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GENERAL STUDIES (TEST CODE : 1064)

Name of Candidate	Jayant Nahata		
Medium Eng./Hindi	English	Registration Number	247939
Center	ONLINE	Date	4/07/18

INDEX TABLE

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

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।

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

Don't write anything this margin (इस भाग में कुछ ना लिखें)

1. Highlight the characteristics and applications of Cyber Physical systems. Also, enumerate the various objectives of the Cyber Physical Systems programme recently launched by the government. **(150 words) 10**
साइबर भौतिक प्रणालियों (साइबर फिजिकल सिस्टम) की विशेषताओं और अनुप्रयोगों पर प्रकाश डालिए। साथ ही, हाल ही में सरकार द्वारा आरंभ किए गए साइबर भौतिक प्रणाली कार्यक्रम के विभिन्न उद्देश्यों को सूचीबद्ध कीजिए।

Cyber-physical systems are those technologies that aim to integrate hardware/physical devices with internet network for augmentation in capabilities.
eg. Pilot assist in aeroplanes.

Characteristics

(1) Amalgamation of internet network & physical systems.

(2) Cutting edge research development

(3) Involves tech like robots, internet of things (IoT) devices, defence systems. ~~like GPS guided cruise missiles etc~~.

(4) They are force multipliers

Applications

(1) Use in defence eg. GPS guidence system in cruise missiles.

(2) Aviation sector eg. Pilot assist.

(3) Robotics & machines in industries networked to internet for collaboration & coordination.

(4) IoT devices

(5) Satellites etc.

Objectives of Cyber physical program

(1) Funding: Increase investments in research via universities, scholarships in cyber physical programs.

(2) Infrastructure development for testing of such systems

(3) Human Resource: Train scientists in this domain & do capacity building.

(4) Private sector collaborations.

Thus, India needs to further pool in efforts in this cutting edge domain to gain superiority over peers!

2. Explaining the rationale behind Geographical Indication (GI) protection, highlight the issues in harnessing the potential commercial benefits of GI in India. **(150 words) 10**

भौगोलिक संकेतक (GI) के संरक्षण के पीछे अंतर्निहित तर्कों की व्याख्या करते हुए, भारत में GI के संभावित वाणिज्यिक लाभों के दोहन से संबंधित मुद्दों और चिंताओं पर प्रकाश डालिए।

The Geographical Indication protection is one part of the global ~~patent~~ intellectual property rights regime.

In India, GI is regulated under the GI Protection Act, 1999.

The Rationale →

(1) Gives protection against 3rd party use → Hence, promotes originality.

(2) Protects the traditional artisans and local products of an area → Additional remuneration!

(3) Gives a 10 year protection which

is subjected to renewal

(3) Can be used for products like agricultural goods, wine, local handicrafts → Promotes culture and saves diversity.

Issues

- Especially for tribals, documentary proof is difficult to produce to show that the product/art belongs to them
- Only name and location is protection, so the good using similar tech can be made by others using different brand.
- ~~Hampers~~ Ambiguity since geographical location ill defined.

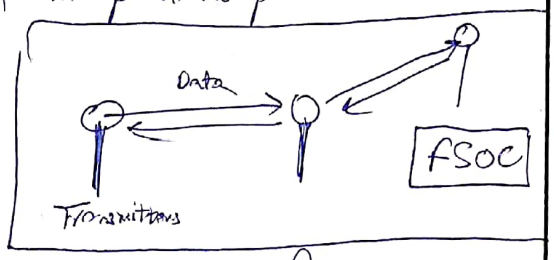
Thus, there's a need to refine the law, make adjustments for marginalised sections, allow for other documents as proofs. Will go a long way in strengthening IPR regime!

3. What do you understand by Free Space Optical Communication (FSOC) Technology? Critically explain its potential in connecting rural and remote areas in India.

(150 words) 10

फ्री स्पेस ऑप्टिकल कम्युनिकेशन (FSOC) प्रौद्योगिकी से आप क्या समझते हैं? भारत में ग्रामीण और दूरस्थ क्षेत्रों को जोड़ने में इसकी क्षमताओं की आलोचनात्मक व्याख्या कीजिए।

FSOC is a new innovation in ~~the~~ Communication technology using line of sight data transfer. Recently, FSOC is being deployed in Andhra Pradesh in partnership with a private firm.



Features

(1) Uses direct ~~big~~ line of sight communication network.

