



An Institute for Civil Services

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**IAS TOPPER'S**

**TEST COPY**

**AMRITPAL KAUR**

**RANK-44** (CSE 2018)

**GS MAINS 2018**

**SCIENCE - TECH. AND ENVIRONMENT**

Time Allowed: 3 hrs.

Max. Marks: 250

Q.	Marks	Instructions to Candidate
1.		<ul style="list-style-type: none"><li>• There are 20 questions.</li><li>• All questions are compulsory.</li><li>• The number of marks carried by a question is indicated against it.</li><li>• Answers to questions no. 1 to 10 should be in 150 words, whereas answers to questions no. 11 to 20 should be in 250 words.</li><li>• Keep the word limit indicated in the questions in mind.</li><li>• Answers must be written within the space provided.</li><li>• Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.</li></ul>
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Name Amaritpal Kaur

Roll No. \_\_\_\_\_

Mobile No. \_\_\_\_\_

Date \_\_\_\_\_

Signature Amaritpal Kaur

1. Invigilator Signature \_\_\_\_\_

2. Invigilator Signature \_\_\_\_\_

**REMARKS**

## Section - A

Q1. What is an air-independent propulsion system? What are its advantages? (10 Marks)

The advancement of technology in under-water surveillance, reconnaissance and offensive capabilities has aided development of new systems. One such system is the air independent propulsion system (AIPS).

An AIPS uses propulsion techniques for submarines and other stealthy ~~two~~ under water ships which can let the submarines stay ~~and~~ below water surface for long periods of time. It does not require periodic coming to the surface like every other day in other systems.

Its advantages are :

- 1) enhanced operation length
- 2) greater stealth capability
- 3) gives a strategic offensive edge to marine military capabilities.

India is also working of AIPS to reach

Remarks



its goal of a blue water navy.

Remarks

Q2. What is cold fusion technology in nuclear power generation? What are its benefits and issues associated with this technology? (10 Marks)

*Remarks*

*Remarks*

Q3. To compete in a future teeming with new technologies and possibilities, banks cannot afford to wait to embark on their artificial intelligence journey. Comment. (10 Marks)

The future, as posited by the World Economic Forum is the 4th industrial revolution combining big data, internet of things, robotics and artificial intelligence.

Banks are based on traditional brick and ~~mortal~~ mortal buildings, deploying technology to aid the operations. But artificial intelligence (AI) creates unique opportunities and challenges which they cannot afford to ignore.

### Opportunities

- 1) AI for discovering transaction trends and corresponding deployment of loans
- 2) Spot odd transactions and take corrective preventive action to prevent NPAs or scams

### Challenges

- 1) Lack of manpower which is skilled in AI operations
- 2) New emerging fin-tech can challenge banks' model

Remarks



such as PNB scam.

3) Recognizing patterns in consumer behaviour to give tailor made products.

3) AI bots intruding bank networks, conducting unauthorized transactions

Going ahead, AI is a reality and banks should co-ordinate with RBI to evolve a level playing field and rules based AI framework, besides nurturing talent in the field.

Remarks



Q4. Whenever global rankings of universities are announced, there is always a discussion about India's poor performance. Overall culture of research is largely missing in Indian institutions. What are the reasons behind it and what should be way-out? (10 Marks)

India's performance

The Quaquarrelli Symonds 500 ranking has only 9 Indian colleges / universities and none under 100. Such global rankings always evoke discussion about India's poor performance.

One of the reasons of the performance is poor research conduct and outcomes besides other factors. There are a number of reasons such as :

- 1) Inadequate infrastructure as frequently pointed out
- 2) Low expenditure - 0.7% of GDP on Research and development as per Economic survey.
- 3) Low incentives for teachers as well as students
- 4) More focus on professional education which ensures a regular job.

