1. What is the CRISPR-Cas9 technique? What are its potential applications? Examine.

Approach:

It is straightforward question where it expects students to write about - in first part write about CRISPR-Cas9 technique - while in second part write about potential applications of CRISPR-Cas9 technique.

Introduction:

Recently, the Nobel Prize in Chemistry for 2020 was given to two women scientists namely Emmanuelle Charpentier (France) & Jennifer A. Doudna (Germany). The Nobel prize was given to them for the development of a method for genome editing. The two scientists have pioneered the use of CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) – Cas9 (CRISPR-associated protein 9) system as a gene-editing tool.

Body:

CRISPR-Cas9 technique:

- It is a method of genome editing in which genetic genes can be added, deleted, or changed. This system mainly consists of two molecules which are the factors of transformation in DNA.
- Cas9 is an enzyme used in this method and acts as a molecular scissor and it cuts the strand of DNA from a specific location in the genome to convert the desired DNA.
- The function of guide RNA is also important in this technique with Cas 9. It is a part of the RNA sequence whose function is to find and bind to a specific sequence of DNA. The guide RNA contains an RNA base that complements the targeted DNA sequence in the genome.
- It will help diagnose genetic diseases and diseases like cancer, Hepatitis B, HIV. Scientists are still working to determine how it will be used for the general public.

Potential applications:

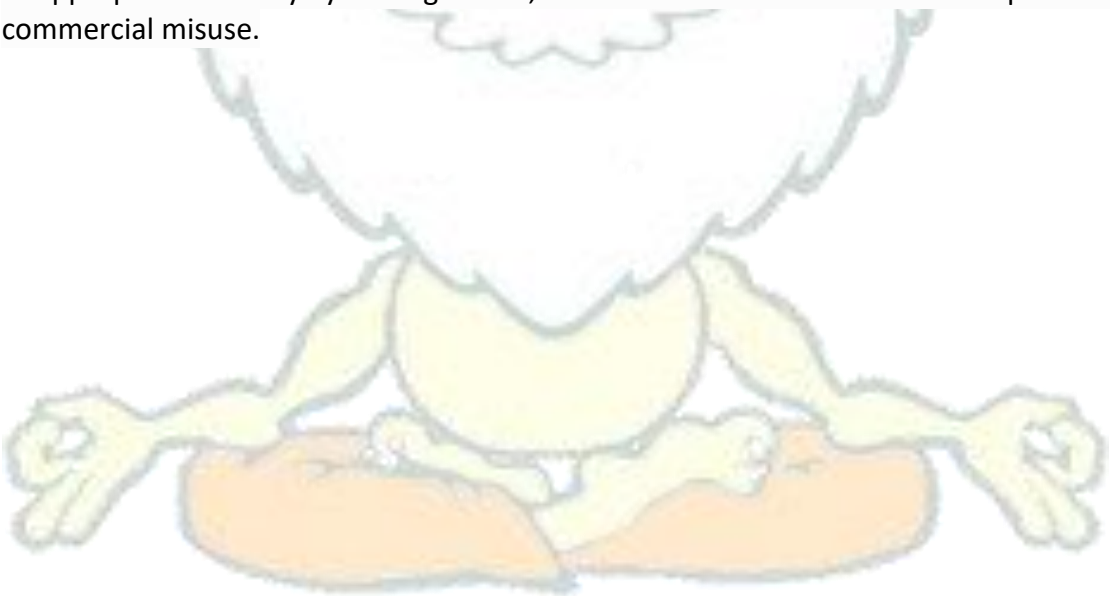
- Embryonic stem cell and transgenic animals: CRISPR-Cas systems can be used to rapidly and efficiently engineer one or multiple genetic changes to murine embryonic stem cells for the generation of genetically modified mice.
- Disease modelling: Disease animal models have been essential resources in advancing the biomedicine field. With the help of genome editing technologies, many applicable models with specific mutations which could mimic clinical phenotypes have been generated.
- Cancer models: With the help of genome editing tools, numerous studies have been carried out through modifying key genes for generating accurate and specific cancer models. Cancer models are the most effective ways to study mutational functions which result in cancer.
- Productivity improvement: Continuous decrease in the availability of land and water for agriculture, uncertain weather conditions and a growing population are signals for the urgent need for an alternative approach in the country. In this

scenario, scientists are optimistic about the possibilities of genome editing for enhancing crop productivity to overcome the shortcomings of traditional transgenic methods like irregular breeding cycles, lack of precision in intended trait selection and uncertainty in getting desirable mutations.