(2) No need of broadband/ spectrum allocation

(3) Cheap in ~~setting~~ up & expansion

(4) Used in all weather conditions.

(5) Ultra fast

It is just ~~like~~ how optical fibres transmit data using light however unlike it, ~~it~~ this doesn't require laying down

the expensive fibre cable networks hence expanding the scope of its deployment especially in rural areas.

Cons

(1) There might be some disturbances in network since the transmitters are placed over ground ~~if it dep~~

(2) Depends on line of sight thus limiting distance.

(3) Fear of stealing of expensive equipment unlike optical cables.

Way forward

The technology shows huge promise to disrupt the connectivity challenge. It should be used as part of Bharat Net project in its next phase for connection to all 2.5 lakh panchayats.

4. What are Orphan Drugs? Examine the significance of putting in place a policy framework for such drugs in a developing country such as India.

(150 words) 10

ऑर्फन ड्रग्स क्या हैं? भारत जैसे एक विकासशील देश में ऐसी दवाओं हेतु एक नीतिगत ढांचा स्थापित करने के महत्व का परीक्षण कीजिए।

Orphan drugs are a classification of drugs by WHO (World Health Organization) as those which don't receive major funding in Research & Development.

Because →

① Mostly for diseases belonging to tropical countries

② Thus, West doesn't fund programs sufficiently. While developing countries of tropics don't have funds.

However, they hold huge importance for countries like India because →

① Massive impact of a single drug in (Orphan category) because of huge population.

② Neglected Tropical diseases (NTD's) like Malaria, Encephalitis etc. Kill millions of people in tropical regions.

③ Can be utilized by our Generic Industry to supply to African nations as well → foreign exchange earning!!

④ Decrease the losses to GDP & to human capital.

In this respect, the way forward is →

① Collaborate with other tropical nations to set up joint research parks.

② Involve private sector & incentivise RnD.

③ Pump in more funds for research → India spends only 0.7% of GDP while China does 2.0%.

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5. Highlight the factors that give advantage in attracting talent to a particular country. In this context, what steps should the government take to turn "brain drain" into "brain gain" in India? **(150 words) 10**
उन कारकों पर प्रकाश डालिए जो किसी विशेष देश को प्रतिभा को आकर्षित करने में बढ़त प्रदान करते हैं। इस संदर्भ में, भारत में "ब्रेन ड्रेन" (प्रतिभा पलायन) को "ब्रेन गेन" (प्रतिभा लाभ) में परिवर्तित करने के लिए सरकार को क्या कदम उठाने चाहिए।

Brain drain has been a hot public issue debated in India. It involves the loss of intellectual/educated Indians to foreign countries due to many factors.

Factors germane to attracting talent

(1) Valuing Merit & Excellence by the institutions rather than excessive focus on reservations.

(2) Funding to Research and Development → India (0.7% GDP) & China (2% GDP)

(3) Economic opportunities → Presence of White collar jobs commensurate to demand.

(4) Push factors like lack of infrastructure in universities, low income package/salaries etc.

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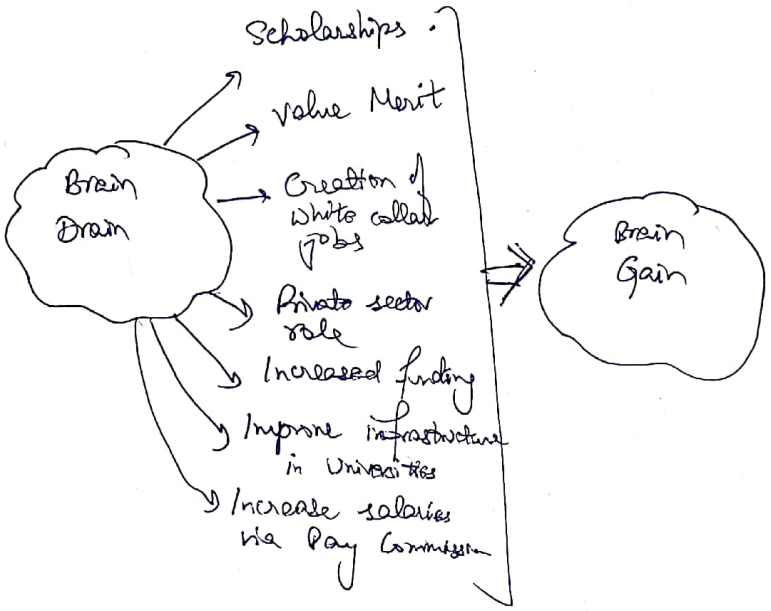
(5) Opportunities to rise up the ladder of income.