Remarks

The way out is a concerted effort on multiple fronts :

- At least 2% of GDP funds for research
- Encouraging research as done in PM fellows scheme
- Enhancing youngsters' interest at a young age in science eg. MANAK should be expanded
- Inviting world class scientists to conduct research such as the VAJRA scheme

Remarks



Q5. Discuss the challenges in increasing adaptability of digital world and ways to enhance digital penetration in India. (10 Marks)

Digitization at all levels from public governance to private communications, besides the governments' thrust through initiatives such as Digital India necessitates that adaptation of digital techniques is there.

This step has, however, certain challenges, such as :

- 1) Digital illiteracy among people about use or security or online behavior.
- 2) Disconnect between policy and groundwork as seen in financial sector where more than 90% of transactions are still in cash.
- 3) Infrastructural bottlenecks which make digital not always reliable.
- 4) The threat of theft, crime and fraud in the absence of an overarching legal and governance redressal framework reduces trust.

Remarks

For enhancing digital penetration in India steps such as PMGDISHA for digital education are required. A data protection law is also a need of the hour. Greater transfer of benefits and transactions encouraged digitally would get people used to it.

Since digitalization push is unmissable, it is best that we stay ahead of the curve.

Remarks

- Q6. DRDO has signed a technology transfer agreement with Jindal Stainless (Hisar) Limited for manufacturing High Nitrogen Steel (HNS). In this context, elaborate on High Nitrogen Steel (HNS), its significance and applications. (10 Marks)

The technology transfer agreement between DRDO and Jindal Stainless Limited (JSL) is a great example of public private partnership wherein public research can materialize into a nation building component.

High Nitrogen steel (HNS) is a steel with much higher nitrogen content. It ~~is~~ has high strength, better corrosion resistance, greater heat tolerance and is chemically inert relative to other steels.

HNS has a number of applications such as :

- 1) defence sector for lighter but stronger armaments
- 2) Industry wherein HNS can bear much more pressure and weights for stronger

Remarks



industrial robots and other shop floor machinery and equipment.

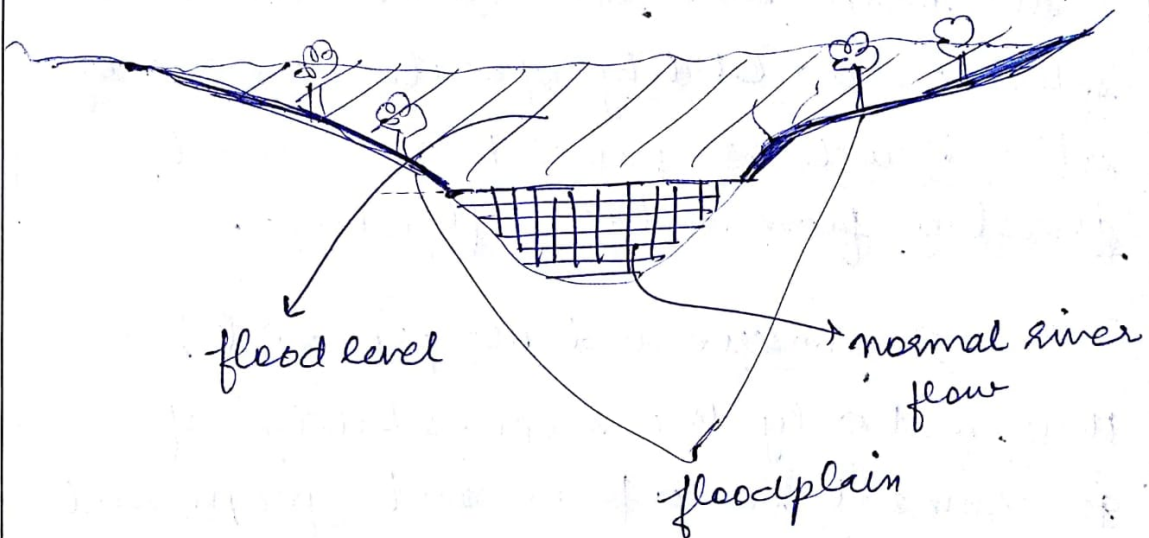
HNS is a great instance and enhances future possibilities of public private co-operation such as in biotechnology, disaster management etc.

