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GENERAL STUDIES (TEST CODE : 1241)

Name of Candidate	HARDIK AGARWAL		
Medium Eng./Hindi	Eng.	Registration Number	429079
Center		Date	15-08-19

INDEX TABLE

Q. No.	Maximum Marks	Marks Obtained
1	12.5	
2	12.5	
3	12.5	
4	12.5	
5	12.5	
6	12.5	
7	12.5	
8	12.5	
9	12.5	
10	12.5	
11	12.5	
12	12.5	
13	12.5	
14	12.5	
15	12.5	
16	12.5	
17	12.5	
18	12.5	
19	12.5	
20	12.5	

Total Marks Obtained:

Remarks:

INSTRUCTIONS

1. Do furnish the appropriate details in the answer sheet (viz. Name, Registration Number and Test Code).
   उत्तर पुस्तिका में सूचनाएं भरना आवश्यक है (नाम, प्रश्न–पत्र कोड, विद्यार्थी क्रमांक आदि)।
2. There are **TWENTY** questions printed in **ENGLISH & HINDI**
   इसमें बीस प्रश्न हैं अंग्रेजी और हिन्दी में छपे हैं।
3. **All questions are compulsory.**
   सभी प्रश्न अनिवार्य हैं।
4. The number of marks carried by a question/part is indicated against it.
   प्रत्येक प्रश्न/भाग के अंक उसके सामने दिए गए हैं।
5. Answers must be written in the medium authorized in the Admission Certificate, which must be stated clearly on the cover of this Question-Cum-Answer (QCA) Booklet in the space provided. No marks will be given for answers written in medium other that the authorized one.
   प्रश्नों के उत्तर उसी माध्यम में लिखे जाने चाहिए जिसका उल्लेख आपके प्रवेश पत्र में किया गया है और उस माध्यम का स्पष्ट उल्लेख प्रश्न–सह–उत्तर (क्यूसीए) पुस्तिका के मुख्य पृष्ठ पर अंकित निर्दिष्ट स्थान पर किया जाना चाहिए। उल्लिखित माध्यम के अतिरिक्त अन्य किसी माध्यम में लिए गए उत्तर पर कोई अंक नहीं मिलेंगे।
6. Word limit in questions, if specified, should be adhered to.
   प्रश्नों में शब्द सीमा, जहाँ विनिर्दिष्ट है, का अनुसरण किया जाना चाहिए।
7. Any page or portion of the page left blank in the Question-Cum-Answer Booklet must be clearly struck off.
   उत्तर पुस्तिका में खाली छोड़ा हुआ पृष्ठ या उसके अंश को स्पष्ट रूप से काटा जाना चाहिए।

EVALUATION INDICATORS

1. Contextual Competence
2. Content Competence
3. Language Competence
4. Introduction Competence
5. Structure - Presentation Competence
6. Conclusion Competence

Overall Macro Comments / feedback / suggestions on Answer Booklet:

1.

2.

3.

4.

5.

6.

All the Best

Answer all the questions in NOT MORE THAN 200 WORDS each. Content of the answers is more important than its length. All questions carry equal marks.

(12.5X20 = 250)

1. Explain the concept of Chandrasekhar Limit and highlight its significance in the field of astronomy.

   चंद्रशेखर सीमा की अवधारणा की व्याख्या कीजिए और खगोल विज्ञान के क्षेत्र में इसके महत्व पर प्रकाश डालिए।

Chandrasekhar limit is the ~~1.5 times of the sun that~~ mass of a star beyond which it no more remains a star but collapses under the gravitation and weight of itself.

Recently it was verified by detection of gravitation waves of a failed star that happened millions years ago.

Chandrasekhar limit has been employed to know the life cycle of stars that finally should convert to Big Hole.

These calculations will help realise the nature of collapse of mass upon itself and determine the time it must have happened for past stars. If we can extrapolate that, then maybe we can determine the time for the Big-Bang event as well.

2. What are nano-pharmaceuticals? Mention their application and highlight the need for regulating the nano-pharmaceuticals in India.

नैनो-फार्मास्यूटिकल्स क्या हैं? उनके अनुप्रयोगों का उल्लेख कीजिए और भारत में नैनो-फार्मास्यूटिकल्स को विनियमित करने की आवश्यकता पर प्रकाश डालिए।

Nano - technology refers to the technology on nano (10^{-9} m) scale to solve other problems. One such problem is in pharmaceutical so nano-pharmaceuticals comes there to for effective drug delivery and medical devices and others.