(6) Respect for educated class.

Steps to be taken



Government is already moving in this direction via programs like PM Research fellowship (Rs. 75000/month), VAJRA (Visiting Advanced Joint Research Assistantship), INSPIRE fellowship, proposal to replace UGC by HECI etc.

All these steps would lead to turn ~~out~~ around slowly!

6. What are quantum computers? Discuss their potential in solving problems that are too complex for today's classical computers. **(150 words) 10**
क्वांटम कंप्यूटर क्या हैं? उन समस्याओं को हल करने में इनकी क्षमता पर चर्चा कीजिए जो वर्तमान के क्लासिकल कंप्यूटरों के लिए अत्यधिक जटिल हैं।

Quantum computers are advanced computers using sub-atomic particles for processing. Qubits are used in such computing. These unlike binary 0 or 1 can occupy the 0/1 states simultaneously & hence →

1) Perform very complex tasks
2) Rapid processing of large data
3) Churn in large statistical observations

They have a huge potential in applications like →

① Quantum Communication
Used in satellites recently by China's Micius sat for very secure & un-hackable communication.

(2) Dynamic modelling of molecular mechanisms → Boost to biotechnology & pharma sectors

(3) Used in Meteorology for predicting cyclone, floods etc much in advance than super-computers today by Meteorological department → SAVE LIVES.

(4) Do complex simulations of missile tests, Satellite launches etc.

(5) Help us know more about the universe churning vast data related to it.

Thus, the scope is huge!
India is making a nascent start whereas China/US are leading the race. We should not miss the bus & start investing in this futuristic technology.

7. Discuss the obstacles in women's access to science education in India and also suggest remedial measures to overcome these obstacles.

(150 words) 10

भारत में विज्ञान की शिक्षा तक महिलाओं की पहुंच के मार्ग में आने वाली बाधाओं पर चर्चा कीजिए और इन बाधाओं को दूर करने के लिए उपचारात्मक उपाय भी सुझाइए।

Science education, like all other spheres of public life has institutionalised discrimination against women because of entrenched notions of patriarchy etc.

This leads to a poor representation of 'Women in Science'

Obstacles

(1) Though enrollment rates at primary level are nearing 100%, the enrollment at higher education is only around 25% with a skewed ratio against women.

(2) Patriarchal mindset stops women from pursuing higher education.

(3) Norms that women need to manage families, leads to them dropping out their careers.

(4) Salaries for women are often not equal to men → Subsistence becomes difficult. (5) Sexual harassment at workplace

This is alarming trend. Urgent steps are needed.

*Remedial Measures

1) Focus on increasing the gross enrollment ratio at secondary level & tertiary level for women.

2) Fight patriarchy via gender sensitization → awareness campaigns, ads etc.

3) Scholarships targeting women talent like INSPIRE program, should be enhanced.

4) Sexual harassment to be tackled → SHE boxes for grievance redressal

Only when women are involved & active participant in the development of nation can we think of a SUPERPOWER status!

8. With the help of examples from various fields discuss the achievements and limitations of India's performance in indigenisation and development of new technology. Also, comment on the significance of MSME sector in achieving indigenisation of technology. **(150 words) 10**

विभिन्न क्षेत्रों के उदाहरणों की सहायता से, नई प्रौद्योगिकी के स्वदेशीकरण एवं विकास में भारत के प्रदर्शन संबंधी उपलब्धियों और सीमाओं पर चर्चा कीजिए। साथ ही, प्रौद्योगिकी के स्वदेशीकरण को प्राप्त करने में MSME क्षेत्रक के महत्व पर टिप्पणी कीजिए।

Indigenization of technology is key to accelerate India's economic growth and prevent from vulnerabilities of external shocks.

Examples of indigenization

★ Achievements

1) ISRO has been developing technologies like →
   - Li-ion batteries recently (E-vehicle application)
   - IRNSS (Regional Navigation)
   - Mars Orbiters (MOM)
   - Cryogenic Engine etc.

2) DRDO has been working on indigenous tech like →
   - Integrated Missile Development Program (Agni, Trishul, Prithvi, Nag etc)

③ Generic pharma industry

④ Recently ROTOVAC vaccine for diarrhoea.

*Limitations

1) Still importing silicon wafers / PV modules from China → Solar industry.

2) Key defence ~~technologies~~ like submarines, S-400 trimf, armed drones from USA.