- Allergy-free food: Food allergies affect a huge percentage of the population and can be life-threatening in some cases. With CRISPR, it could be possible to make milk, eggs or peanuts that are safe for everyone to eat.
- Greener fuels: Gene editing could improve the production of biofuels by algae. Using CRISPR-Cas9, the company Synthetic Genomics has created strains of algae that produce twice as much fat, which is then used to produce biodiesel. In particular, the gene-editing tool allowed scientists to find and remove genes that limit the production of fats.
- Eradicating pests: CRISPR could help us control the numbers of animal species that transmit infectious diseases or that are invasive in a particular ecosystem. The gene-editing technology can be used to create 'gene drives' that ensure a genetic modification will be inherited by all the offspring, spreading throughout an animal population over several generations.

Conclusion:

This CRISPR technology is indeed a path-breaking technology, to alter genes in order to tackle a number of conventional and unconventional problems, especially in the health sector. However, experiments and tests to validate its use must be subjected to appropriate scrutiny by the regulators, and their use must be controlled to prevent commercial misuse.



2. What are the commercial prospects of IoT in India? What are the challenges in its adoption? Discuss.

Approach:

As the directive here is discuss it is necessary to consider various angles and provide a solution to challenges. In the introduction you can start by explaining what is IoT. In the first half of main body part give commercial prospective applications of IoT in India. In the next half give challenges. A brief way forward with conclusion will fetch you more marks.

Introduction:

Internet of Things (IoT) is the interconnection of digital devices, electronic appliances, human, machines, and other objects with one another across a wireless networks. It is the next step in evolution of internet and has the potential to improve public utility services thereby improve their efficiency.

Body:

Commercial prospects of IoT in India:

- As per Nasscom, the Indian IoT market is expected to reach $15 billion by 2020 and constitute 5 % of the global market.
- Investing in IoT will boost India's economy on par with global leaders. Many of global counterparts have already begun reaping the rewards of investing in IoT-based infrastructure. It will bring in investments, boost job creation and improve Indian public infrastructure.
- With a network of interconnected devices, the economy becomes digital, the healthcare network and services will get interconnected. For instance, voice-enabled systems to remind people to take their medication in time.
- It has tremendous potential to improve commercial prospects for the care/service of vulnerable sections of society. For instance, Japan is using humanoid smart robots as elder care robots.
- In the field of agriculture, it can be used to improve overall productivity by having enhanced weather forecasting, soil nutrient content, pest infestation, etc.
- Besides in Industry, IoT can be used to reduce human error, increase efficiency, and improve productivity, etc.
- Commercial prospects of IoT in the transportation sector has humongous potential. It has commercial prospects to revolutionise the transportation sector. For instance, IoT can be used on toll booths, traffic management, driverless cars, etc.
- Also, Indian government has outlined a plan to leverage IoT as part of the Digital India mission and the National Digital Communications Policy has come out with a machine-to-machine (M2M) roadmap, with an aim to put regulators, industry agencies that develop standards, users and manufacturers on the same page.

Challenges in adoption of IoT:

- Complexity: The designing, developing, and maintaining and enabling the large technology to IoT system is quite complicated.
- Evolution of IoT faces the threat of data security. The Data Protection framework submitted by the Justice Srikrishna Committee had provisions for personal data protection.
- Job loss threat: Automation in Industries will naturally bring in job losses. It will lead to replacement of humans with machines.
- Lack of Transparency: As per IoT Security Foundation report, many of the IoT brands did not want to share vulnerabilities in their application/service with the public.
- Adaptation only with Artificial Intelligence: Processing the tremendous amount of real-time IoT data is possible only through artificial intelligence or AI algorithms. If AI systems power essential functions of smart cities, preventing hackers and miscreants from accessing it and manipulating its data still remains a challenge.
- Specifically with respect to India, its data security concerns are widened as Justice BN Srikrishna commission recommended Aadhaar Act 2016 should be amended to ensure the autonomy of the UIDAI and to "bolster data protection".
- Justice BN Srikrishna commission also expressed concerns citing RTI act. It also recommended that RTI Act 2003 should be amended so, that there is no obligation to reveal personal information which was not related to "public activity or interest".

Although IoT technology has tremendous potential to change the world, with greater advantage comes a potential risk to privacy. Hence, following steps are needed to be taken up:

- Across the world, legislators, device manufacturers, and law enforcement agencies should come together to figure out how to benefit from IoT while mitigating risks.
- The government also permitted 100% FDI in the telecom sector. This should also aid the development of IoT in India.
- The Department of Electronics and Information Technology (DeiTY) also published a draft policy for IoT in India. Which needs to be modified as per requirement of the time.

