



An Institute for Civil Services

INTERVIEW GUIDANCE SERIES

IAS
2024

SELF MOCK QUESTIONS

SCIENCE &
TECHNOLOGY (PART-1)

for UPSC INTERVIEW PREPARATION



An Institute for Civil Services

INTERVIEW GUIDANCE PROGRAMME 2024

Give **Mock Interview** with the **India's Most Eminent Panel**
of **Acclaimed Civil Servants & Academicians**



Dr. J. N. Singh
Retd. IAS,
Former Chief
Secretary Gujarat



U Venkateswarlu
Ex. Chief
Secretary,
Tripura



R.P. Sinha
Retd. IAS,
Former Secretary,
Govt. of India



Akhil Shukla
Ex DGP,
Tripura



Sumeet Jerath
IAS (Retd),
Former Secretary,
Govt. of India



Dakshita Das
Former Additional
Secretary,
Govt. of India



B.K. Pandey
IES,
Former Adviser -
Niti Aayog



S.B. Singh
Well known
IAS Interview
Mentor



S.D. Muni
Member
Exe. Council,
IDSA



Sudhir Tiwari
Ex. Additional
Secretary, Gol



Dr. N.K. Sahu
IES,
Former Joint Secy.
HRD Ministry



Manoj K. Jha
Director,
GS SCORE



Anurag Mishra
Ex IIS
Chief Editor
Yojna



Devi Prasad
IES, Celebrated
Budget & Economic
Survey Expert



K.D. Singh
IFoS, Ex Principal
Conservator of
Forests



Prof. C. Mahapatra
Ex. Prof,
International
Relations

To get Customized
Questionnaire on your DAF &
Contemporary issue notes

Mail Your **DAF** at
daf@iasscore.in
or

REGISTER AT



For any query call at **9899448458**

SCIENCE & TECHNOLOGY (PART-1)

1. INDIA & THE PROBLEM OF 'DEEPAKE'

- Q. What are deepfake? Why they have become a significant problem, especially in the context of India's evolving technology landscape?
- Q. India currently lacks specific laws addressing deepfakes. How do you think the existing provisions under the IT Act could be applied to combat the challenges posed by deepfakes, and what are the limitations of this approach?
- Q. Given the complexity of the issue, what collaborative strategies and measures do you believe are essential for tackling the deepfake problem in India? How can various stakeholders, including government bodies, tech companies, and civil society, contribute to a comprehensive solution?

2. ISRO'S STELLAR SUCCESS

- Q. Can you provide an overview of ISRO's recent achievements, particularly focusing on the successful Chandrayaan-3 mission and the precision deployment of Aditya? What significance do these accomplishments hold for India's space exploration endeavors?
- Q. The Chandrayaan-3 mission targeted a landing on the lunar South Pole, known for its challenging terrain and extreme conditions. What were the specific challenges faced by ISRO in landing on the South Pole, and how did they overcome these obstacles?
- Q. The success of Chandrayaan-3 is not only a national achievement but also elevates India's global standing in space exploration. How do you think ISRO's success can inspire and influence other countries, particularly in the Global South?

3. INDIA'S SPACE SECTOR

- Q. How do you see India's journey in space exploration? Can you provide overview on its current standing in the global space community?
- Q. How has the inclusion of private players contributed to the growth of the Indian space ecosystem?
- Q. In what ways has the increase in space exploration impacted various sectors like meteorology, energy, telecommunications, insurance, transport, maritime, aviation, and urban development?
- Q. Can you highlight specific examples where space technology has led to increased efficiency in these sectors?

- Q. How has the government's encouragement of private players attracted investment in the space sector?
- Q. Can you provide examples of Indian space tech businesses and startups that are leading the way in revolutionizing the industry?

4. FLEX FUEL VEHICLE

- Q. Could you explain what sets a flex-fuel vehicle apart from regular petrol or diesel vehicles? Specifically, what makes the Innova Hycross by Toyota unique as the world's first BS6 Stage II-compliant flex-fuel vehicle?
- Q. How do flex-fuel vehicles operate, and what are the key components that differentiate them from conventional petrol-only cars? Can you elaborate on the modifications required in a flex-fuel vehicle to accommodate ethanol or methanol as alternative fuels?
- Q. What are the notable advantages and disadvantages associated with flex-fuel vehicles? How do these factors contribute to or hinder the widespread adoption of flex-fuel technology?