3) Vaccines like Glenvac for cancer, ~~etc~~. deboraud & Bedaquiline for TB. etc.

Significance of MSME

1) Contributes to 40% of exports so huge role

2) With funding, they can manufacture PV modules in India too.

3) A large workforce is employed here.

4) Engineering goods are already indigenised tech & exported ~~to~~ ~~of~~ outside.

Thus, there's a need to step up indigenization, role of MSME is crucial in this endeavour!

9. India needs to collaborate and participate in international scientific projects in order to place itself as a major player in cutting edge research. Discuss in the light of ongoing global mega science projects. **(150 words) 10**
कटिंग एज रिसर्च में स्वयं को एक प्रमुख प्रतिभागी के रूप में स्थापित करने हेतु भारत को अंतर्राष्ट्रीय वैज्ञानिक परियोजनाओं (इंटरनेशनल साइंटिफिक प्रोजेक्ट्स) में सहयोग करने और भाग लेने की आवश्यकता है। वर्तमान में वैश्विक स्तर पर जारी मेगा साइंस प्रोजेक्ट्स के आलोक में चर्चा कीजिए।

Collaboration is the key in today's world as the technologies get complex and the cost/manpower required gets increasing.

Examples

① CERN → Higgs Boson (Large Hadron Collider)

- Multi-national physics experiment happen here.
- Indian Universities also took part.
- Helps in understanding of the universe
- Indian Collaboration/participation received praise. ~~Also ...~~
- Helps in developing cutting edge equipments like telescopes, observatories, carrying out fundamental particle physics research etc.

(2) Human Genome Project
- Multi-national program to sequence the human genome / biotechnology frontiers etc.
- India didn't participate, thus we lost opportunity to gain insights into new gene sequencing techniques, funding for research, best partners that could have collaborated..

(3) LIGO
- Laser interferometer Gravitational Wave Observatory.
- India also has plans to set up one here.
- Will establish us in this cutting edge research to uncover secrets of the universe.

(4) Neutrino observatory @ Pottipuram Hills.

Thus, India should step up collaboration to place itself ahead in cutting edge research to solve problems of mankind!

10. What is Mitochondrial Replacement Therapy? Discuss its potential in reducing genetic disorders. Also, list various issues around its use in fertility medicine. **(150 words) 10**

माइटोकॉन्ड्रियल रिप्लेसमेंट थेरेपी क्या है? आनुवांशिक विकारों को कम करने में इसकी क्षमता पर चर्चा कीजिए। साथ ही, फर्टिलिटी मेडिसिन (प्रजनन चिकित्सा) में इसके उपयोग से जुड़े विभिन्न मुद्दों को सूचीबद्ध कीजिए।

Mitochondrial Replacement Therapy or MRT is a technique through which defective mitochondria from a patient is replaced using healthy mitochondrial nucleus & placing it in the patient's cell.

Potential

- Recently, UK allowed 3 parents baby using MRT technology.
  - Helps prevent carry forward of defective genes from mother to the child.
  - otherwise led to fatal diseases.
- Genes which are defective & present in mitochondria can be replaced easily.
- No Ethical challenge as majority (> 99%) genes are from biological mother/father, rest fraction is from donor.

Issues

- Ethical challenges, though less, are still a roadblock.
- It is an expensive technology so issues of equity come in.
- Success rate is still not very high so reliability factors.
- Regulatory / Legal barriers present in India.
- Individual hesitatance to using MRT

MRT is a revolution in medicine. Necessary research funding & enabling regulations are need of the hour.

11. The rapid diffusion of Artificial Intelligence begets unique opportunities and challenges for India. Discuss. What can be done to address these challenges? **(250 words) 15**

आर्टिफिशियल इंटेलिजेंस (कृत्रिम बुद्धिमत्ता) का तीव्र प्रसार, भारत के लिए विशिष्ट अवसर और चुनौतियां उत्पन्न करता है। चर्चा कीजिए। इन चुनौतियों का समाधान करने के लिए क्या किया जा सकता है?

Artificial intelligence (AI) is the intelligence acquired by machines. Has the potential to disrupt the way we live, work & interact!

Opportunities

1) Take up menial & laborious tasks & leave only human aspects / rewarding jobs - eg. Scavenging ops.
2) Supplement efforts to increase productivity.
3) AI in defence technology like radars, drones, weapons can be a force multiplier.
4) AI in business like chat bots could push growth & expansion.
5) AI has potential to be the third factor of production apart from capital & labour.
6) AI in education → AI assisted teachers in rural areas.