Conclusion:

IoT technology has the potential to facilitate the 'convergence of real and virtual world'. An integrated, concerted and collaborative policy approach is necessary to fully utilise the potential of IoT. It will not only boost growth and development of India but it will also ensure better facilitation of products and services to the Indian citizens thereby easing their lives.

3. What are the challenges posed by deepfakes? What can be the possible strategy to counter it? Suggest.

Approach - It expects students to write about deepfakes and its challenges, also suggest possible strategy to counter it.

Introduction

The word deepfake combines the terms "deep learning" and "fake," and is a form of artificial intelligence. In simplistic terms, deepfakes are falsified videos made by means of deep learning. Deep learning is "a subset of AI," and refers to arrangements of algorithms that can learn and make intelligent decisions on their own. This technology can be used to make people believe something is real when it is not.

Body

Challenges posed by deepfakes:

1. Damage to Personal Reputation: Deepfake can depict a person indulging in antisocial behaviours and saying vile things. These can have severe implications on their reputation, sabotaging their professional and personal life. Even if the victim could debunk the deep fake, it may come too late to remedy the initial harm. Further, Deepfakes can be deployed to extract money, confidential information, or exact favours from individuals.
2. Disrupting Electioneering - A high-quality deepfake can inject compelling false information that can cast a shadow of illegitimacy over the voting process and election results. Leaders can also use them to increase populism and consolidate power. Deepfakes can become a very effective tool to sow the seeds of polarisation, amplifying division in society, and suppressing dissent.
3. Undermining Democracy - A deepfake can also aid in altering the democratic discourse and undermine trust in institutions and impair diplomacy. False information about institutions, public policy, and politicians powered by a deepfake can be exploited to spin the story and manipulate belief.
4. Targeting Women - The malicious use of a deepfake can be seen in pornography, inflicting emotional, reputational, and in some cases, violence towards the individual.
5. Pornographic deep fakes can threaten, intimidate, and inflict psychological harm and reduce women to sexual objects. Deepfake pornography majorly targets women.
6. New Front of Warfare - A deepfake could act as a powerful tool by a nation-state to undermine public safety and create uncertainty and chaos in the target country.
7. Nation-state actors with geopolitical aspirations, ideological believers, violent extremists, and economically motivated enterprises can manipulate media narratives using deepfakes. It can be used by insurgent groups and terrorist organisations, to represent their adversaries as making inflammatory speeches or engaging in provocative actions to stir up anti-state sentiments among people.

8. Catfish accounts - Catfishing refers to the practice of setting up fictitious online profiles most often for the purpose of luring another into a fraudulent romantic relationship.
9. Spreading distrust - Distrust through victimisation, extortion business, factual relativism, communal chaos, hate speeches

Possible strategy to tackle deepfakes -

- Detect and amplify: We also need easy-to-use and accessible technology solutions to detect deepfakes, authenticate media, and amplify authoritative sources.
- Need for Regulation: Meaningful regulations with a collaborative discussion with the technology industry, civil society, and policymakers can facilitate disincentivizing the creation and distribution of malicious deep fakes.
- Technological Interventions: There is also a need for easy-to-use and accessible technology solutions to detect deep fakes, authenticate media, and amplify authoritative sources.
- Enhancing Media Literacy: Media literacy for consumers and journalists is the most effective tool to combat disinformation and deep fakes. Improving media literacy is a precursor to addressing the challenges presented by deepfakes. As consumers of media, they must have the ability to decipher, understand, translate, and use the information. Even a short intervention with media understanding, learning the motivations and context, can lessen the damage.

Conclusion

To counter the menace of deepfakes, we all must take the responsibility to be a critical consumer of media on the Internet, think and pause before we share on social media, and be part of the solution to this infodemic. To defend the truth and secure freedom of expression, there is a need for a multi-stakeholder and multi-modal approach. Collaborative actions and collective techniques across legislative regulations, platform policies, technology intervention, and media literacy can provide effective and ethical countermeasures to mitigate the threat of malicious deep fakes.

4. What are the applications of big data in governance? In this regard, discuss the recommendations of Kris Gopalan panel.

Approach:

Students are expected to write about the applications of big data in governance in first part, and discuss the recommendations of Kris Gopalan panel in the second part.

Introduction:

Big data is a term that describes the large volume of data – both structured and unstructured – that inundates a business on a day-to-day basis. Big data can be analysed for insights that lead to better decisions and strategic moves. The use and adoption of big data within governmental processes allows efficiencies in terms of cost, productivity, and innovation. Data analysis often requires multiple parts of government (central and local) to work in collaboration and create new and innovative processes to deliver the desired outcome.

