

GS SCORE

An Institute for Civil Services

IAS TOPPER'S

TEST COPY

K. LALITH

RANK - 626

GS MAINS



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SCIENCE - TECH. AND ENVIRONMENT

Time Allowed: 3 hrs.

Max. Marks: 250

Q.	Marks	Instructions to Candidate
1.		<ul style="list-style-type: none">• There are 20 questions.• All questions are compulsory.• The number of marks carried by a question is indicated against it.• 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.• Keep the word limit indicated in the questions in mind.• Answers must be written within the space provided.• Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.
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1. Invigilator Signature



2. Invigilator Signature

Name K. Lalith

Roll No. _____

Mobile No. _____

Date 13/Aug/2018Signature K. Lalith

REMARKS

- Use more suitable points
- conclusion should be the part of answer.

Section - A .

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

An air-independent propulsion system is technology of engine where fuel and oxygen need not be carried on board together thus reducing the weight of the vehicle.

Only fuel is carried and oxidation or combustion of fuel happens by drawing oxygen from external environment.

The RAM-JET & SCRAM-JET technologies are based on AIPS.

ADVANTAGES

- ① Reduced weight of the craft thereby reducing overall fuel consumption.
- ② Increased efficiency per unit of fuel consumed.
- ③ facilitate carrying of heavier payloads
- ④ Duration of the flight could be increased.
- ⑤ Has advantages to improve the cruise missile technology which follow the terrain-hugging protocol.

Remarks

augment the diesel-electric propulsion system
 augment range and improve underwater endurance

⑥ Bigger passenger air-crafts could be built in future thereby reducing the cost and time of journey.

⑦ Increases the potential speed of the aircraft/missile/sounding rocket so as to achieve greater Mach speed and achieve supersonic and hypersonic speeds easily.

The potential application of this technology could be seen in the field of defence, space technology etc. increasing the range of cruise missiles like Brahmos thereby making India's Arsenal stronger.

(3/2)

Remarks

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

Cold fusion technology is a ~~new~~ revolutionary new technology in the area of spontaneous power/energy generation through the use of non-radioactive materials/metal that too at room temperature to produce energy. Metals like palladium etc. are used.

BENEFITS.

- ① Boost to India's ambitious India's power generation target by 2022
- ② Reduced air pollution by non using conventional coal, thus reducing NO_x , SPM (suspended particulate materials) etc.
- ③ No direct impact of lethal radiation leaks eg Fukushima incident in Japan.
- ④ Doesnot require compliance with strict international requirements of IAEA, thereby reducing compliance cost.

Remarks

not need to be connected to the electric grid

⑤ Reduced dependence on foreign countries for continuous supply of reactor technology, nuclear fuels.

ISSUES ASSOCIATED

- ① The technology has not yet been scaled up to be economical.
- ② Difficult to create low energy nuclear radiation technology in a controlled manner.
- ③ Material required for proliferating such technology is already in scarcity.

In a nutshell, this technology could be a potential source to India's energy security in the wake of green energy initiatives undertaken by the countries.

4/2

no conclusive theory explaining if the experiment proved to be completely irreproducible

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)

Artificial Intelligence (AI) is an emerging and promising field of study offering plethora of advantages.

Financial sector especially formal banking mechanism has huge benefits if used with caution.

① Advent of AI may reduce clerical errors in Data-Entry and processing of critical financial information thereof.

② Increased Speed of transactions especially routine transactions which would be predicted by AI systems.

③ Use of AI enabled Robots in Bank branches to help customers like LAMI Robot in CITY UNION BANK, CHENNAI.

Remarks

most virtual agent or chatbots.
Robotic process automation
used for fund management

④ AI could better integrate Core Banking Systems with SWIFT.

⑤ May help in detecting defaulters thereby reducing potential NPA in the long run.

future competition in the financial sector is going to be on speed, time and accuracy and client satisfaction through online banking.

Integrating technologies such as Blockchain to AI is the way to go for international banking for the days to come.