Challenges

1) Unlike previous disruptions like steam engine or computers, AI can wipe out not

only low class but middle class jobs. Can lead to mass social unrest.

2) AI bias / stupidity can cause us lives!

3) AI in defence is ethical challenge.

4) Singularity → phase when AI replaces humans.

5) AI can turn against humans! → Apocalypse

~~Steps~~

~~1) Create a conducive regulatory environment~~

6) AI tech requires high skilled human capital whereas India lacks behind.

Steps

1) Create a conducive regulatory environment
- have ethicists in AI labs / funding to AI.

2) Step up funding in RnD → Only 0.7% of GDP currently vs China (2%)

3) Education system → Computer Science to be introduced compulsorily from secondary education

(4) Incentives to industry to research on AI & incorporate it to 'supplement' human labour.

(5) Regulations to be framed carefully to avoid mass unemployment -
Eg. Restrictions on self-drive cars to save driving jobs.

In this multi-pronged approach, we can aim to utilise/savour the fruits of AI while gearing up to its challenges.

12. Briefly explain the concept of Additive Manufacturing as well as its advantages and challenges in comparison with conventional manufacturing methods. Also, comment on its potential in terms of revolutionising organ replacement in humans. **(250 words) 15**

ऐडिटिव मैन्युफैक्चरिंग (योजक विनिर्माण) की अवधारणा की संक्षेप में व्याख्या कीजिए, साथ ही परंपरागत विनिर्माण विधियों की तुलना में इसके लाभों और चुनौतियों को भी बताइए। साथ ही, मनुष्यों में अंग प्रतिस्थापन में क्रान्तिकारी परिवर्तन लाने के संदर्भ में इसकी क्षमता पर टिप्पणी कीजिए।

Additive Manufacturing implies technologies like 3-D & 4-D printing which can manufacture objects rapidly using multiple base materials in a pre-designed layout.

Advantages

(1) Materials like plastic etc. can be used after melting.

(2) Multiple design options

(3) Its very portable → Small 3-D printers are now at International Space Station.

(4) Can be used on-site manufacturing. eg. Construction of houses in China (robot based)

(5) Its Cheaper

(6) Doesn't require advanced knowledge to operate.

(7) Automation is inbuilt → Very efficient

Challenges

(1) Heavy equipments & tools still out of scope.

(2) Only limited materials can be used → Those which can be easily melted.

(3) Engineering goods, heavyweight capital goods can't be made.

(4) Still, a nascent technology.

Potential in Organ Replacement

(1) Manufacturing of scaffolds is easy & possible in labs.

(2) Organs like bones, knees (for knee replacement surgery) can be manufactured.

(3) Recently, even tissues ~~can be~~ are being used to make epithelial cells (skin), ears, nose etc.

Thus, additive manufacturing is a cutting edge development. More focus is to be given to further develop this technology & use in our industry!

13. What is the Human Genome Project–write (HGP-write) and how is it different from the earlier Human Genome Project (HGP)? In this context, also critically explain the potential benefits of the HGP projects for healthcare activities in India. **(250 words) 15**

ह्यूमन जीनोम प्रोजेक्ट-राईट (HGP-write) (मानव जीनोम परियोजना-राईट) क्या है और यह पूर्ववर्ती ह्यूमन जीनोम प्रोजेक्ट (HGP) से किस प्रकार भिन्न है? इस संदर्भ में, भारत में स्वास्थ्य देखभाल गतिविधियों के लिए HGP के संभावित लाभों की आलोचनात्मक व्याख्या भी कीजिए।

Human Genome Project was an ambitious program initiated by USA with the objective of sequencing the entire human genome.

- Helped to sequence the 1st Human Genome completely.
- Developed rapid gene sequencing technologies
- Increased understanding of the basic unit of life → DNA as well as RNA.

HGP-write aims to further develop on the HGP program. ~~Earlier~~.

Potential benefits

(1) Big boon to pharmaceutical sector
- Personalised medicine based on genetic makeup can be developed

(2) Gene editing using CRISPR-Cas will be better deployed once full knowledge of genome is there
- Help treat genetic disorders
- Designer babies can be developed

(3) Biotechnology sector → Companies like BIOCON will be benefited

(4) Given the anti-microbial resistance, new therapies based on genes i.e gene therapy can be deployed to treat vast number of diseases.

In this way, HGP holds a huge significance to India.