5. RISKS AND ALTERNATIVES OF CHATGPT

- Q. What is chatGPT? How does it leverage GPT-3 and GPT-4 to enhance conversational capabilities in comparison to previous models?
- Q. As with any AI technology, ChatGPT raises concerns such as security, data leakage, confidentiality, and liability. Can you elaborate on these concerns and discuss how they might impact the adoption and usage of ChatGPT in various applications?
- Q. Given the concerns related to ChatGPT, what alternative approaches or mitigation strategies could be implemented to address issues like data security, confidentiality, and compliance with international laws? How can developers and organizations ensure responsible and ethical use of such AI technologies?

6. SPACE DEBRIS

- Q. Can you provide an overview of the space debris issue, including its composition involving both natural meteoroids and human-made orbital debris?
- Q. How has the frequency of satellite launches increased over the years, contributing to the growing challenge of space debris?
- Q. What are the threats posed by the escalating amount of orbital debris, and how does it affect space vehicles and the environment, including issues like light pollution and alumina deposition?
- Q. According to international law, who bears the responsibility for damage and harmful interference caused by space debris, based on treaties and conventions from 1967 to 1972?
- Q. Can you highlight some initiatives that have been undertaken to address the problem of space debris, including organizations like the Inter-Agency Space Debris Coordination Committee and specific missions like ClearSpace-1 (launching in 2025-26)?

- Q. What innovative solutions and methods have companies proposed worldwide to clean up space debris, and could you provide examples of these strategies, such as removing dead satellites from orbit?

7. MILITARISATION OF SPACE AND A SLOW MOVEMENT TOWARDS WEAPONISATION OF SPACE

- Q. What are the contemporary challenges posed by the militarization and weaponization of outer space, emphasizing their impact on international relations and global security?
- Q. What is the meaning of 'weaponization of space', and how does it involve the deployment of weapons to transform outer space into a potential battleground, particularly targeting satellites and critical infrastructure?
- Q. Could you discuss emerging technologies such as Anti-Satellite Weapons (ASAT) and their capabilities in destroying satellites in low earth orbit (LEO)? How does this affect communication, navigation, and reconnaissance systems?
- Q. What role do space-based military assets, including satellites for communication, navigation, and reconnaissance, play in the context of weaponization of space? How is the Defense Space Agency (DSA) involved in enhancing space-based military capabilities?
- Q. From a military perspective, what are the benefits sought through the weaponization of space, including the pursuit of space supremacy and ensuring national security by protecting space investments?

8. LAUNCH VEHICLES: IMPORTANCE OF RE-USEABLE LAUNCH VEHICLES

- Q. How are launch vehicles integral to a nation's space program, specifically in facilitating the transportation of payloads into space?
- Q. Could you explain the concept of Reusable Launch Vehicles (RLVs) and their significance in contrast to traditional expendable launch vehicles? What is the primary objective behind designing RLVs?
- Q. What are the key technologies associated with Reusable Launch Vehicles, and how do features like hypersonic flight, autonomous landing, and powered cruise flight contribute to their functionality? How does the configuration of RLV-TD differ from traditional launch vehicles?
- Q. How does the Reusable Launch Vehicle Technology Demonstrator (RLV-TD) function as a flying test bed, and what specific technologies does it aim to demonstrate through its missions?
- Q. What are the primary benefits of employing Reusable Launch Vehicles, particularly in terms of cost reduction, reliability, and efficiency? How does reusability eliminate the need for manufacturing new vehicles for each launch?