ISSUES

- ① Low skilled Bank staff (require KSA accordingly).
- ② Potential job losses in banking sector due to automation.
- ③ Overuse of AI may give rise to techno-stress.

⑤

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)

Indian universities usually do not rank very high on international rankings. In 2017, only 3 out of top 500 universities featured from India.

The culture of research is not at its best because :-

- ① Academics and research work parallelly happens in Indian universities thereby rendering less time to research.
- ② Lack of funds (Budgetary support) for undertaking scientific researches.
- ③ State funded universities are further aggravated with infra-structural bottlenecks.
- ④ Lack of Industry - Academia interface.
- ⑤ The key research talent is limited to few colleges like IIT / IISc's in India.

Remarks

Lack of clarity in developing a research culture
victim to the peripheral grants

To improve the situation:-

- ① Ease of doing research (Economic Survey 2017-18)
- ② Government programmes like ASPIRE where one institution will give research support to one particular social problem.
- ③ focus on Prime Minister Fellowship programme for aspiring researchers, 3000 candidates per annum.
- ④ Schemes like UAJRA and GIATN to attract international talent towards Indian universities etc.

4/2
need to move from isolated individual researcher to the activity of large number of interconnected colleagues

Remarks

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

The proliferation of WWW and social networking has given birth of a new era of a digital world.

Digitisation has become the new normal, redefining boundaries and increasing speed of communication.

CHALLENGES IN ADOPTION.

- ① Digital illiteracy - The country is still tackling with literacy rate challenges and digital literacy is the next level.
- ② Infrastructural bottlenecks → Technology such as devices and network systems are not afforded by one and all even today.
- ③ Apprehensions of Data theft, users are apparently vulnerable to cyber threats for example, Digital banking still not preferred by many Indians.

Remarks

Low penetration of POS terminal
Lack of adaptability by many vendors

④ Lack of awareness among the rural mass regarding the benefits.

To enhance digital penetration :-

① Ambitious Digital India programme launched by the government.

② Bharat Net programme to connect all ~~gram~~ gram panchayats with high speed broadband. (80% of the target achieved, Economic Survey 2017).

③ Mass production of digital devices. there by increasing affordability.

④ Government initiatives towards e-governance and cashless economy initiatives to bring attitudinal changes.

⑤ smartphone penetration
 stringent security

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)

High nitrogen steel refers to an hybrid version of stainless steel by changing its chemical composition during initial forging.

Such steel has high tensile strength and could be used for various defence purposes.

SIGNIFICANCE OF HNS :-

- ① Increased strength in comparison to traditional steel.
- ② Lighter in weight and density
- ③ Higher melting point thereby giving physical edge.
- ④ flexible / pseudo-malleability giving it the ability to be forged into thinner sheets.

Not satisfactory

POTENTIAL APPLICATIONS OF HNS.

- ① could be used in building the

Remarks

• pave the way for further developments
 of locally developed tech.
 global leadership in defence

defence equipment such as Armoured tanks, which are lighter and could move faster.

② Increase the stealth of the vehicle by ~~see~~ releasing less heat.

③ Manufacturing stronger barriers (bariladings).

④ Potential in missile technology by making the missile lighter thereby better targeting facilitated.

more thereby facilitated.
 infantry
 combat
 vehicle

It also has potential application to be used in bullet proof vests / suits in the armed forces, can also be used in space technology, reduce the weight and increase the stability of rockets etc.

(3/2)

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)

The Conserve and Use Principal has found great relevance in modern times especially to combat urban water crisis.

According to World Bank (WB) report aquifers in India are receding by the rate 10-25 mm per annum.

Flood plains are the potential rechargers of aquifers across the country.

ADVANTAGES WITH SUSTAINABLE USE:-

① Central Ground Water Board (CGWB) has envisaged sustainable pumping of water from floodplains of perennial rivers to meet the local demands.

② Caution against overuse as it may lead to Arsenic contamination, example, Ganga Doab region.