Wf

1. Increase funding to HGP research.
2. Collaborate in science projects at International level.
3. Regulations to be suited to faster innovation
4. Patent regime to be strengthened to incentivise RnD.

14. Comment upon the need for encouraging participation of private players in the space sector in India. Can it be argued that furthering India's achievements in the space sector requires a comprehensive space law? **(250 words) 15**

भारत में अंतरिक्ष क्षेत्रक में निजी प्रतिभागियों की भागीदारी को प्रोत्साहित करने की आवश्यकता पर टिप्पणी कीजिए। क्या यह तर्क दिया जा सकता है कि अंतरिक्ष क्षेत्रक में भारत की उपलब्धियों को आगे बढ़ाने के लिए एक व्यापक अंतरिक्ष कानून की आवश्यकता है?

Space sector, unlike other sectors has remained a traditional domain of government even after the new economic policy (NEP) of 1991.

Need for private participation

(1) Develop an indigenous space industry
- Help to indigenize technologies
- capture the $5-3 bn space launch market
- Reduce dependance on foreign countries like France (Ariane), Russia (Glonass) etc.

(2) Channelise greater funding to space given limited resources at the disposal of government → Annual ISRO budget → ~Rs. 10,000 crore only.

(3) Private sector can readily form Joint Ventures & bring in new technologies

(4) Mass production & launch of satellites.

- Now Space Secretary has said all PSLV's will be manufactured by private sector by 2020.

(5) Global trends as Model

U.S.A has huge private sector participation in the form of Elon Musk's SpaceX, Virgin Galactic etc. They have immensely benefited.

(6) Take the load off ISRO for manufacturing tasks & leave it for only RnD sector.

India's space sector does need a comprehen-sive law →

(1) National security strategy remains disjointed → Needs to be integrated given China's space weaponisation.

(2) Private Sector role to be enhanced

(3) Human Space program to be aimed at in the near future.

(4) furthering the scope of international collaborations.

(5) Pursuing space diplomacy eg. GSAT 7 i.e South Asia Satellite should be a goal

(6) Holistic development of the sector building upon already stupendous achievements.

15. Water shortage in India has been sought to be addressed through various policy and technological interventions. Explain. Also, examine the benefits of desalination technology and the costs associated with it. **(250 words) 15**
भारत में विभिन्न नीतिगत और तकनीकी उपायों के माध्यम से जल की कमी की समस्या का समाधान करने के प्रयास किए जाते रहे हैं। व्याख्या कीजिए। साथ ही, विलवणीकरण प्रौद्योगिकी के लाभों एवं इससे संबद्ध लागतों का परीक्षण कीजिए।

Water shortage has become critical with NITI Aayog's latest report pointing to the worst ever water crisis affecting 60 crore Indians.

Water shortage can be addressed →

* Policy actions / Technology interventions

1. Groundwater Management Bill needs to come up into action → India's 70% water needs are fulfilled from here.
   - Aquifer mapping needs to be done via remote sensing technology.
2. Wastewater management needs to become a priority.
   - Recent, LOTUS project with Netherlands to treat Barapullah drain via biotechnology is a welcome step.

3. Rainwater harvesting needs to be prioritised.

4. Water use efficiency to be increased especially in agriculture using micro-irigation → Partnering with Israel already.

5. River basin management

6. Inter-linking rivers eg. Ken-Betwa linkage

7. Reuse water & Recycle it

8. Desalination of seawater (on pilot) being attempted

9. Rejuvenation of traditional water storage structures eg. Tanks in South India, Baolis in Rajasthan.

Desalination Technology holds promise

Benefits

① Can utilise potentially unlimited sea water for daily use as well as drinking.

② Israel has already tapped this tech to recycle 90% of its water.

③ Can end water shortage for coastal populations.

Costs

① Very costly technique

② Equity issues since poor can't afford

③ Huge infra required

④ Technology is still nascent in India

Urgent steps need to be taken to get us out of water crisis facing us today!

16. Originally devised as a distributed ledger technology for Bitcoin, Blockchain offers a wide range of applications across sectors, especially banking and finance. Discuss. **(250 words) 15**

मूलतः बिटकॉइन के लिए एक डिस्ट्रीब्यूटेड लेजर टेक्नोलॉजी के रूप में प्रकल्पित (इज़ाद), ब्लॉकचेन विविध क्षेत्रकों, विशेष रूप से बैंकिंग और वित्त में विभिन्न प्रकार के अनुप्रयोग प्रस्तुत करती है। चर्चा कीजिए।

Blockchain is a distributed public ledger which is based on cryptography for secure record keeping and transactions between individuals.

