate change: Rising global temperature has led to extreme rainfall events, increased melting of glaciers; as a result, more water flows over the steep slope. This increased water presence saturates the soil which results in solifluction (soil/mud flow) increasing landslide risk. E.g. Increased flooding and landslip incidents in Kerala.
2. Tectonically active Himalaya: Himalayas being a young fold mountain range, lies above an active convergent zone which is prone to earthquakes. Seismic activity induced vibration can overcome frictional force responsible for holding the sediments together. Also, it makes easier for water to seep into the soil.
3. Population pressure: Rising population over a fixed land availability increases pressure on land. Deforestation and dam construction for developmental activities, slope modification significantly reduces soil binding capacity, making them prone to erosion and landslides. E.g. Char Dham project in Uttarakhand.
4. Nature of rivers: Rivers in Himalayas are in their youthful stage. Swift flow of river over a steep slope result in vertical corrosion and down-cutting. This enhances the occurrence of landslides.

Effects of Landslides

1. The impact of a landslide can be extensive, including loss of life, destruction of infrastructure, damage to land and loss of natural resources.
2. Landslide material can also block rivers and increase the risk of floods.
3. Deep landslides, triggered by major earthquakes or volcanic activity can destroy thousands of square kilometres of land and kill thousands of people.
4. Landslides have a devastating effect on farmers' livelihoods as they can prevent access to land for years, destroy seed and food stocks and will commonly result in the loss of livestock and standing crops

Important components of the National Landslide Risk Management strategy

1. Generation of User-Friendly Landslide Hazard Maps
2. Development of Landslide Monitoring and Early Warning System
3. Awareness Programmes
4. Capacity Building and Training of Stakeholders
5. Preparation of Mountain Zone Regulations & Policies
6. Stabilization and Mitigation of Landslides and Creation of Special Purpose Vehicle (SPV) for Landslide Management.

Question 19: Analyse the multidimensional challenges posed by external state and non-state actors, to the internal security of India. Also discuss measures required to be taken to combat these threats.

Answer: India face multifold threat from external states and non-state actors on internal security front. State actors includes government' representative and their

agencies. Non state actors may include international NGOs, multinational companies, terrorist and religious groups, hackers etc.

Challenge posed by external state actors:

1. May support various insurgent groups such as Naxalites or separatist groups through illegal money, supplying arms etc.
2. Instability in Jammu and Kashmir by the Pakistan (Pakistan's state policy to bleed India through a thousand cuts)
3. External state actors may also indulge in cyberattacks, thus affecting national security. (e.g. cyberattacks emanating from China)

Non-state actors:

1. Terrorism: State sponsored terrorism as well as support to other terrorist groups such as Lashkar-e-Taiba, Jaish-e-Mohammad by Pakistan.
2. Indulging in counterfeit currency and money laundering activities and providing illegal funds to insurgents in NE India
3. Inter and Intra state drug trafficking (proximity to golden crescent and golden triangle routes).
4. The deep-rooted nexus between drug mafias, arms dealers, and money launderers for financing terrorism.

Measures required to combat these threats are:

1. Effective communication and co-ordination between intelligence agencies and law enforcement agencies. To ensure better coordination, interoperability among the agencies must be improved.
2. Cyber security measures to thwart any attempt of cyber attacks
3. Collaboration between the government, media and the public to ensure quick and efficient sharing of information about suspicious activities to the law enforcement agencies.
4. Local police forces must be well trained and well equipped with necessary gears so that they can respond to the terrorist attacks until the Special Forces reach the site

Question 20: Analyse the complexity and intensity of terrorism, its causes, linkages and obnoxious nexus. Also suggest measures required to be taken to eradicate the menace of terrorism.

Answer: Terrorism is the illegitimate use of force to provide injury to common people for political and ideological gains. Terrorists violate law, threaten common people and directly challenge the state.

Causes of Terrorism

1. Perceptions of deprivation and inequality, especially amongst culturally defined groups. This can lead to civil violence, of which terrorism may be a part.
2. A lack of political legitimacy and continuity, as well as a lack of integration for the political fringes, encourages ideological terrorism. The potential is exacerbated by ethnic diversity.

3. Terrorism in one country can spillover into neighbouring areas. (For example – state sponsored terrorism in India by Pakistan)
4. Extreme ideologies may sometime result in hatred towards other section of society and may lead to terrorism. Examples of terrorist groups motivated by ideology include the Irish Republican Army (IRA), in Sri Lanka the Liberation Tigers of Tamil Eelam (LTTE), and the Bader Meinhoff in Germany.

Linkages and obnoxious nexus of terrorism

1. The terrorism and organised crime support each other to thrive and survive. The economic proceeds of organised crime, such as extortion/kidnapping are made legitimate through money laundering and then used to fund terrorist activities. For example – In the Northeast, extortion, kidnapping, human and drug trafficking, arms smuggling (organised crime) is the fundamental basis for funding all forms of terrorism. In J&K, counterfeit currency has been a major source of funding terrorism. In Punjab, drug trafficking is rampant to fund terrorism. Thus illegal money generated through organised crime and this money is then used to fund terrorist activities.
2. Organized criminals give arms, ammunition and weapons by smuggling to terrorist parties in exchange for drugs and diamonds. Terrorist parties use smuggling nets set up by organized criminal parties to send their members to different countries of the world. Organized criminal groups also act as money laundering. Terrorist groups levy taxes on drug traffickers to provide security to criminals in their controlled area.

Steps Taken

1. Legislative Measures – Unlawful Activities (Prevention) Act, 1967, Prevention of Money Laundering Act, 2002
2. Strengthening Border Management to prevent cross border terrorist activities.
3. FATF
4. UN Conventions on Transnational Organised crime and UN Convention on Corruption

Measures Required

1. Strengthening national coordination mechanisms to promote inter-agency participation and information exchange, facilitating joint monitoring, threat assessment.
2. Updating national legislation to ensure that terrorist and organized crime offences are precisely defined, in accordance with international standards.
3. Promote border security efforts to prevent the illicit transit of goods and people.
4. Adoption of a Comprehensive Convention on International Terrorism