9. SPACE STATION MISSIONS: WHERE DOES INDIA STAND?

- Q. Can you elaborate on the concept of space stations and their significance in space exploration, particularly in terms of providing platforms for scientific research, technology experiments, and human activities in space?
- Q. How has India, through the Indian Space Research Organisation (ISRO), expressed its commitment to constructing a space station, and what does this milestone signify in the context of India's space exploration journey?
- Q. What emerging technologies are integral to ISRO's focus on space station missions, and how do technologies like orbital rendezvous and docking play a crucial role in linking separate units in space?
- Q. Could you provide insights into the Gaganyaan programme and its role in advancing technologies related to human-rated rockets, crew training, and life support systems, which are essential for space station missions?
- Q. How does the PS4-Orbital Platform (PS4-OP) contribute to ISRO's approach to space station missions, and what experiments and capabilities does this platform enable in orbit around the Earth?

10. ARTEMIS MISSION: TAKING HUMANS TO HITHERTO UNEXPLORED AREAS.

- Q. Can you provide an overview of the Artemis program and its significance in addressing the challenges associated with human exploration beyond Earth, including technology, sustainability, and international collaboration?
- Q. What is the meaning of the Artemis Mission, and how does it symbolize NASA's ambitious goal of returning humans to the Moon with a focus on inclusivity and diversity in space exploration?
- Q. Could you elaborate on the emerging technologies introduced by the Artemis program, such as the Space Launch System (SLS) rocket, the Orion spacecraft, and advanced systems for navigation, communication, and life support, and how these technologies represent a leap forward in space exploration capabilities?
- Q. What are the diverse applications of the Artemis missions, including human lunar exploration, international collaboration, and inspiring future generations in the fields of science, technology, engineering, and mathematics (STEM)?
- Q. What are the specific benefits of the Artemis Mission, particularly in terms of breaking gender and racial barriers, promoting diversity in space missions, contributing to scientific advancements through lunar sample collection, driving technology innovation, and inspiring educational pursuits in STEM fields?
- Q. What challenges are associated with the Artemis program, considering factors such as budgetary constraints and the technical complexity of developing and integrating advanced technologies for deep space exploration?

11. SOLAR MYSTERIES AND SOLAR MISSIONS LIKE ADITYA- L1

- Q. Can you provide an overview of the significance of understanding the Sun in human history and the advancements in technology that have enabled in-depth exploration of solar mysteries in the early 21st century?
- Q. What is the meaning of the Aditya-L1 mission, and how does it symbolize India's commitment to exploring and comprehending the solar dynamics, with a particular focus on studying the Sun's outer layer, the corona?
- Q. Could you elaborate on the emerging technologies integrated into the Aditya-L1 mission, including sophisticated instruments like the Visible Emission Line Coronagraph (VELC) and the Solar Ultraviolet Imaging Telescope (SUIT), and how these technologies contribute to space-based astronomy?
- Q. What are the primary applications of the Aditya-L1 mission, particularly in terms of studying various solar phenomena such as the corona, photosphere, chromosphere, solar emissions, winds, flares, and Coronal Mass Ejections (CMEs), as well as its role in space weather prediction?
- Q. What benefits does the Aditya-L1 mission bring, both in terms of providing scientific insights into solar activities and enhancing space weather forecasting for Earth-directed storms?

12. VENUS MISSIONS LIKE SHUKRAYAAN: ITS RELATION WITH EVOLUTION OF EARTH

- Q. Can you elaborate on the significance of missions like Shukrayaan by ISRO and their role in unraveling the mysteries of Venus, particularly in understanding the planet's evolution, atmospheric conditions, and its relevance to Earth's own history?
- Q. How does the exploration of Venus, through missions like Shukrayaan, contribute to our understanding of planetary evolution and provide insights into the diverse conditions that planets can undergo over time?
- Q. What emerging technologies are incorporated into the Shukrayaan mission, and how does the synthetic aperture radar (SAR) payload enhance the exploration of Venus' surface and subsurface?
- Q. What are the primary objectives of Shukrayaan, and how do they include mapping Venus' surface and subsurface, studying its atmospheric chemistry, and examining its interaction with solar wind? How will the mission's findings contribute to planetary science and potential future missions?
- Q. What scientific benefits does Shukrayaan bring, especially in terms of providing valuable data on Venus' geological features, atmospheric composition, and solar interactions, and how does it enhance our understanding of planetary systems?