Originally, the blockchain technology became popular with the rise of Bitcoins which had Blockchain at its back-end.

Features of Blockchain

(1) Distributed network → Trust!
(2) Cryptographic technique → Can't be tampered
(3) Low-cost as no intermediates required
(4) Very fast transactions for some reasons.

Blockchain because of its features has wide applications →

(1) Used in banking & finance →

- For records of financial transactions such as deposits received, loans sanctioned, mortgaged properties, interest payments etc.
- Helps in easy/quick fraud detection.
- Help fight Non-Performing Assets problem.
- Self-accountability & audit
- Low cost of transactions so decreased interest costs to borrowers → Economic growth!
  eg. Axis bank recently incorporate it (on pilot basis)

(2) Use in land records

- Land titling will be easier.
- Land ceilings can be complied with

(3) Benami Transactions can be identified.

(4) Income Tax records will be easy to scrutinize → Prevent tax evasion

(5) Enforce Intellectual Property Rights

(6) Communication technology can be boosted

Thus, blockchain has myriad applications, there's a need to incorporate it to increase productivity across industries!

17. What do you understand by TRIPS plus provisions being advocated by developed countries outside the WTO based TRIPS agreement? Do you think India should show some flexibility and incorporate certain TRIPS plus provisions in its IPR regime? **(250 words) 15**

विकसित देशों द्वारा WTO आधारित ट्रिप्स (TRIPS) समझौते से बाहर अनुशंसित किए जा रहे ट्रिप्स-प्लस प्रावधानों से आप क्या समझते हैं? क्या आपके विचार से भारत को कुछ लचीलापन दिखाना चाहिए एवं अपनी IPR व्यवस्था में कुछ ट्रिप्स-प्लस प्रावधानों का समावेश करना चाहिए?

Intellectual property rights (IPR) are a set of legal provisions used to protect the originality and maintain ownership with the creator.

TRIPS agreement was a landmark agreement on IPR agreed & ratified to by almost all members of the WTO (World Trade Organization) as part of Doha Rounds. Currently India is fully compliant with its provisions. We made changes in our patent laws substantially. For eg. Incorporation of the concept of 'product' patent rather than the 'process' patent earlier.

Recently, developed countries especially USA & Japan (the latter as part of RCEP negotiations) are forcing India to adopt TRIPS plus provisions. • These are a set of extra, stricter rules to strengthen the existing TRIPS regime.

- Include provisions for secondary patents a.k.a evergreening of patents
- These include provisions for patents of even minor variants showing little change in bio efficacy.

Pros

1. Will help negotiate other concessions from developed countries in return.
   Eg. Freer access to their markets for our services or movement of skilled professionals
2. Help boost innovation & R&D investments
3. Increase the portfolio of patented pharma products available to Indians consumers.

Cons

(1) Will lead to evergreening of patents on pharma/medical products thereby hampering access to cheaper generics

(2) Indian consumers ~~need~~ bereft of cheaper drugs

(3) They are anyway outside WTO mandated TRIPS to which we are compliant.

(4) Expropriation of profits by global MNCs.

Thus, given that the cons of accepting are detrimental to India's interests, we should ally with other countries like China to push back such demands of TRIPS+.

Don't write anything this margin (इस भाग में कुछ ना लिखें)

18. What do you understand by Digital therapeutics? Discuss the opportunities & challenges of Digital Therapeutics specifically in context of preventing lifestyle diseases in India. **(250 words) 15**

डिजिटल थेराप्यूटिक्स (चिकित्सा शास्त्र) से आप क्या समझते हैं? विशेष रूप से, भारत में जीवनशैली से संबंधित रोगों की रोकथाम के संदर्भ में डिजिटल थेराप्यूटिक्स के अवसरों एवं चुनौतियों पर चर्चा कीजिए।

Digital therapeutics are digital/electronic devices used for augmenting medical care to patients.
for eg. Diabetes monitor via glucose sensitive chip inside patients arm.

Opportunities

1) Revolutionary way to increase/augment medical treatment along with conventional medicines.

2) Help to inform patients & doctors of vital body parameters like glucose, WBC, temperature levels → lifestyle diseases prevention

3) Intervene to nudge patients to take medicines at right time or to adopt healthy lifestyle practices.