Their applications include:

(1) Precise and effective and safe drug-delivery inside living body where generally doctor's can't reach via ~~robots~~ nano-robots.

(2) Medical devices on nano scale are produced for knee implants, breathing aids, hearing aids. etc.

(3) For health monitoring and

check-ups also there may be used.

④ making pharma textiles such as band-aids, straps.

⑤ Use in bio-technology to make drugs ~~and study~~ and devices.

Need of regulation:

① Can be used without the knowledge.

(2) If misuse can lead to toxicity.

(3) Needs precision thus proper training for handling by doctors and staff.

(4) New industry and people are unaware so quacks and such should not fool and only registered doctors, specialist in this must be allowed to provide such care.

3. Explaining the working mechanism of ramjet engine, highlight the significance of Solid Fuel Ducted Ramjet (SFDR) propulsion-based missile system for India.

रैमजेट इंजन की क्रियाविधि समझाते हुए, भारत के लिए सॉलिड फ्यूल डक्टेड रैमजेट (SFDR) प्रणोदन आधारित मिसाइल प्रणाली के महत्व पर प्रकाश डालिए।

Ramjet propulsion engine is used in missiles. This is a new technology developing from liquid fuel based thrust engines.

It has now moved to solid based rocket-fuels and now further to solid fuel ducted Ramjet propulsion-based engine that actually uses the thrust produced from the burning of fuel based on the oxygen or air available from outside the rocket only. Therefore now these missiles / rockets wouldn't have to carry that oxygen

glinder with itself, rotating can use atmospheric air/oxygen itself.

With this ~~more payload can~~ more fuel can come in payload and missiles can become light weight for faster and more farther reach and more effective and deceitful manoeuvre. This can especially be used in Air Defence System that requires speed and precision.

4. Give a detailed description of the benefits provided by nuclear technology and materials in the field of agriculture, industry, medicine, public safety and environmental sustainability.

कृषि, उद्योग, चिकित्सा, सार्वजनिक सुरक्षा और पर्यावरणीय संधारणीयता के क्षेत्र में नाभिकीय प्रौद्योगिकी और पदार्थों द्वारा प्रदान किए गए लाभों का एक विस्तृत विवरण प्रस्तुत कीजिए।

Nuclear technology is a broad term that includes all the technology using concepts at sub-atomic level.

Generally only energy and radio-activity are popular but it is used in various sectors such as:-

Agriculture:

(1) To devise proper fertilisers, pesticide and check their effect on human health.

(2) Soil Health and nutrient availability determination.

(3) GM and other such hybrid technologies.

Industry:

(1) Electricity production via Nuclear power as we all know.

(2) Many materials are needed and thus produced for chips, materials used in communication and defence equipments.

(3) Use of lasers and microwaves in research and development of sophisticated equipments.

Medicine:

(1) Their use in treating cancer via radio-activity is immense.

(2) To identify iodine levels in body via I-131.

(3) For human health affected by various chemicals, nuclear tech is employed to identify impacts and interdependence.

Public Safety:

(1) Use of nuclear technology in DNA fingerprinting.

(2) Bio-metric checks. ~~and~~

(3) Radioactivity detection and threats.

Environmental sustainability:

(1) Ozone and other critical elements maintaining adequate levels.

(2) UV rays impact on human health.

(3) Carbon-dating to realise fossil value and age and impacts.

(4) Developing right plants and trees to tackle climate change via carbon sequestration.

India must develop culture of Nano-technology and a mission on Nano-Technology and National Policy along with effective regulation is what we need.

5. Examining the risk posed by space debris, suggest some measures which can be taken for its mitigation and removal.

अंतरिक्ष में मलबे द्वारा उत्पन्न जोखिम का परीक्षण करते हुए, इनके शमन एवं हटाने हेतु कुछ उपायों का सुझाव दीजिए।

Recent demonstration of space missile by India by Mission Shakti has raised concerns for emerging space debris as well.

Risk ~~of~~ When space objects collide bt of space debris is created. Also when satellite space bodies are no more of use they end up being just waste or debris.

Risk associated with space debris:-

1) Can collide and destroy other space objects.
2) Can come in the path of rockets.
3) Very dangerous for astronauts space vehicle.

(4) In future as a lot of may create trouble especially in low-earth orbit.

(5) Difficult for poor countries to reach higher orbit. Thus making it inequitable space for space technology.