Body:

By implementing a big data platform, governments can access vast amounts of relevant important information of daily functions.
Applications of big data in governance:

- Income tax dept has initiated Project insight. Under this project an integrated data warehousing business intelligence platform being rolled out in phased manner. Under this project a dedicated compliance portal would be used to capture response on compliance issue in structured manner for effective compliance monitoring and evaluation. It shows the transparency attribute of good governance.
- National Intelligence Grid (NATGRID) an Information Technology (IT)-enabled platform, is being created to help the security and law enforcement agencies across the country by sharing information relating to crime in real time and keep track of such incidents in the best interest of national security. It will use modern technologies like big data and to analyse vast amounts of data to track suspected terrorist and crime related activities to help prevent them. It shows the responsive nature of good governance.
- GeoMGNREGA', as geo-tagging of assets created under MGNREGA is known, involves generation of an asset ID after completion of work and marking it as a primary asset. Geo-tagging of completed assets is done through the Bhuvan mobile platform, which involves capturing of the GPS location of the asset along with two photographs. It shows the transparency and accountability attributes of good governance.
- Smart city's network would be based on Big Data. Big data systems are stored, processed, and mined in smart cities efficiently to produce information to enhance different smart city services. In addition, big data can help decision

makers plan for any expansion in smart city services, resources, or areas. It shows the Effective and efficient attributes of good governance.

- The government has rolled out the direct benefits transfer scheme (DBT) in various states where benefits and subsidies are transferred to the bank accounts seeded with the Aadhaar numbers of the individuals directly in order to do away with the intermediaries involved in the flow of funds, thereby reducing leakages. It shows the transference attribute of good governance.
- CCTNS (Crime and Criminal Network Tracking System) is an e-governance project under the Digital India mission which seeks to use IT for better provision of citizen-centric services, connect about 14000 police stations across the country and facilitate investigation, detection and prevention of crime. It shows the accountable attribute of good governance.