4) Convenient
5) Easy access across multiple devices & to far off doctors → Telemedicine in rural areas.

Challenges

1) High cost is a barrier especially for poor & lower middle income groups.
2) Not tested completely to verify accuracy
3) Regulatory framework to inhibit development & practical mass use.
4) Patient's inhibitions in use of new technologies.
5) Privacy is a concern since data gets sent to internet connected devices.
6) Bio-Compatibility an issue
7) Availability in developing markets like India

Hence, we see that there are both vital challenges & opportunities in this technology. We need to evolve a set of suitable regulatory framework, invest in RnD to verify its advantages and bring down costs to truly usher in a revolution.

19. The efforts to improve science and R&D in India need to go beyond questions of expenditure. Comment. **(250 words) 15**

भारत में विज्ञान तथा R&D को उन्नत बनाने के प्रयासों को व्यय के प्रश्नों से परे जाने की आवश्यकता है। टिप्पणी कीजिए।

India lags far behind its peers (BRICS) and developed nations in the field of Science and RnD.

Most Scholars point to the low expenditure by India as the primary cause → India spends only 0.7% of GDP whereas China spends nearly thrice at 2.1% of GDP.

However, even with small budgets wonders can be done, so the efforts to improve current scenarios in science need to go beyond questions of expenditure.

(1) Firstly, Countries like Israel, the size of Kerala, with much smaller budgets have far advanced RnD Sector thus its not about expenditure alone.

(2) The current spending is mostly driven by government & not private sector which is opposite to what exists in developed countries.
The private sector should take initiatives.
eg. Tata Institute of fundamental Research (TIFR) is a model.

(3) Even the current spending by government is to select few ~~sects~~ sectoral organizations led by DRDO (for defence), ISRO (space), BARC (nuclear science) etc.
We need to diversify.

(4) The role of universities in research is not praiseworthy either. More research funding, autonomy, industry - university collaborations should happen.
eg. BMW has partnerships with German Engineering Institutions.

(5) Investment needs to go in a concentrated fashion to achieve outcomes rather than thinning out resources.

Thus, it is about setting priorities, diversification, providing private sector and universities to step up their role. Only then India can aim to break into the top league of nations. Recent, Global Innovation Index India's ranking improved to 60 after 5 long years so its a positive sign. Long way to go!

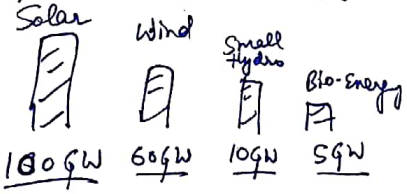
20. Adopting a mission mode approach for developing energy storage systems will be crucial for realizing India's electric mobility ambitions as well as achieving our renewable energy targets. Analyze. **(250 words) 15**

भारत की इलेक्ट्रिक मोबिलिटी महत्वाकांक्षाओं को साकार करने एवं साथ ही हमारे नवीकरणीय ऊर्जा लक्ष्यों को प्राप्त करने के लिए, ऊर्जा भंडारण प्रणालियों (एनर्जी स्टोरेज सिस्टम्स) का विकास करने हेतु एक मिशन मोड दृष्टिकोण को अपनाना महत्वपूर्ण होगा। विश्लेषण कीजिए।

India on its path to fulfill the Intentionally Determined National Contributions (INDC's) to paris climate accord as well as to achieve self-sufficiency in fuel requirements has adopted two goals →

1) Electric Mobility Vision 2030 → To shift to electric vehicles completely by 2030 (EV)

2) 175 GW renewable energy targets by 2022



For both of these missions, developing energy storage systems is crucial.
A mission mode approach is needed.

Reasons

(1) Renewable energy once produced has to be stored for use later as instant consumption is not feasible.

(2) Since solar, wind etc. suffer from vagaries of nature, there's a need to store energy at times of low production.

(3) Since, the targets are very ambitious, a mission mode approach is needed.

a) Faster Adoption and Manufacturing of Electric Vehicles (FAME) program of government aims to push in funding for associated EV technologies such as energy storage systems. There's a need to push in more funding.

b) Timeline based approach is required eg. Using a sun-set clause on government funding.

c) Partnerships with multi-nationals for faster tech transfers.
eg. TESLA's Power Wall is a revolutionary energy storage device recently launched.

d) Coordination among various departments like Ministry of Heavy Industries, Ministry of Power, Ministry of New & Renewable Energy.

e) Collaborate with private players etc.

Thus, a mission mode approach is needed to fulfill the twin goals!