Some measures required :-

(1) Adherence to outer space treaty and international treaty on space debris removal and management.

(2) Intl. co-operation to share info on space debris ~~and~~ and space bodies as already done.

(3) Global cooperation to reduce space debris.

(4) Creater Pay responsibility, that is each country must be liable for an equivalent amount of its own space debris.

India must take the lead and build consensus on healthy use of outer space and create level playing field for all by first starting to reduce space debris. Also it must delineate its intentions on being responsible enough to not use space missile to create problematic space debris.

6. Explaining the concept of data exclusivity, bring out the arguments for and against incorporating data exclusivity norms in India's IPR regime.

डेटा एक्सक्लूसिविटी (डेटा विशिष्टता) की अवधारणा की व्याख्या करते हुए, भारत की IPR व्यवस्था में डेटा एक्सक्लूसिविटी संबंधी मानदंडों को सम्मिलित करने के पक्ष और विपक्ष में तर्क प्रस्तुत कीजिए।

Data exclusivity refers to the data obtained via clinical trials and other info during a research process and its trials.

By using data of one company other company can similarly and much easily produce same or similar products. This is especially useful in pharma industry where data of clinical trials forms integral part of production.

By data exclusivity such data can't be shared and used

Merits of Data-Exclusivity:

(1) Produce company enjoys benefit and more revenue.

② Value is the one who put effort into collecting the data.

① With time and ~~data~~ geography and context, data results may change hence new data must be collected and used each time.

Demerits:

① Smaller companies can't rise and remain 'dwarf'.

② When second company is using the previously collected, some anomalies are detected and thus mandates ~~improvement~~ correction. That might not take place.

③ Poor developing countries will suffer the most.

India needs a thriving economy and regulation of IPR regime is critical but it should give enough space as well for new research to take place. For this issue some time ~~of sunset~~

and clause may be added and legitimate payment for data usage to the parent company ~~and the~~ as a share of profit accrued by the beneficiary company.

7. Internet of Things (IoT) promises to offer numerous opportunities across multiple sectors, but there are many challenges that need to be addressed in realizing its potential. Discuss.

इंटरनेट ऑफ़ थिंग्स (IoT) विविध क्षेत्रों में अनेकों अवसर प्रस्तुत करने का वादा करता है, लेकिन इसकी क्षमता को साकार करने के लिए कई चुनौतियों से निपटे जाने की आवश्यकता है। चर्चा कीजिए।

Internet of things refers to the technology or application where things that we commonly use are interconnected to each other such as TV, mobile, lights, fridge, desktop computer, car, home door, AC etc.

Potential of IoT ~~in~~ as and opportunities:

(1) Ease of living and living standard for rising middle class and urbanisation.

(2) Effective and reduced electricity consumption.

(3) Safety of appliances and home and driving.

(4) Care for children, elderly.

(5) Independence and self-sufficiency for women.

(6) In industry used for automation and production for effective supply-chain management.

Challenges:

(1) Requires huge investment in electricity, internet.

(2) Appliances overhaul required for they must be sharing upgraded some protocols.

(3) Cyber-security needs to be not effectively considered.

(4) Data-privacy concerns.

(5) Technology and components are all imported. Import substitution must take place.

Way Forward:

(1) Industry-academia collaboration.

(2) Pilot projects to solve social

problems first.

(3) Regulations and accreditation and standard protocols across industry.

(4) Data localisation and other cyber-security measures.

India is at a critical juncture with large changes demography. lot must effectively be supported and used alongwith 5G, AI, robotics and such new age technologies to solve our ground problems.

8. Highlighting its potential, discuss the challenges that are being faced in generation and utilisation of energy from fusion process. What scientific advancements have been made in addressing these challenges?

इसकी क्षमता पर प्रकाश डालते हुए, संलयन प्रक्रिया से ऊर्जा के उत्पादन और उपयोग के समक्ष आ रही चुनौतियों की विवेचना कीजिए। इन चुनौतियों से निपटने में क्या वैज्ञानिक प्रगति हुई है?

Fusion process refers to the generation of energy ~~that~~ via fusion (collision) to two atoms of hydrogen (usually).

This generates tremendous amounts of energy as it happens in the sun and other stars.

Potential of such technology :-

(i) Only hydrogen required as fuel.

(ii) Completely clean.

(iii) Generous tremendous amounts of energy able to sustain all the needs of humanity even for future.