Remarks

by engaging farmers
have to be least
through a PPP and an assured
steady income to the
farmers

- ③ The banks of Yamuna river used for this purpose to meet the daily demand of Delhi NCR.
- ④ Sustainable use helps to dried out wells.
- ⑤ Use of aquifers leaves it with extra capacity to absorb flood waters thereby mitigating potential shoreline calamity.
- ⑥ Floodplains are potential horticulture hotspots for eg, Watermelon farming on Yamuna Bank.
- ⑦ Reduced cost of technology to dig deeper borewells and recharging it through rain water harvesting.

4/2

Remarks

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

DNA repair mechanism also known as gene therapy and is undertaken through DNA Recombinant technology, helps to cure genetic disorders and autosomal diseases and has huge potentials in medicine.

MAJOR TECHNIQUES :-

- ① Gene editing → Edits the existing characteristics.
- ② Gene splicing → Removes unwanted and junk DNA.
- ③ Gene Suppressing → Suppresses specific targetted genes such as ONCOGENES.
- ④ Technology used → A vector like E-coli bacteria with a gene editing protein such as ~~DNA~~ Lipase CRISPR/Cas9 and DNA Ligase are used to target the specific

Remarks

Cells for therapy.

SIGNIFICANCE FOR HUMANS.

- ① Hereditary diseases could be combated. eg → Type 1 Diabetes.
- ② Designer babies is a promising field of study.
- ③ would help to combat carcinogenic cells thus reducing the cancer potential.
- ④ The three parent baby (UK) could be successful through Mitochondrial DNA transplantation.
- ⑤ Stem-cell therapy is based on gene-technology.

future potential of DNA repair mechanism could be identified by the fact the Shinaya Yamanaka was given nobel prize in 2014 for discovering somatic cell gene therapy.

Remarks

utilize nucleotide excision repair to correct defects caused by mutagenic substances

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 trawling is a proliferating ecological issue which is also manifesting into international conflicts for example India and Sri Lanka.

Deep sea trawling is undertaken by motorised fisherboat to increase the catch of benthic fish.

IUU fishing is being objected by UN, USA, Sri Lanka due to ecological cost, because it is illegal, unsustainable and unregulated.

Also undertaken in the quest of polymetallic nodules (PMN) and other resources from the seabed.

ECOLOGICAL COSTS OF DEEP SEA

TRAWLING:-

① Destruction of coral reefs beyond repair across Coral Atolls and fringing reefs

Remarks

unselective and severely damages the sea floor ecosystem
increases the plastic debris

- ② Leads to marine pollution as sub-terranean wastes are brought onshore.
- ③ Deposition of plastic, rubber etc. which are not degradable.
- ④ Small fishes are also captured in the midst of Deep sea ~~trawling~~ ~~trawling~~ thereby reducing overall fish population in the long term.
- ⑤ Underwater flora such as crucial weeds and plants gets disturbed.

The ~~ITLOS~~ ~~ITLOS~~ International Tribunal on Law of Sea and International Seabed Authority has taken cognizance of this issue.

Steps

deep sea fishing should be promoted
alternate employment to fishermen

4/2

Remarks

Q10. What are eco bridges? Discuss the need and significance of eco bridges in biodiversity management. (10 Marks)

Eco-bridges are a novel concept being used to maintain the integrity of forest ecosystem and are being extensively built in bridging the transition areas between 2 forests etc. being undercut by river streams or human habitations etc.

NEED AND SIGNIFICANCE -

- ① To compensate for human intervention in pre-existing natural ecosystems.
- ② To maintain the quality and density of vegetation and associated fauna in a particular area.
- ③ To give the animals a natural feel of their habitats in protected areas. (to increase survival through in situ management of conservation in protected

Remarks

areas -

- ④ Telengana government is using this technique in Adilabad region for smooth passage of tigers.
- ⑤ Potential application in reducing Man-Animal conflict.
- ⑥ Could be used to enhance the efficacy of Elephant corridors, across the country.
- ⑦ Being used in Western ghats to protect indigenous fragile fauna (KASTURI RANGAN REPORT ON THE CONSERVATION OF WESTERN GHATS).