13. HYPERSONIC MISSILES

- Q. Can you explain the significance of missions like Shukrayaan by ISRO and how they aim to unravel the mysteries of Venus, providing insights into the planet's evolution, atmospheric conditions, and its relevance to Earth's own history?
- Q. How does the exploration of Venus through missions like Shukrayaan contribute to our understanding of planetary evolution and provide valuable insights into the diverse conditions that planets can undergo over time?

- Q. What advanced technology is incorporated into the Shukrayaan mission, particularly the synthetic aperture radar (SAR) payload, and how does this technology enhance the exploration of Venus' surface and subsurface?
- Q. What are the primary objectives of Shukrayaan, including mapping Venus' surface and subsurface, studying its atmospheric chemistry, and examining its interaction with solar wind? How will the mission's findings contribute to planetary science, exoplanet studies, and potential future missions?
- Q. What scientific benefits does Shukrayaan bring, especially in terms of providing valuable data on Venus' geological features, atmospheric composition, and solar interactions, and how does it enhance our understanding of planetary systems?

14. WARSHIPS: PROJECT 15B, PROJECT 17A, PROJECT 28

- Q. Can you elaborate on the significance of Projects 15B, 17A, and 28 in the context of India's efforts to strengthen its naval capabilities, particularly in the face of evolving geopolitical challenges and disruptions in global supply chains?
- Q. How does the incorporation of stealth technology in Projects 15B and 17A, including radar-absorbent coatings, contribute to reducing the vessels' detectability, and what strategic advantages does this provide in both defensive and offensive naval operations?
- Q. In what ways does the integrated construction methodology used in Project 17A optimize hull block construction, enhancing efficiency, and reducing construction timelines for warships?
- Q. How do these projects, with over 75% indigenous content, exemplify the 'Aatmanirbhar Bharat' initiative, promoting self-reliance in warship design and construction, and what role does this self-reliance play in India's maritime security?

15. IMPORTANCE OF DRONE TECHNOLOGY IN INDIAN AGRICULTURE

- Q. How has the integration of drone technology in agriculture evolved, and what role does it play in enhancing productivity sustainably?
- Q. Can you elaborate on the emerging technologies, such as artificial intelligence (AI) and machine learning (ML), that have contributed to the widespread adoption of drone technology in various industries, including agriculture?
- Q. What are the key applications of drones in agriculture, and how do they contribute to tasks such as irrigation monitoring, crop health surveillance, and livestock tracking?
- Q. In terms of benefits, how does the use of drones lead to enhanced agricultural production, increased safety for farmers, faster data availability for decision-making, and reduced resource wastage?
- Q. What challenges does India face in fully utilizing drones in agriculture, considering factors like weather dependency, internet connectivity issues, and the need for knowledge and skill development among end-users?

16. POLICING IN THE METAVERSE

- Q. What is the significance of Interpol launching a metaverse designed specifically for law enforcement agencies, and how does it align with the evolving nature of the Internet and computing?
- Q. Can you elaborate on the concept of the metaverse and its primary purpose, which is to empower users to create their own experiences and collaborate with others in virtual spaces?
- Q. In terms of uses, how are individuals currently engaging with the metaverse, and can you provide examples of activities such as virtual concerts, online trips, and trying on digital clothing?
- Q. How is access to the metaverse structured at present, and is there a defined entrance or gateway considering the theoretical nature of a single metaverse?
- Q. What is India's current position in the global metaverse market, and how does the country contribute to shaping the development and adoption of metaverse technologies?

17. 5G TECHNOLOGY & INDIA

- Q. What is the significance of the India Cellular and Electronics Association's prediction that 75–80% of new smartphone launches in India by the end of 2023 will be 5G-enabled, and how does it align with the ongoing rollout of 5G in more than 50 cities and towns?
- Q. Can you explain the meaning of 5G technology, especially in comparison to its predecessor, 4G, highlighting the technological advancements that make 5G more complex?
- Q. What are the important features of 5G, such as ultra-low latency, super bandwidth, reliable connectivity, extensive coverage, and the capacity to connect more devices per unit, and how do these features contribute to its superiority over previous generations?
- Q. In terms of benefits, how does the implementation of 5G in India contribute to faster connectivity, act as a socio-economic multiplier, improve technology systems in industries, strengthen the healthcare system, and support new-age technologies?
- Q. What are the bottlenecks or challenges faced in the adoption of 5G technology in India, including factors like obsolete technology, low fiberisation footprint, restricted range, and a lack of finance? How are Indian telecom companies addressing these challenges, especially in terms of developing their own 5G technology through platforms like O-RAN (Open-Radio Access Networks)?