(iv) Not radioactive waste unlike nuclear fission energy.

(v) Can give rise to new elements like helium that may find some use

later as more research is undertaken

Challenges :-

(i) Uncontrollable amounts of energy.
(ii) One accident so powerful to destroy large parts of planet.
(iii) May give rise to new pollution and hazards as it is used later.
(iv) Huge investments are required into research at nascent stage that poor countries can't afford.

Advancements as yet :-

(i) China has recently unveiled plans and reactor for its research on thermonuclear fusion technology.
(ii) International Thermonuclear Energy Conference (ITEC) has made strides in its research and base in Antarctica are such will be set up for experiments. India is also a part of that.

(iii) Feasibility check is being done to set up such plants on other planets like Mars or maybe Moon. But it is too far fetched as of now.

Given the impact of burning carbon such advancements are necessary to assess and satisfy future needs.

But safety comes first be in thermonuclear fusion or fission technology. Dependence on carbon has to stop and advancement into H_2S, H_2O Fuel cell etc. are welcome and need global cooperation and commitment.

9. Highlight the significance of Gaganyaan mission for India. Enlist various challenges that the mission is likely to face.

भारत के लिए गगनयान मिशन के महत्व पर प्रकाश डालिए। इस मिशन के समक्ष अनुत्पन्न हो सकने वाली विभिन्न चुनौतियों को सूचीबद्ध कीजिए।

Gaganyaan mission is the man-to-space mission for ISRO that has set the target for itself in 2022. Recently there have been some progress on this front such as:-

(1) Pact with Russia ROSCOSMOS for Indian Astronauts to get training at ISS.

(2) Demonstration of Reusable Rocket launch vehicle by ISRO that can go and bring back objects / humans.

(3) Govt's firm commitment and ISRO releasing the statement that it is able on its way to achieve the deadline.

Significance of such a mission:-

(1) Name and glory for to become only the 4th country to be able to do so.

(2) Will bring business and investment for space technology to India.

(3) India can take on research and investments on Moon and Mars etc by humans.

(4) Can such technologies can even be used to bring back soil and such material from other as planets and bodies for study.

Challenges that remain:-

(1) Concerns for a poor country to have priority in space rather than fighting drought/floods.

(2) Requires investment and technical know-how that ISRO

should be away of.

(3) Life of astronauts is always in danger in such missions.

(4) The benefits of that to solve ground problems is not clear.

ISRO has already made a name for itself worldwide and Gaganyaan will be another feather in the cap.

10. Though big data analytics offer opportunities for better policy formulation and improved service delivery to citizens, it also brings with itself many challenges, which the government needs to address. Examine.

यद्यपि बिग डेटा एनालिटिक्स बेहतर नीति-निर्माण और नागरिकों को बेहतर सेवा वितरण का अवसर प्रदान करता है, तथापि यह अपने साथ कई चुनौतियाँ भी लाता है, जिन्हें सरकार द्वारा दूर किए जाने की आवश्यकता है। परीक्षण कीजिए।

'Data' is the new oil for 21st Century as 'The Economist' put it. Big data refers to the data that is so large in quantity (storage) that normal machines (home PCs); softwares (ms excel) can't handle it and sophisticated machines dedicated to this task are required.

Big data Analytics refers to the analysis of such data to bring out meaningful insights for multiple uses. Data mining is also a term used for such techniques.

Opportunities:

(1) Find the missing links between the data.

(2) Use it for medicine, to find people prone to diseases, efficacy of drugs, vaccines, spread of epidemics etc.

(3) Use in economics for finacial and tax administration to catch the tax theft and hoarding and spread of black money. Like Project Insight of Tax authorities after demonetisation.

(4) In security to find vulnerable people and their links.

(5) In IOT and such technologies for better recommendations to buy right products and consume a liked content.

Challenges:

(2) Requires investment into storage infra.

(3) Our IT industry is not research based to lacking in such field.

(3) Universities have still not rolled out specialized branches for studying this unlike US, China where this was done 4-5 years ago.

(4) Govt. regulation and standardisation is required for personal data and privacy issues are also there.

(5) Our service Industry gave the required boom for Indian Economy but it has stagnated now and facing a threat to automation to finish are BPO like jobs. Research and adoption of Big Data analytics in this need of the hour.