Remarks

Q7. Floodplains' 'conserve and use principal' can be a game changer in sustainable management of flood plains and in ensuring the demands of water in nearby cities. Discuss.

(10 Marks)

Floodplains are the neighbouring area of a river stream which are under water during floods and otherwise exposed.



The conservation of floodplains by strict enforcement of building laws to prevent encroachment by human settlements, illegal construction, sand mining or deforestation creates uses such as :

- 1) recharge of underground reservoirs
- 2) ~~pro~~ produce from trees

Remarks

- 3) leisure and recreation facilities.
- 4) stability of surrounding reservoirs connected with the flood plain.

This means that sustainable use can enhance availability of water in nearby cities as well as prevent man made disasters from natural flooding.

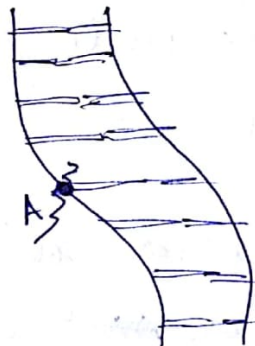
The conserve and use principle is thus, not only the responsibility of government to enforce but people and private bodies to pursue.

Remarks



Q8. What is DNA Repair Mechanism? Explain how this mechanism works and what its significance for Human? (10 Marks)

DNA is the basic molecule that carries the genetic buildup of organisms. Like any other molecule it is also subjected to wear and tear.



The double helix  
DNA structure

If due to any reason, the DNA breaks at, say, point A the body's mechanism will repair it by regeneration of that component of the chain which has broken down. with the DNA repair mechanism.

Its significance for human lies in the fact that it is from the DNA only that the code for generation of proteins that

Remarks

build up our body is procured.

So,

→ if the repair doesnot happen, ~~that~~ the particular protein that the given DNA generates will not be formed. ~~as happens in~~

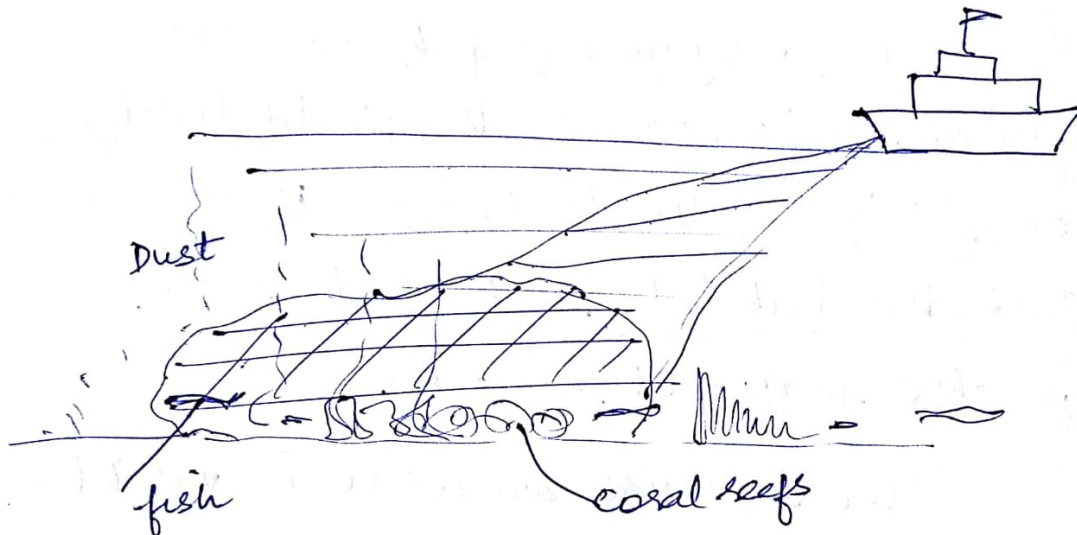
→ if there is an error in the repairs, a wrong protein ~~and~~ which the body doesnot need will be generated as happens in cancer.