18. INDIA'S GEOSPATIAL TECHNOLOGY

- Q. Can you elaborate on the meaning of geospatial technologies and the various components it encompasses, such as Geographic Information System (GIS)/Spatial Analytics, Global Navigation Satellite System (GNSS) & Positioning, Earth Observation, and Scanning?
- Q. How are geospatial technologies utilized, and what are their applications, particularly in the context of data acquisition and utilization, making informed decisions for resources, and creating intelligent maps and models?

- Q. The Geospatial "Artha" Report 2021 projects that India's geospatial technology industry will cross Rs 63,100 crores by 2025 at a growth rate of 12.8%. Can you discuss the factors contributing to this growth and its significance for the Indian economy?
- Q. What are the key issues faced by the geospatial technology sector in India, including challenges related to demand, awareness, manpower, and data availability? How are these challenges impacting critical areas like agriculture, disaster management, internal security, infrastructure, railways, and natural resources?
- Q. Considering the expected growth in India's geospatial economy, how can initiatives be taken to address the identified issues and further leverage geospatial technologies for the country's development?

19. CRISPR & ITS ROLE IN CHANGING THE WORLD (10 YEARS OF CRISPR)

- Q. Can you explain the meaning of CRISPR and its significance in gene editing, highlighting the reference to clustered and repetitive DNA sequences found in bacteria?
- Q. How does CRISPR-gene editing technology work, and what potential does it hold for correcting genetic information, providing a permanent cure for genetic disorders, and addressing deformities related to abnormal gene sequences?
- Q. In what ways has CRISPR revolutionized biology research, particularly in terms of studying diseases and accelerating drug discovery? How is it influencing the development of crops, foods, and industrial fermentation processes?
- Q. Could you elaborate on the government's intervention in promoting CRISPR technology, such as the approval of a five-year project to develop it for curing sickle cell anemia? Additionally, what are the anticipated next steps for CRISPR, especially in terms of its safety and effectiveness as a treatment?
- Q. The ethical dilemma surrounding CRISPR revolves around its potential for inducing significant changes in individuals. How are scientists addressing concerns about the misuse of this technology, and what safeguards or ethical considerations are being implemented to ensure responsible use?

20. STEM CELLS THERAPY AS A REGENERATIVE MEDICINE

- Q. Can you elaborate on the meaning of stem cell therapy within the context of regenerative medicine and how it aims to utilize the body's raw materials for repairing diseased or injured tissues?
- Q. How does mesenchymal stem-cell therapy exemplify the evolving technology's potential in tissue repair, as seen in Mumbai's experimental use? Additionally, what role does therapeutic cloning play in advancing our understanding of human cell growth and contributing to treatment possibilities?
- Q. Could you discuss the significance of the National Guidelines for Stem Cell Research in India, established in 2013, and how they reflect the emerging focus on ethical and scientific norms in stem cell research?

- Q. In terms of application, how does stem cell therapy show promise in treating various conditions such as Parkinson's disease, spinal cord injuries, Alzheimer's, cancer, and diabetes? How does stem cell research contribute to developmental studies and drug testing, particularly in providing insights into birth defects and facilitating ethical drug testing?