11. Elaborate on the concept, methodology and applications of DNA Fingerprinting.

DNA फिंगरप्रिंटिंग की अवधारणा, कार्यप्रणाली और अनुप्रयोगों का सविस्तार वर्णन कीजिए।

DNA fingerprinting is the technology to take DNA samples and use them to identify and match criminals or suspects.

Because fingerprints may fail sometimes and may have been tempered with, DNA profile matching or fingerprinting is more safe and secure for identification.

Govt. has brought in a draft Bill on this ~~to~~ is with following element :-

① Setting up a new authority to regulate

② Keeping of centres / labs to store such DNAs.

③ Destruction of DNA collected after case completed.

④ Using DNA only for this purpose

as per mandated by court/ tribunal in cases of a case.

Applications of DNA fingerprinting

(1) To identify criminals / suspects.

(2) To figure out lineages and hierarchy.

(3) Use genome sketching and find out vulnerable genes to particular disease / epidemic.

(4) Help in somatic cell & technology to reproduce organs.

(5) In Blood transfusion process.

Further explanation:

DNA fingerprinting is based upon the gene that works like a code that tells what protein to produce.

And the levels of protein produced determine constitute and thus

determine our body.
Thus this DNA is most critical part and it's 'can unique and unchangeable for any living organism.

By identification that DNA (sequencing of protein chain) one DNA can be matched to another.
Because it is unchangeable, identification is safe and exact.

misuse of DNA collected can also be done, therefore govt must take ample precaution to limit such use.

12. Highlight the applications of supercomputers. What steps have been taken by India to establish its domestic supercomputing ecosystem? Also, suggest some further steps which can be taken by India in this regard.

सुपर कंप्यूटर के अनुप्रयोगों पर प्रकाश डालिए। भारत द्वारा अपने घरेलू सुपरकंप्यूटिंग पारितंत्र की स्थापना के लिए क्या कदम उठाए गए हैं? साथ ही, इस संबंध में भारत द्वारा उठाए जा सकने वाले कुछ भावी कदमों का सुझाव दीजिए।

Supercomputers are large, complex and sophisticated computers that do a lot more than our usual computers / laptops / smartphones.

Applications of supercomputers :-

(1) In Big data analytics to process large chunks of data easily for various purposes such as medicine, education, business etc.

(2) Do meteorological data study by simulation on large data and multiple equations to factor various elements of nature for it to be able to predict and forecast weather phenomenon.

③ Use to solve artificial intelligence problems in developing complex neural networks.

④ Required in safety checks of in networks for filtering of suspicious information in surveillance.

India has recently launched Pratyush and Mihir as supercomputers that has brought India in the list of elite nations with high supercomputer prowess measured in Flops (Peta byte operations per second)

Starting from establishment of C-DAC in 1961, India has come a long way, further steps to be taken in this regard include:-

① Allow some of them to be used in universities for research and development environment and motivate students by giving them

hands - on.

② Foreign collaboration on further development and safe practices to use.

③ Research into quantum computing, China already leading the way.

④ Sharing and using supercomputers for international diplomacy in regions specifically as South Asia.

13. Compare and contrast fifth generation (5G) of wireless telecom technology with 4G technology. What challenges need to be overcome for 5G's pan-India rollout?

4G प्रौद्योगिकी के साथ पांचवी पीढ़ी (5G) की वायरलेस दूरसंचार तकनीक की तुलना कीजिए और उनके मध्य अंतर बताइए। 5G के अखिल भारतीय क्रियान्वयन हेतु किन चुनौतियों से निपटने की आवश्यकता है?

5-G technology has been unveiled in USA and South Korea with other countries like China soon coming up.

Advancements that come with 5G include:-

(1) Ultra-low latency.

(2) Super fast speed of data transmission upto 1-3 GBPS.

(3) Use of narrow band for extra-transmission.

(4) 24×7 connectivity with too few outbreaks and outages.

(5) Special protocols for fast upload as well as download.

But all of this comes with few challenges as well:-

① India requires 5 lakh crore investment to unravel 5G all over.

② Based on optical fibre connection

③ Requires substation to connect with main via optical fibre. whereas in India we have only 20% as copper fibre and 80% as microwave which is too old.

④ Safety protocols are advanced.

⑤ Technology and equipments need overhaul in all systems.

⑥ Huge imports are required because such telephonic equipments are not manufactured in India.

⑦ Concerns of privacy with such telecommunication coming from China by Huawei company, as raised in the US & Canada.