4/6 to prevent genetic isolation of fragmented flora and fauna
 greater interaction between individuals leading to a healthy exchange of genetic material

Remarks

Section - B

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

Virtual Reality means visualising a 3-Dimensional aspect which does not actually exist at that time and space.

Augmented Reality is a step forward ~~from~~ which enhances the impact of VR by allowing the person to actually experience a particular aspect as if it were happening around them. It super-imposes VR over the actual reality thereby merging both and giving an integrated and rich experience.

Artificial Intelligence is a potential area of study where computer technology is being used for decision making, analytics and deriving logical conclusions on the basis of Big-data assessment. AI makes computer system smarter by

Remarks

developing cyber neural networks and studying patterns.

APPLICATIONS FOR HUMANS :-

- ① To better integrate Digital and real world in complementary ~~matter~~ manner.
- ② To improve digital experience especially in the field of gaming, digital tourism, e-governance such as health ~~and~~ education, computer simulations for testing new technologies etc.

③ Role in Health sectors :-

- ① Improve quality of tele-health services.
- ② AI may be helpful in medical research for example Drug Discovery, identifying emerging diseases.
- ③ Remote health checkup without Physically visiting a doctor through

Remarks

- provide more practical approach
- provide more learning of learning
- provide real world experience in studies

remotely operated labs.

(b) Education sector

- Improve cognitive skills through AI based games.
- VR based learning modules for better understanding and conceptualisation.
- Augmented Reality being heavily used in Architecture to determine new constructions and match with landscape, etc.
- ISRO launched new App based on AR to increase common man's interest in space tech.
- Virtual gaming and 3D puzzles to improve alertness in specialised jobs.
- Simulator based training for pilots, motorment etc. to develop complex skills.

The above technologies offer huge advantages and potential application in the days to come.

Remarks

(7)

VR can be used in various therapies to track body movement precision medicine

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)

The migratory species are facing huge stress from human and climatic causal factors.

Global initiatives such as Bonn convention have been undertaken for the protection of migratory species.

Not fully satisfied due to international complication hence no consensus in toto.

The CITES (Convention on International Trade on endangered species) also known as Washington Convention is a joint initiative by UNEP and IUCN.

It has 3 lists classifying endangered species, in the first appendix requi-

Remarks

Practically
climate change
high voltage power line

ring both import-export, license. Vulnerable species. population decreased over passed 2 decades in the world requiring export license in the 2nd Appendix. And 3rd Appendix concerning geography specific conservation

TULN also releases Red Data Book for the conservation of flora and fauna including migratory species.

The Raptor Mow Co has been agreed upon the countries to the convention of migratory species to protect and conserve the habit of migratory birds of prey whose population is dwindling. For example Cygnus ucture who has been bred in situ so as to increase their population.

Still anthropogenic factors plague the issue :-

Remarks

① Extensive release of GHGs leading to climate change thus interrupting of migratory path of Arctic tern.

② Increased traffic of marine vessels have disturbed sonar ability of Dolphins & whales, thereby diverting them from intended path.

Initiatives by civil society & NHO's

① Bombay Natural Historical Society's recent initiatives to protect the Himalayan vultures and belied herons.

② Madurai falcon, being conserved over the river Vaigai.

③ Community conservation initiatives across Chilka Lake and protection of Hornbill in Nagaland. Hornbill & flamingo festival organised in Kerala.

⑦ Marine Wetland protection coalition
Ricky mountain Bird observatory

Remarks

Salim Ali Centre for ornithology
and Natural history

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 refers to scarcity of water and associated resources in the vicinity for thriving an healthy ecosystem.

As per GOI's recent definition drought is associated with meteorological phenomenon of monsoon and rainfall and is known as deficit periods and long deficit periods.