21. GENETIC ENGINEERING: ISSUES AND CHALLENGES

- Q. How would you define genetic engineering and its scope, particularly in the alteration of an organism's DNA? How does this technology range from single base pair changes to the introduction of foreign DNA, and how is it applied across various organisms, including plants and animals, for purposes such as agriculture and medicine?
- Q. Could you shed light on the emerging technologies in genetic engineering, such as precision gene editing tools like CRISPR-Cas9, synthetic biology involving the design of new biological entities, and the applications of gene therapy in the medical field for treating or preventing diseases by correcting faulty genes?
- Q. In terms of application, how is genetic engineering utilized in agriculture to create crops with enhanced nutritional value, stress tolerance, and pest resistance? Additionally, how does gene therapy in medicine hold promise for treating genetic disorders and contributing to personalized medicine?
- Q. What benefits does genetic engineering offer, particularly in the creation of improved crop varieties for food security and agricultural sustainability? How do advancements in gene therapy and genetic engineering contribute to potential breakthroughs in treating genetic diseases and improving healthcare, and what distinguishes genetic engineering from traditional selective breeding in terms of precision in trait selection?

22. BASE EDITING TECHNIQUE FOR CANCER TREATMENT

- Q. Can you elaborate on the significance of base editing as a genome editing approach, especially in the context of cancer treatment, and how it differs from conventional methods in terms of precision and minimizing collateral damage to healthy tissues?
- Q. How does base editing, when combined with CRISPR-cas9 technology, enable the direct conversion of one base or base pair into another, and how does this capability allow for the correction of genetic mutations at the molecular level without inducing double-stranded DNA breaks?
- Q. In the application of base editing for cancer treatment, particularly in T-cell leukemia, how does it target specific genetic sequences in T-cells? What is the overarching goal of base editing in this context, and how does it contribute to the elimination of cancerous cells while preserving the overall immune system?
- Q. What are the key benefits of using base editing in cancer treatment, with a focus on precision medicine, minimized collateral damage, and enhanced treatment efficacy? How does the avoidance of double-stranded DNA breaks contribute to a more controlled and targeted therapeutic intervention?
- Q. Addressing challenges, what considerations should be taken into account regarding the long-term effectiveness of base editing for cancer treatment? What safety concerns

exist, including the potential for unintended consequences, off-target effects, and the overall impact on the patient's health? Additionally, how important is further clinical validation to establish the efficacy and safety of base editing across diverse patient populations and cancer types?

23. GENETICALLY MODIFIED ORGANISMS: HOW THEY ARE DIFFERENTIATED THE OUTCOMES OF GENOME EDITING

- Q. Can you explain the key distinction between genetically modified organisms (GMOs) and genome editing, highlighting how each approach achieves genetic modification in agriculture and the implications for food production, safety, and ethical considerations?
- Q. Regarding genetically modified organisms (GMOs), can you provide examples and elaborate on how they involve the introduction of foreign genetic material into a host organism to confer specific traits? How has this technology been applied in agriculture, such as in the case of BT Cotton?
- Q. In the context of genome editing, particularly utilizing techniques like CRISPR-Cas9, how does this approach differ from traditional GMOs? What is the primary focus of genome editing, and how does it contribute to controlled and efficient genetic modifications in crops, animals, and microbes?
- Q. What are the benefits associated with genome editing, emphasizing precision and control in modifying specific DNA sequences? How does this technology contribute to targeted agricultural advancements, aligning with goals such as improved yields, resistance to pests, and adaptability to environmental conditions?
- Q. Addressing challenges, what ethical dilemmas are associated with the use of genome editing, especially in germline cells? How do concerns about the creation of "designer babies" and the hereditary implications of genetic modifications come into play? Additionally, what challenges exist in terms of variable efficacy, off-target effects, and potential ecological impact, particularly regarding gene drives and genetic diversity?

24. RECOMBINANT VACCINES

- Q. Can you provide an overview of the challenges associated with developing vaccines against intracellular pathogens causing chronic infections, emphasizing the limitations of traditional vaccine strategies in eliciting robust cell-mediated immunity?
- Q. Explain the meaning of recombinant vaccines and how they address the challenges in vaccine development using recombinant DNA technology. Highlight the key steps involved, such as incorporating DNA encoding antigens, expressing and purifying antigens, and utilizing them to stimulate immune responses.
- Q. Explore the emerging technology of recombinant vaccines, covering recombinant protein vaccines, DNA vaccines, and live recombinant vaccines that use viral or bacterial vectors. Discuss the innovation behind highly purified recombinant proteins, virus-like particles (VLPs), and DNA plasmids in eliciting targeted immune responses.
- Q. Delve into the applications of recombinant vaccines, specifically discussing recombinant protein vaccines and the use of VLPs, DNA vaccines administered through naked DNA plasmids, and live recombinant vaccines employing genetically modified viral or bacterial vectors. Highlight the advantages of these approaches in terms of immunogenicity, scalability, and simplicity.