It is for this reason that mechanisms to study DNA repair and ways to copy/change it are very significant to ~~solve~~ find remedies for diseases.

Remarks



- Q9. Deep Sea Trawling has emerged a significant threat to marine ecosystem including destroying coral reefs and pristine marine habitats. Elaborate. (10 Marks)



Deep sea trawlers try to capture marine organisms from the deepest recesses of ocean, ~~sometimes~~ even wiping across bottom of the ocean.

This not only upsets the settled surface creating dust and releasing corals from their point of connection with the surface, but also captures deep sea marine fish and organisms which are

Remarks

not even eatable. These organisms die in the process.

The very young fish are also captured. This reduces the productivity from fishing in the long run as well as disturbs the habitat such that new eggs also may not survive.

The pressure on coral is visible in the Gulf of Mannar, even as trawling pollutes the water too reducing visibility for sea creatures whose movement is disrupted, possibly hampering migration to areas suitable for their reproduction.

It is important for the fishing economy, food security and environmental sustainability that deep sea trawling is regulated for best outcomes.

Remarks



Q10. What are eco bridges? Discuss the need and significance of eco bridges in biodiversity management.

(10 Marks)

The protected areas such as national parks are often located across prospective connectivity projects' passages. Eco bridges reconcile the need for connectivity with conservation of biodiversity, especially in countries like India which are developing as well as megadiverse.

They are passages that link two protected areas to ensure that the wildlife corridors that connect the two areas or two parts of one area are not disrupted. They provide underpasses ~~below~~ below a highway or otherwise maintain the link.

They are needed to ensure intermingling of genetically varied populations of species, to secure supply of water or prey which might be located across the highway and to maintain the expanse

Remarks

required for species such as tigers. They serve as migration corridors. Recently an eco bridge was constructed across tiger reserve that covers Maharashtra and Telangana.

They are significant because they:

- 1) ~~conserve~~ wildlife habitat
- 2) ensure genetic exchange which is important for ~~sepe~~ species' residence
- 3) maintain the habitats.

Remarks



## Section - B

Q11. Briefly elaborate on concepts Virtual Reality (VR), Augmented Reality (AR) and Artificial Intelligence (AI), along with their role in improving social parameters like health and education.  
(15 Marks)

The onslaught of virtual reality (VR), augmented reality (AR) and artificial intelligence (AI) holds a lot of innovation potential for social goods such as health and education.

Virtual reality is entirely based on software to depict or portray events, processes and occasions. For instance, a character in video game is virtual reality although one can make it move and do things.

Augmented reality is a combination of the physical and virtual world, with virtual imagery superimposed onto physical objects. eg. glasses which make it appear as if a teddy bear is moving about in your room when you wear the glasses.

Artificial intelligence is the computing ability of a machine to learn, process, update information and make decisions based on stored data sets.

Remarks



Health

AI can be used to collect data on a population and recognize susceptibility to a disease, say, diabetes and evolve solutions accordingly.

VR can be used to -

train local health providers in simple surgical procedures to increase treatment at primary healthcare centres reducing exacerbation of small problems and to localise treatment

AR can help the providers practice.

Education

AI has been used in Andhra Pradesh to predict students who are likely to dropout, similarly it can be used to monitor teaching outcomes based on vast data parameters.

VR can increase penetration of practical

Remarks

training through real time problem solving skills.

AR can be used to give hands on experience at laboratories and science experiments at government schools where physical infrastructure is not available.

Harnessing such futuristic technologies can help reduce the out of pocket medical expenditure of 70%. and improve learning outcomes of students too.

Remarks



Q12. Although, there are several international efforts like Bonn Convention and CITES for conservation of migratory birds, yet they are facing severe threat from human and climate related changes. Discuss. Highlight some initiatives taken by civil and NGO organization to save migratory birds. (15 Marks)

A number of initiatives such as CITES and Bonn Convention seek to curb and regulate trade in migratory birds while promoting national and international actions to conserve and protect them.