Deficit period is where rainfall is less than 90% of LPA. It is broader than just deficiency of rainfall because drought also means depletion of groundwater resources (United Nation's Standards).

Less than 1700 cubic meters per capita per annum

Remarks

is known as water stress condition and less than 1000 cubic meters is crisis.

CONSEQUENCES OF DESERTIFICATION.

(1) loss of natural flora & fauna
 eg → ~~SARAWAK~~ SARAWAK desert was once upon a time green.

(2) loss of agriculture ~~due to~~ potential ~~be~~ due to deteriorated quality of soil.

(3) Deteriorating aquifers and ^{myrid} drying up surface water and bodies.

(4) Nutrition deficiency due to ^{suffer} lack of feed and fodder for human and animals alike.

^{carbon exchange mechanism} Desertification is a global as trophic challenge addressed broadly in SDG's. SDG number, 6, 12, 13, 14 and SDG 2 on human health

Remarks

Comprehensively highlight the desertification.

REMEDIAL STEPS.

① Bonn Challenge → To ~~defeat~~ desertify 100 million hectares of land by 2030.

Desertification.

Impacts 200 million hectares per annum	3.2 Billion people affected by this.
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② Community conservation techniques such as land profiling.

③ Mapping vulnerable areas for rehabilitation of affected community.

④ Active steps undertaken by UNCCD as per Sendai framework (2015-2030).

⑦ Integating land and water management in dryland agriculture

Remarks

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)

CBD 1992 was undertaken parallelly in the Earth with 3 main objectives:-

- ① Conservation of Biodiversity
- ② Sustainable use
- ③ Fair and Equitable sharing of Benefits.

further strengthened mechanism through Cartagena protocol for the transboundary movement of Genetically Modified Organisms (GMO/LMO), Nagoya Protocol (Access and Benefit sharing) and Aichi Targets.

Bio prospecting refers to the study and research on biological components of an area

Remarks

In order to develop beneficial biological materials for human economic ~~consumption~~ consumption.

BENEFITS:-

- ① It is the basis of biological research.
- ② Helps in better understanding of ecology and its human usage.
- ③ To catalogue critical biological information on ^{Sustainable} endemic flora and fauna ^{Innovations} for conservation. ^{included}
- ④ Application of natural components in the field of medicine (Naturopathy, Ministry of AYUSH).
- ⑤ To develop and protect intellectual property rights of naturally occurring flora and fauna as per TRIPS, WTO standards.

Remarks

Q20. Discuss the role of wildlife coalition in conservation, protection and management of wildlife and environment. (15 Marks)

Wildlife coalition refers to 'in situ' conservation of biodiversity. following techniques are used :-

IN SITU MODES
Wildlife Sanctuaries
National Park
Biosphere Reserves
Community Reserve (Sacred groves)

① wildlife sanctuaries. → Here specific fauna is conserved in its natural habitat eg elephants, tigers etc. Here notification and management are done by a state government.

Remarks

② National Parks → Saves the flora and fauna in toto that is the overall ecosystem including 1 or more than 1 keystone species. It is notified by central government and notified by states such as Tiger Reserves etc. No exploitative economic activity is allowed.

③ Biosphere Reserve → It is notified by central government under the Man and Biosphere programme of UNESCO for the protection of overall ecosystem and communities therein.

④ United Nation recognises (UNESCO) 13 out of 17 giving financial and technical support divided into core, buffer

Remarks

and transition areas. Economic activities are allowed in transition areas only thereby safeguarding core areas and maintaining their natural pristine quality.

④ COMMUNITY RESERVES →

Greatest coalition between community as a whole and ecology by maintaining and preserving the sacred groves and resorting to social forestry, agro-forestry, ~~agri~~ cultural conservation, hillage etc. for sustainable agricultural activities. For example Bishnoi Samaj, Sarqija. Thus the role of such valuable efforts are sustainable and economical for ecosystem and mankind in the long term.

Remarks

sensitize media to the realities of wildlife
encourage experts to disseminate knowledge on wildlife