Scanned by CamScanner

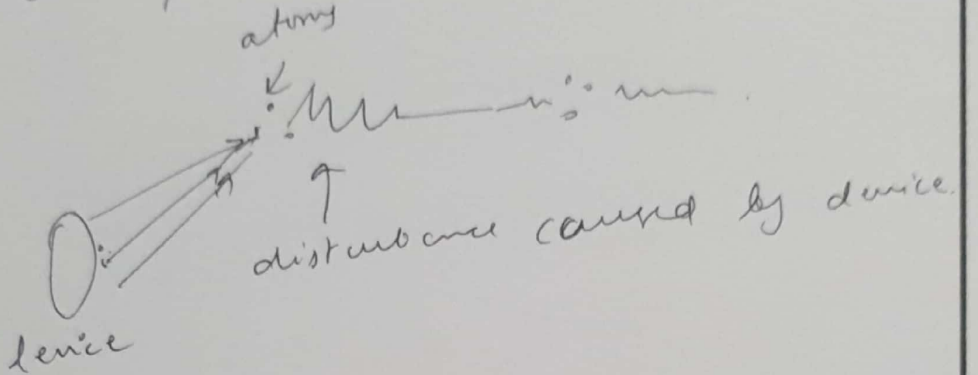
5G has huge applications in IoT and tele-education, tele-medicine and cloud computing. Roll out of this can help many problems of our country via effective use of ICT & and e-governance.

Govt. has already special commission to design strategy for such rollout by 2020. But bad condition of telecom market is a concern because they are mostly in debt due to disruption and excessive spectrum charges and too low consumption charges from consumers due to competition.

14. Explain the concept of optical tweezers and state their working principle. Also, highlight some of their applications.

ऑप्टिकल चिमटी (ऑप्टिकल ट्वीजर) की अवधारणा की व्याख्या कीजिए और उनके कार्यचालन सिद्धांत को स्पष्ट कीजिए। साथ ही, उनके कुछ अनुप्रयोगों पर प्रकाश डालिए।

This year nobel prize has been awarded to the discovery of optical tweezers.



We know that all matters send electromagnetic radiation on acceleration. For subatomic particles and photons such effect is much more observable.

Optical Tweezers uses the concept of ~~ma~~ waves to produce highly effective lasers via ~~gradients~~ motion (tweezing) of such particles at micro-scopic scale.

Although laser also uses the same concept, but optical tweezing is much more exact and effective at minute nano-scale.

Applications:

(1) Effective drug-transmission via radiation.

(2) Chemo-therapy and other cancer relieving technologies can be made more safe and effective.

(3) Making of nano-chips.

(4) Use in satellites and space technologies to study materials.

India must also welcome such innovations and build such R&D environment domestically to allow people to come up with ideas and then do research and later meet market for applications.

For promoting mobility, we can set-up a dedicated committee to make action-plan and sustain the momentum like Institutions of Eminence receiving heavy govt. funding.

15. Though Hydrogen enriched Compressed Natural Gas (H-CNG) fuel is dubbed as a better substitute of CNG, there remain certain challenges in making it commercially viable. Discuss.

यद्यपि हाइड्रोजन समृद्ध संपीडित प्राकृतिक गैस (H-CNG) ईंधन को CNG के बेहतर विकल्प के रूप में जाना जाता है, तथापि इसे व्यावसायिक रूप से व्यवहार्य बनाने में कुछ चुनौतियाँ बनी हुई हैं। चर्चा कीजिए।

H-CNG is dubbed as a better substitute of CNG for its many benefits such as:-

(i) Not very expensive than CNG.
(ii) much reduced pollutants.
(iii) Engine don't require overhaul or change.
(iv) Energy-wise more efficient.

Challenges:

(1) Setting up regulation is difficult hye chances of non-compliance and adulteration in fuel.
(2) Technology and know-how for such fuel is to be developed and checked for

safety.

(3) Hydrogen as a fuel even with CNG requires huge volume by weight, so difficult in transportation.

(4) The changes required in engine, efficiency modulation, vehicle fuel container size, may affect able auto industry already under stress.

(5) May stop the momentum in ~~H-CNG~~ replacing CNG as a fuel which is carbon based.

H-CNG is a welcome step but should be seen as a start to process of decarbonising our fuels.

Further research in bio-methane, bio-ethanol, fuel cells etc. must be continued and ~~strengthened~~ strengthened.

16. Discuss the challenges confronting higher self-reliance and indigenisation of defence industry in India. What steps can be taken to accelerate its pace?