Still, they face severe threats from :

### humans

- 1) unhindered hunting for food and decorative purposes
- 2) trade in supposedly medicinal beaks, meat and feathers.
- 3) destruction of habitats and nesting sites as seen in Andhra Pradesh.

### climate change

- 1) upsets the optimal conditions required for breeding
- 2) disturbs the migratory pattern as their nesting and resting sites get thermally and environmentally affected
- 3) unseasonal rainfall, cyclones and

Remarks



storms disrupt migratory patterns such as polar vortex, cyclonic rainfall,

A number of civil society actions have saved migratory birds. The Amur falcon protection programme taken up in Nagaland has literally eliminated the hunting of these birds.

Similarly, Bird Atlas helps birders update information birds to monitor trends in numbers and patterns so that corresponding action can be taken.

Chilika lake has been locally protected by people and so is the Pulicat lake by a vigilant citizenry which values the cultural and environmental value of migratory birds.

Remarks

These initiatives highlight how civil society and NGOs can help in positive contribution to the cause of biodiversity protection, a fact also highlighted by UNEP and forest principals of UN.

Remarks

Q13. Drought is a broader concept than just deficiency of rainfall. Discuss how drought is more of a man-made disaster than a mere deficiency of rainfall. Elaborate on the consequences of desertification that drought prone regions face. Also, bring out the preventive steps to be taken in light of targets to curb desertification as mentioned under the SDGs.

(15 Marks)

Drought is the lack of availability of adequate quantity of water for human, and livestock needs. It is not merely a deficiency of rainfall because ~~rainfall~~ rainfall is not the only source of water.

It is more of man made disaster resulting from exacerbation of poor rainfall due to :

- 1) overexploitation of ground water which reduces water availability.
- 2) misuse of available water by irresponsible irrigation, industrial and household practices
- 3) lack of rain water harvesting in previous seasons
- 4) treating underground and surface water separately rather than comprehensively

Remarks



Desertification is the process of conversion of degraded / poor fertility soils into totally sterile region. It is more likely in drought prone areas as lack of water reduces moisture and crop sustaining qualities of soil. It has adverse consequences such as;

- 1) food insecurity due to low crop production especially in remote and poor areas.
- 2) Death of livestock or poor productivity as fodder and grass is removed.
- 3) economic crises because a productive resource i.e. land is lost
- 4) health consequences for people

Under the SDGs, relevant goals are  
 goal no. : 1, 2, 5, 6, 12, 14.

Remarks

The preventive steps to be taken are ;

- 1) empowerment of local communities to plan and execute water conservation projects such as the Ralegan Siddhi experiment.
- 2) scientific and technological support through drought resistance crop varieties and weather forecasts to farmers for prudent decision making eg. mKisan Portal, Kishi Vigyan Kendras, Mera Gaon mera Gaurav.
- 3) International cooperation such as with Israel for technology sharing in dry area agriculture.
- 4) Incorporating perspectives of women as they are disproportionately affected through SHGs

These steps can help along with support from

Remarks International agencies such as global environment facility which implements the united nations convention on desertification



Q14. Convention on Biological Diversity (CBD) 1992, included bio-prospecting as one of its objectives, putting forth an international treaty that aims to ensure fair and equitable sharing of benefits arising from the use of biological resources. In this context, explain bio-prospecting? What are the main benefits and challenges associated with it?

(15 Marks)

Bio prospecting is the search for biologically biological resources such as plants, trees, animal resources and herbs which have potential industry-level applications in pharmaceutical, manufacturing; alternative medicine. It could be a part of these resources or a substance isolated from these. For instance, neem has many applications.

Convention on biological diversity (CBD) included provisions to encourage bio prospecting for the benefit of humanity while fully protecting the rights of the communities and countries where these resources are located, in terms of fair and equitable benefit sharing.

Remarks



The commercialization after bioprospecting has benefits such as :

- 1) Industrial application fetches returns to the researchers as well as the host country.
- 2) Promotes sustainable use of natural resources.
- 3) Inclusive growth of the relatively poor tropical countries harboring major diverse flora and fauna.