25. GENE THERAPY

- Q. Can you explain the meaning of gene therapy and its transformative role in modern medicine, emphasizing the different mechanisms involved, such as gene replacement, inactivation, and introduction?
- Q. Explore the emerging technology in gene therapy, discussing various types of gene therapy products, including plasmid DNA, viral vectors, bacterial vectors, human gene editing, and patient-derived cellular therapies. Highlight the significance of human gene editing, particularly CRISPR technology, for precise modifications, and the role of viral and bacterial vectors as vehicles for therapeutic gene delivery.
- Q. Discuss the benefits of gene therapy, focusing on its potential to provide cures for diseases with no effective medications, the convenience of one-time administration, long-lasting effects for symptom relief, and the generational impact of preventing the transfer of faulty genes to future generations. Highlight the role of advancing technology in the continuous improvement and increased FDA approvals of gene therapies.
- Q. Examine the challenges associated with gene therapy, including the cost barrier that makes it inaccessible for some individuals, the experimental nature leading to uncertainties and guarantees of success, safety concerns related to unintended effects and risks of altering reproductive cells, and ethical dilemmas surrounding the definition of "good" and "bad" uses, along with concerns about social acceptance and designer babies.
- Q. Discuss the potential infection risks associated with some gene therapies that use viral vectors and the importance of robust regulation in addressing safety concerns. Explore the need to strike a balance between innovation and safety in the responsible advancement of gene therapy, considering ethical, accessibility, and regulatory aspects.
- Q. Can you elaborate on the Genome India Project and its objective to map the genetic information of 10,000 individuals across the country, creating a reference genome for the diverse Indian population? Discuss the significance of understanding genetic makeup for healthcare, agriculture, and life sciences.

26. THREATS POSED BY NANOMATERIALS: THEIR HEALTH AND ENVIRONMENTAL CONCERNS

- Q. Can you elaborate on the potential threats posed by nanomaterials to health and the environment, considering their distinctive properties and the challenges in understanding their implications for toxicity, exposure pathways, and environmental impact?
- Q. Explore the meaning of nanotechnologies and nanomaterials, emphasizing the manipulation of materials at the nanoscale and the unique properties of nanomaterials. Discuss the challenge of comprehending these differences and the potential effects on health and the environment.
- Q. Discuss the emerging technology of nanotechnology and its utilization of nanomaterials with distinct properties. Highlight the applications of nanotechnology in fields such as nanomedicine, environmental sensing, and materials science, offering novel solutions and advancements.

- Q. Examine the challenges associated with nanotechnology, particularly the lack of understanding of the toxic effects of nanoparticles on human health and the environment. Address concerns related to limited knowledge about how nanoparticles affect biochemical pathways, the economic challenges posed by expensive processes, and the difficulty in drawing conclusions on environmental risks due to diverse impact data and nanomaterials.
- Q. Explore the challenges of insufficient data on environmental hazards related to nanoparticles in soils and sediments. Discuss the scarcity of comprehensive models describing the release, distribution, and exposure of nanomaterials in complex environments, hindering the safe integration of nanotechnologies into various applications.