भारत में रक्षा उद्योग के समक्ष उच्च आत्म-निर्भरता और स्वदेशीकरण से संबद्ध चुनौतियों की विवेचना कीजिए। इसकी गति को तीव्र करने हेतु क्या कदम उठाए जा सकते हैं?

Defence Planning Council has been setup to outline an overall roadmap for defence sector in India. One of its recommendation include indigenisation of defence equipments and aims for self-reliance to protect sovereignty.

Challenges in self-reliance and indigenisation :-

(1) Lack of technical know-how
(2) Low manufacturing base.
(3) Absence of private sector participation significantly.
(4) ~~Poor~~ Absence of availability of critical raw materials

which have to be imported otherwise, who supply is not stable.

(5) Industry - govt - academia collaboration is absent in this sector.

Way Forward:

(1) Involving private sector by starting to delegate supply of non-critical and supporting equipments.

(2) All foreign deals to involve technology transfer and self-maintenance.

(3) supply of critical components to be substituted by domestic manufacturing.

(4) Following standard global protocols especially in communication and networks protocol.

(5) set-up a long term action plan and prepare for future.

⑥ Start to sell already developed technology to other countries to generate resources.

⑦ Private collaborations that direct and simple buying.

⑧ Increase defence spending in capital sector.

Defence Acquisition Council, Strategic Private Partnership in defence, Make in India are significant steps to make ourselves self-reliant.

Following recommendations of DPC is essential in to ensure security and indigenisation both in the long run.

Because safety and security of nation can't be compromised with, adequate spending is necessary and too for capital acquisition and creation and not just salaries and pensions.

17. Artificial Intelligence (AI) and robotics can prove to be a game changer in comprehensively improving the primary, secondary and tertiary sectors of Indian economy. Comment. Also, enumerate various policy measures which can help leverage these technologies for furthering our social and economic objectives.

कृत्रिम बुद्धिमत्ता (AI) और रोबोटिक्स भारतीय अर्थव्यवस्था के प्राथमिक, द्वितीयक और तृतीयक क्षेत्रकों में व्यापक सुधार लाने में महत्वपूर्ण परिवर्तक सिद्ध हो सकते हैं। टिप्पणी कीजिए। साथ ही, उन विभिन्न नीतिगत उपायों को सूचीबद्ध कीजिए जो हमारे सामाजिक और आर्थिक उद्देश्यों को आगे बढ़ाने हेतु इन तकनीकों का लाभ उठाने में सहायता कर सकते हैं।

Artificial Intelligence and Robotics are technologies that promote automation and machine based learning and decision-making to ease the work of man and solve complex problems easily and effectively such as in various sectors :-

Primary :

(1) Use in agriculture to detect soil types and recommend right fertilizers, pesticide, herbicide.

(2) Suggest right cropping patterns.

(3) Show effective water sprinkler and pesticide-fertilizer spreaders via robots.

Secondary :-

(1) Automation in manufacturing to ease production and make it fast and problem free.

(2) Design right production processes for effective inventory and supply-chain management.

(3) Gauge market demand well

(4) ~~and~~ Driver-less cars, drones, IoT equipments all need manufacturing sector to level up.

Service sector :

(1) Use in e-governance to reach the needy first and easily.

(2) Effective delivery of service in logistics sector.

(3) Use in forecast and prediction in meteorological phenomenon.

(4) Better financial transactions audit and monitoring.

(5) Banking and digital payments.

(6) Botnet clearing and cyber-security.

Various policy measures include

→ (1) Skill India + Make in India
(2) New Super computers
(3) Cyber security measures by NCIIPC, CERT-in, NCCC.
(4) Setting up committee on AI.
(5) Drone policy and Bill.
(6) Roll out of 5G, committee

AI and Robots are good only in controlled by humans otherwise there are hazards of AI overpowering us for absence of ethics in machines. Loss of jobs and data privacy are other concerns to be away of.

18. Mentioning some its key features, highlight the benefits and applications of Hyperspectral Imaging Satellite recently launched by ISRO.

हाल ही में, ISRO द्वारा प्रक्षेपित किए गए हाइपरस्पेक्ट्रल इमेजिंग सैटेलाइट की कुछ प्रमुख विशेषताओं का उल्लेख करते हुए, इसके लाभों और अनुप्रयोगों पर प्रकाश डालिए।

ISRO recently launched its own-the-top type state-of-the-art HyperSpectral-Imaging-Satellite a first-of-its-kind in the category of Remote Sensing and Geo-mapping.