However, challenges remain, such as :

- 1) Corporate theft denying share to the host population
- 2) May encourage unsustainable exploitation which could affect the ecological balance of the region
- 3) Riches of some at the cost of many, an ethical issue.

Remarks

4) lack of record of resources with the host countries such that it cannot claim ownership of original molecule eg. happened in South America

5) lack of institutional capacity to take up legal challenge against big corporate houses in case of violation.

Although, the Nagoya protocol of CBD addresses these issues, but true benefits can be obtained if funds are available for capacity building and enforcement of provisions.

Remarks



Q15. According to MOEF&CC, 40% of the Indian 8,414-km long coastline is subjected to coastal erosion which is posing a significant threat toward sustainability of coastal ecosystem. In this context discuss the major reason of coastal erosion. Also suggest measures to deal with coastal erosion. (15 Marks)

India's coast of 8,414 km is a major source of food, trade, economic growth and biological diversity. It is subjected to coastal erosion which is threatening the sustainability of coastal ecosystem.

Some of the reasons are :

- 1) wave and tidal erosion due to strong water movement and receding
- 2) encroachment of coastal ecologically sensitive zones which upsets the natural protection mechanisms such as tidal inter tidal zones.
- 3) the geological structure of the peninsula with western submergent coast is naturally prone to erosion.
- 4) Culling of coastal vegetation of the Sundarbans removes the protective cover of mangroves.

Remarks



- 5) climate change has enhanced adverse weather events ~~which~~ such as cyclones and raises water level
- 6) Damming of rivers reduces silt and coastal build up from river water inflows.

According to certain estimates, at this rate half of Mumbai will be underwater by 2100, climate change being combined with coastal ~~erosion~~ erosion.

The measures that can be taken are:

- 1) Strengthening and strict enforcement of coastal regulation zone guidelines.
- 2) Awareness generation among people for reduction of demand for coastal land.
- 3) Provision of adequate house in inner areas.
- 4) Planned urbanization and making

Remarks

sustainability contingent on release of funds for schemes such as AMRUT and affordable housing scheme.

- 5) Scientific planning of hydroelectric projects with cost benefit analysis and ways to mitigate impact on river load.

A holistic approach can aid in sustainable development of coastal areas.

Remarks



Q16. Rapid urbanization and other anthropogenic activities have become greater threat for the existence of birds. In this context, discuss various reasons for decline in the population of the birds. Also, suggest solution to protect this avifauna. (15 Marks)

The existence of birds is dependent, by and large, on naturally available resources, whether it is for food, water, reproduction or shelter.

Rapid urbanization has thus come as a major challenge for birds as:

- 1) deforestation for urbanization eliminates place to build nests.
- 2) concretization removes natural water puddles, endangering populations
- 3) Soil is not available for feeding on insects and worms, they fail to survive
- 4) the urban heat islands upset the thermal balance of bird's bodies
- 5) high rise buildings disrupt free movement even causing deaths due to collisions

Similarly, other anthropogenic activities

Remarks



such as mobile towers and the radio waves are said to disorient them leading to death eg. the common house sparrow. Wind mills also cause noise pollution and death due to collision. Marine pollution also harms birds who depend on fish and other water based organisms, India being one of the 17 megadiverse countries is more problematic as bird diversity and species are at danger even while India has to urbanize to accommodate the 600 million people who are going to inhabit urban areas by 2030.

The following solutions can be taken up:

- 1) Urban forests such as in Chandigarh, Islamabad should be incorporated.
- 2) Placement of water containers at

Remarks

major locations and through  
community involvement -

- 3) environmental impact assessments  
for wind power projects should  
include effect on birds and how to  
mitigate those.

These steps can help to minimize the  
impacts on avifauna.