27. QUANTUM COMPUTING

- Q. Can you elaborate on the potential threats posed by nanomaterials to health and the environment, considering their distinctive properties and the challenges in understanding their implications for toxicity, exposure pathways, and environmental impact?
- Q. Explore the meaning of nanotechnologies and nanomaterials, emphasizing the manipulation of materials at the nanoscale and the unique properties of nanomaterials. Discuss the challenge of comprehending these differences and the potential effects on health and the environment.
- Q. Discuss the emerging technology of nanotechnology and its utilization of nanomaterials with distinct properties. Highlight the applications of nanotechnology in fields such as nanomedicine, environmental sensing, and materials science, offering novel solutions and advancements.
- Q. Examine the challenges associated with nanotechnology, particularly the lack of understanding of the toxic effects of nanoparticles on human health and the environment. Address concerns related to limited knowledge about how nanoparticles affect biochemical pathways, the economic challenges posed by expensive processes, and the difficulty in drawing conclusions on environmental risks due to diverse impact data and nanomaterials.
- Q. Explore the challenges of insufficient data on environmental hazards related to nanoparticles in soils and sediments. Discuss the scarcity of comprehensive models describing the release, distribution, and exposure of nanomaterials in complex environments, hindering the safe integration of nanotechnologies into various applications.

28. BIOPIRACY

- Q. Can you explain the concept of "biopiracy" and its origin, as coined by Pat Mooney in the early 1990s? Discuss how biopiracy involves the theft or misappropriation of genetic resources and traditional knowledge through the intellectual property system.
- Q. Highlight some famous cases related to biopiracy, such as the Neem Patent Case, Turmeric Patent Case, Basmati Patent Case, Colgate Case, and Yoga Patent Case. Explain the grounds on which these cases were opposed and the outcomes in terms of patent revocation or rejection.

- Q. Explore the effects of biopiracy, emphasizing the threats it poses to indigenous communities, the unfair usurpation of traditional knowledge, and the impact on livelihoods. Discuss the ethical concerns related to ill-earned profits by patent holders and the lack of compensation for indigenous people.
- Q. Examine the impact of biopiracy on biodiversity, including the depletion of endemic biodiversity, exploitation of communities safeguarding biodiversity, and the potential extinction of endemic species. Discuss the broader environmental consequences of such activities.
- Q. Discuss measures to curb biopiracy, including the need for useful laws and rules to protect generational knowledge, acquisition and profit-sharing provisions for the benefit of both parties, and the role of international agreements such as the Convention on Biological Diversity in asserting national rights over natural biological resources.

29. INCREASING ADOPTION OF AI (DELHI POLICE'S USE OF FACIAL RECOGNITION TECHNOLOGY)

- Q. Can you provide a brief definition of Artificial Intelligence (AI) and explain how it involves the simulation of human intelligence by machines?
- Q. India has recently been elected as the chair of the Global Partnership on Artificial Intelligence (GPAI) for 2022-23. What significance does this hold for India, and why is having a seat on the GPAI table crucial for the country?
- Q. Explore the various applications of AI, including natural language processing, machine learning, vision, expert systems, and speech recognition. How do these applications contribute to the advancement of AI technology?
- Q. India is considered an IT powerhouse and the second-largest online market globally. Discuss the factors in India that have led to the flourishing of AI, and how increased technological investments and internet penetration play a role in this phenomenon.
- Q. Looking ahead, with the 4th Industrial Revolution on the horizon, why is artificial intelligence considered an essential component of this revolution? Discuss the potential role AI will play in shaping future advancements and operations on a global scale.

30. DATA PRIVACY

- Q. Can you explain the key provisions related to the storage of personal data as outlined in the Digital Personal Data Protection Bill (DPDP)? How does the draft law address the responsibilities of data fiduciaries in maintaining accurate personal data?
- Q. Discuss the significance of data privacy highlighted in the context of the DPDP. How can the compromise of personal data, including financial and healthcare information, lead to potential risks such as fraud and identity theft? Why is building trust in handling personal data crucial for individuals engaging online?
- Q. Clarify the distinction between data privacy and data security. How does data privacy focus on the protection of data when shared with third parties, and how does this differ from the role of data security in safeguarding data from hacker attacks?

- Q. Explore the influence of global standards, particularly the EU's General Data Protection Regulation (GDPR), on data protection legislation. How has the GDPR shaped privacy regulations in various countries, and what role does explicit consent play in the processing of personal data under such standards?
- Q. The Digital Personal Data Protection Bill has undergone multiple drafts since its proposal in 2018. What are the key challenges or considerations in getting this bill approved by parliament and enacted into law? How does the approval of such legislation contribute to a comprehensive legal framework for regulating the online space in India?