More will follow this and be useful in various sectors of our socio-economy and security.

Its features include use of multi-spectral imaging to detect and highlight minute details on earth's surface with much more clarity and scope of detection than before.

Benefits and applications:-

(1) For soil health check.

(2) Soil water availability.

(3) Study of landscapes and threats for disaster.

(4) DAM Dams water level monitoring and ~~other~~ similar for river flow and sea-level rise.

(5) For forest canopy measurement and pollution calculation via clouds density and composition mapping.

(6) It can also be used to identify for security by identifying foreign base on border, ~~and too large too~~

Such imaging satellites are increasingly being used by other countries as well to solve complex problems on ground via satellite high-above the sky.

NaVIC, IRNSS, other communication satellites must be used effectively for all sectors. Military satellites launch is also commendable and motivating.

19. What are neutrinos? In the context of India-based Neutrino Observatory project, bring out the significance of studying neutrinos.

न्यूट्रिनो क्या हैं? भारत-स्थित न्यूट्रिनो वेधशाला परियोजना के संदर्भ में, न्यूट्रिनो के अध्ययन के महत्व को प्रदर्शित कीजिए।

Neutrinos are ever present subatomic particles that form the even smaller parts of neutrons and protons.

Some characteristics of neutrinos:-

(1) subatomic and undetectable with eyes or even common microscopes.

(2) Form the sub constituent particle of atomic particles like neutrons, protons as we know.

(3) They are everywhere and infinite in number nearly 65 each second in millions in air.

(4) They are not easily deflected by electromagnetic radiation.

India has decided to set up a neutrino observatory in Tamil Nadu. ~~Some facts~~

associated ~~with~~ such observatory :-

- ~~It~~ is deep below surface of earth, because neutrinos are less in number there and easy to detect.
- Very few countries in world are doing this and India will be like a pioneer in this field having first mover advantage if successful.

~~They~~ There is other significance as well :-

1) help to solve some mysteries surrounding black hole.
2) Radioactivity and other subatomic phenomenon may be more comprehensible.
3) make a research environment in the country, largely stagnant as yet.

4) motivate scientists and researchers to look ~~of~~ towards India.

5) Might be a chance for another ISRO in sub-atomic field research and technology.

Recently govt. is taking many initiatives like ASTROSAT, space based observatory, GROWTH telescope, Deep ocean mission to expand our knowledge in uncharted territories.

It must be kept in mind to use these technologies finally for the welfare of marginalised and the poorest the first.

20. Among others, low R&D expenditure, is a key challenge facing the innovation ecosystem in India. Discuss.

अन्य बातों के साथ, अनुसंधान और विकास पर कम व्यय, भारत में नवाचार पारितंत्र द्वारा सामना की जाने वाली एक महत्वपूर्ण चुनौती है। चर्चा कीजिए।

India stands far poor in Global Innovation Index and 10th in patent filing much below what our population can supply and needs.

Our scientists and engineers have made a mark all over the world but domestically research and innovation has suffered for multiple reasons such as :-

1) Low R&D Expenditure

(i) Only 2.8% spent on education

(ii) research gets below 1%

(iii) Research expenditure is thought as extravagance for a poor county.

(iv) Low salaries for researches and

teachers.

(1) Low and delayed allocation of funds for labs.

(2) Brain drain

(3) Lack of policy support and consistency.

(4) Poor regulation and standardisation thus failing in global standards.

(5) Lack of autonomy and over-centralisation.

(6) Lack of accreditation and regular checking of labs for safety protocols and safe practices.

(7) Lack of environment and thrust overall for bio-tech research, preference to the method of Jack.

(8) Below standard primary and secondary education leading to overall poor quality in higher education and research.

Way Forward:

1) Increase spending as share of GDP.
2) Improve autonomy in allocation and use of funds via effective decentralisation in academic institutions.
3) Improve industry - civil-society-market - academia government institutions collaboration to promote research as a solution.

4) Integrate labs to market directly for their reach to market for self-systenance financially.
5) Improve foreign collaborations and check and reduce 'Brain-Drain'.

Schemes like IMPRINT, STARS, SPARCS, IMPRESS, UAJRA, Atal Mission on Innovation are commendable and sure to give thrust to research and environment in the country. Their use for solving basic problems for Indian society must also be considered sincerely.