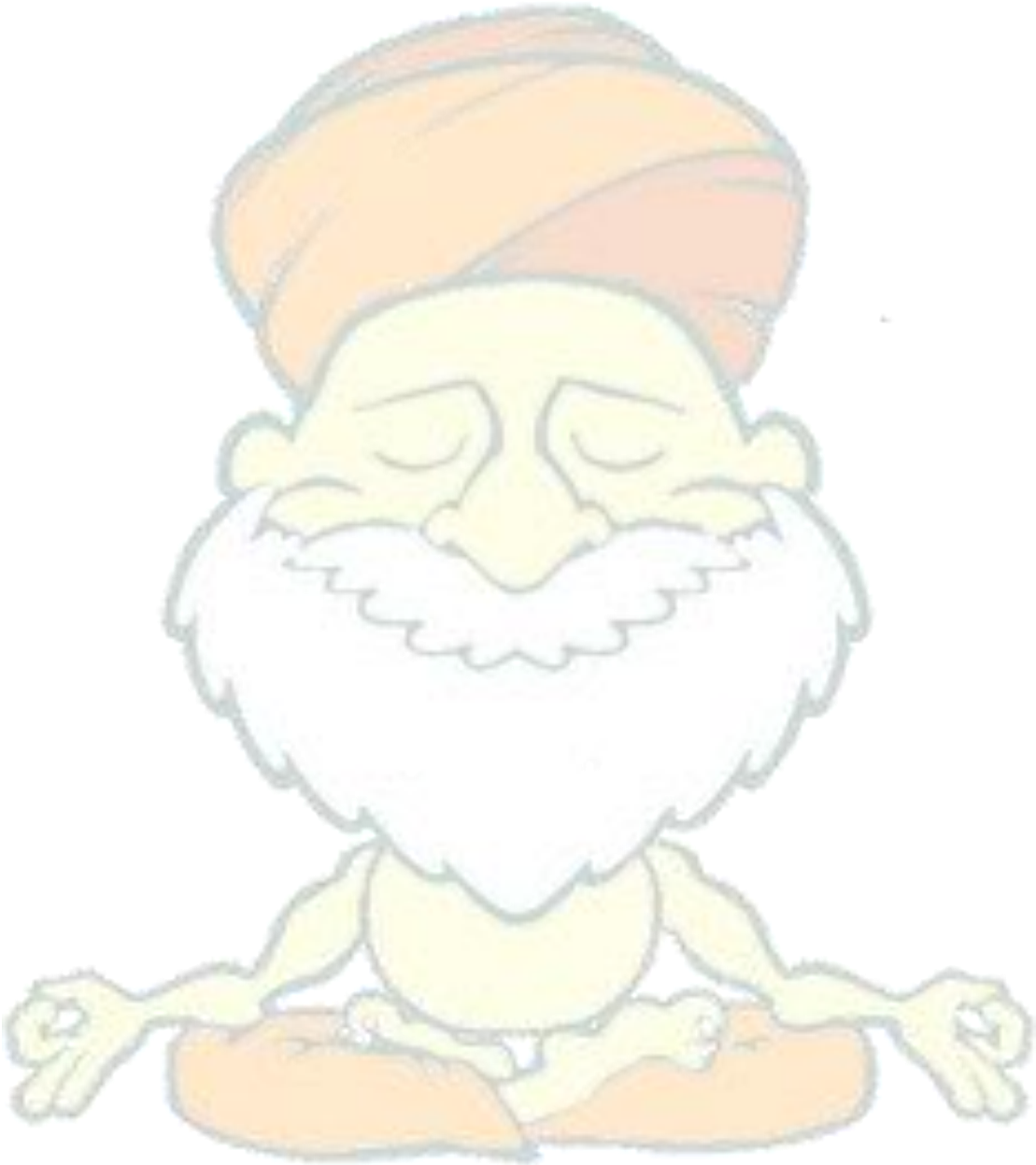
Recommendations of Kris Gopalan panel

- The Committee has defined three categories of Non-Personal Data – 1) Public Non-Personal Data 2) Community Non-Personal Data & 3) Private Non-Personal Data. The Committee has also defined a new concept of 'sensitivity of Non-Personal Data', as even Non-Personal Data could be sensitive from the following perspectives – 1) It relates to national security or strategic interests. The Committee recommends that the data principal should also provide consent for anonymisation and usage of this anonymized data while providing consent for collection and usage of his/her personal data.
- Define Non-Personal Data Roles Articulating a legal basis for establishing rights over Non-Personal Data and Create a new category / taxonomy of business called 'Data Business' that collects, process, store, or otherwise manages data, and meets certain threshold criteria.
- Data Business is a horizontal classification and not an independent industry sector. Many existing businesses in various sectors, collecting data beyond a threshold level, will get categorized as a Data Business. Data Businesses will provide, within India, open access to meta-data and regulated access to the underlying data. The compliance process will be light-weight and fully digital.
- Data Sharing Purpose or Sovereign purpose in this, Data may be requested for purposes of national security, legal purposes, etc. Core Public Interest purpose – Data may be requested for community benefits or public goods, research and innovation, policy making, for better delivery of public-services etc.
- Data may be requested in order to encourage competition and provide a level playing field or encourage innovation through start-ups activities (economic welfare purpose), or for a fair monetary consideration as part of a well-regulated data market.

Conclusion:

'Governance' is the process of decision-making and the process by which decisions are implemented or not implemented. Big data technology is vitally important for governments. It can't solve every problem, but it's a step in the right direction. It's

giving leaders the tools necessary to enact important changes that will be of benefit for citizens now and in the future.



5. What is the Global Partnership on Artificial Intelligence (GPAI)? What are its objectives?

Approach:

It is straightforward question where it expects students to write about - in first part write about Global Partnership on Artificial Intelligence (GPAI) - while in second part mention it's objectives.

Introduction:

India joins Global Partnership on Artificial Intelligence (GPAI) as a founding member to support the responsible and human-centric development and use of AI.

Body:

Global Partnership on Artificial Intelligence (GPAI):

- GPAI is an international and multi-stakeholder initiative to guide the responsible development and use of AI, grounded in human rights, inclusion, diversity, innovation, and economic growth.
- It is the league of leading economies including India, USA, UK, EU, Australia, Canada, France, Germany, Italy, Japan, Mexico, New Zealand, Republic of Korea, and Singapore.
- GPAI will be supported by a Secretariat, to be hosted by Organization for Economic Cooperation and Development (OECD) in Paris, as well as by two Centres of Expertise- one each in Montreal and Paris.
- This is also the first initiative of its type for evolving better understanding of the challenges and opportunities around AI using the experience and diversity of participating countries.

Objectives of GPAI:

- Initiative will look to bridge the gap between theory and practice on AI by supporting cutting-edge research and applied activities on AI-related priorities.
- In collaboration with partners and international organizations, it will bring together leading experts from industry, civil society, governments, and academia to collaborate to promote responsible evolution of AI.
- It will help to evolve methodologies to show how AI can be leveraged to better respond to the present global crisis around COVID-19.

Conclusion:

By joining GPAI as a founding member, India will actively participate in the global development of Artificial Intelligence, leveraging upon its experience around use of digital technologies for inclusive growth.