**Remarks**



Q17. It is a well-established fact that no nation aspiring to great power status can expect to achieve it without being substantively self-reliant in defence production. In this context, discuss the need for indigenization of defence technology. (15 Marks)

Defence expenditure to the tune of 54 billion dollars annually in India shows the importance of defence in India's strategic calculations.

India, however imports more than 80% of its defence equipment while countries such as China and USA are major exporters in the world today. If India aspires to be a great power, it has to develop an indigenous research, technology and production infrastructure for defence to :

- 1) eliminate foreign leverage in case of war
- 2) enhance preparedness
- 3) reduce expenditure and conserve foreign exchange
- 4) ensure secrecy and covert nature of defence equipment

Remarks



The Kargil review committee, Naresh Chandra task force as well as various defence experts have rooted for indigenisation.

India can export armaments to other countries if we have an indigenous set up. It can build up a defence-industrial complex which will boost employment as well as technological advancement. eg. DRDO's fire resistant coating has many other applications. Similarly, its high nitrogen steel can be used in industry.

It is in this light that the Pentam Singh committee had recommended a non capsable defence expenditure fund. The Make in India initiative along with the IDDM category in

Remarks

Defence procurement procedure  
along with the strategic partnership  
model can go a long way to  
help India be self reliant in defence  
production.

This becomes all the more  
necessary because of emergent risks in  
the neighbourhood.

Remarks



Q18. Throughout the history, dams have contributed significantly toward the economic and social developmental. However, riverine fisheries, fauna, fauna and ecosystem is near collapse due to them too. In this context, analyses the impact of dams on riverine fishing and their sustainability. (15 Marks)

Dams were called the temples of India in decades post independence highlighting their role in powering up houses and industries, irrigating fields that aided the Green Revolution and providing drinking water to the countrymen.

India has more than 5000 dams and hydroelectricity contributes around 16% to overall installed capacity.

But dams have had negative impacts too as encroachment of catchment areas of rivers and the consequent deforestation destroyed wildlife habitats while reducing the mitigating impact of these on flooding.

Remarks



Certain basins were deprived of water due to diversion from reservoirs, ~~fishing the~~ eliminating survive fishing in the areas, and altering balance in the receiving areas.

The siltation of dams has hindered movement of fish for spawning thereby reducing fish catch for fishers along the banks of rivers while also depriving downstream waters of nutrition. So downstream fishing also suffers. This is visible in the Karakka barrage area.

The flooding caused by sudden release of water from dams as seen in Kerala also destroys the survive fishing industry.

Despite these factors, the expansion of channels has also aided

Remarks

greater fishing resources in hitherto dry areas. The electricity generated has been used to power cold storage facilities to store and export inland fisheries resources.

The inland waterways ease motor boats which can fish in far areas.

Steps such as fish staircase which aid fish movement in barrages and silt management with national dam safety bill to ensure proper management of dams can help to mitigate impacts and enhance benefits from dams.

Remarks



Q19. This year, wetland day was celebrated with theme "Wetlands for a Sustainable Urban Future". In this context, discuss how wetland can contribute toward the sustainable urban future and development.

(15 Marks)

Wetlands have been called the kidneys of the world because of the many benefits they provide. This necessitates their sustainable use, especially in urban areas where population pressure and waste generation is higher.

The wetland day theme could not have come sooner because wetlands have multifarious uses for urban areas such as :

- 1) Purification of waste water by natural filtration
- 2) absorption and percolation of excess rainwater in a concretized setting to prevent flooding
- 3) house biodiversity for aesthetic, ecological and creative purposes.  
eg. Subhne Lake

Remarks



- 4) generate employment <sup>in</sup> fishing, boating etc.
- 5) provide compost for household gardening.
- 6) house trees and plants that purify air and mitigate green house gas impacts, for instance mangroves in Mumbai.

Therefore wetlands are important not only for sustainable development but also resilience of cities. The encroachment of wetlands in Mumbai and Chennai was one of the reasons for floods. It is for this reason that Ramsar convention encourages states to conserve wetlands.

India has also incorporated holistic urban development in AMRUT.

Remarks