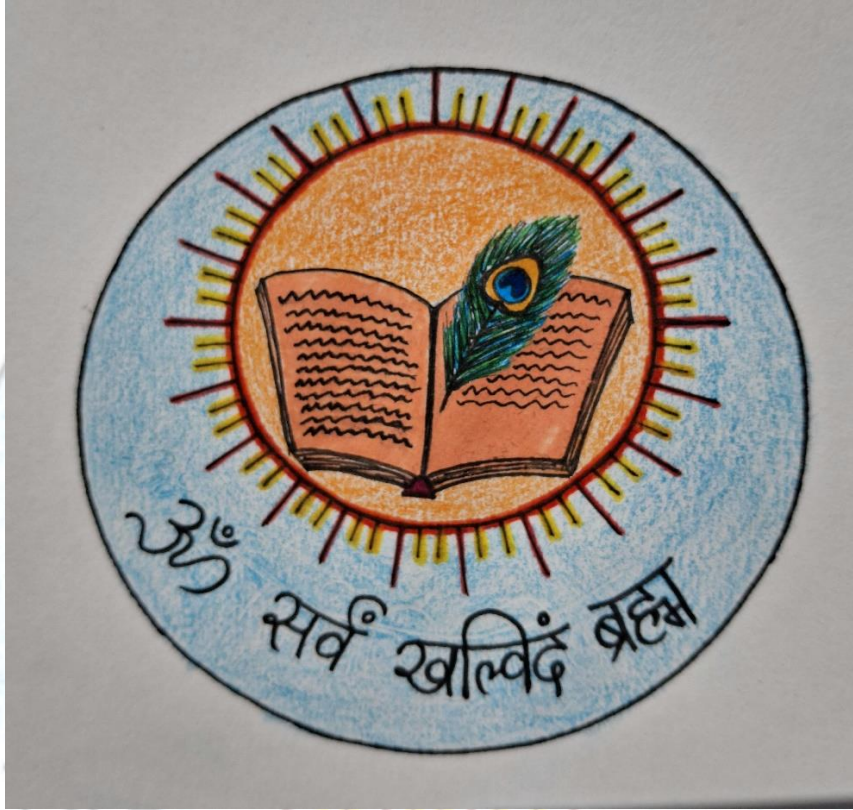




# International Journal of Original Research and Development (IJORD)



**September 2024 Issue:**

**A Futuristic Paper on, “Achieving Sustainable and Supreme Development Goals of human civilisation on the Mother Earth and on the Moon, on the Mars and Beyond, wherever human may go: Using Quantum Computing and Artificial Intelligence!”**

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## International Journal of Original Research and Development

An attempt to provide ready to use latest research and development knowledge to the society and to lead human civilisation to Moon, Mars and Beyond, with deadlines of 2030 A.D. Moon colonisation, 2050 A.D. Mars Colonisation, and beyond, with full of ethics, values and sustainable safe growth.

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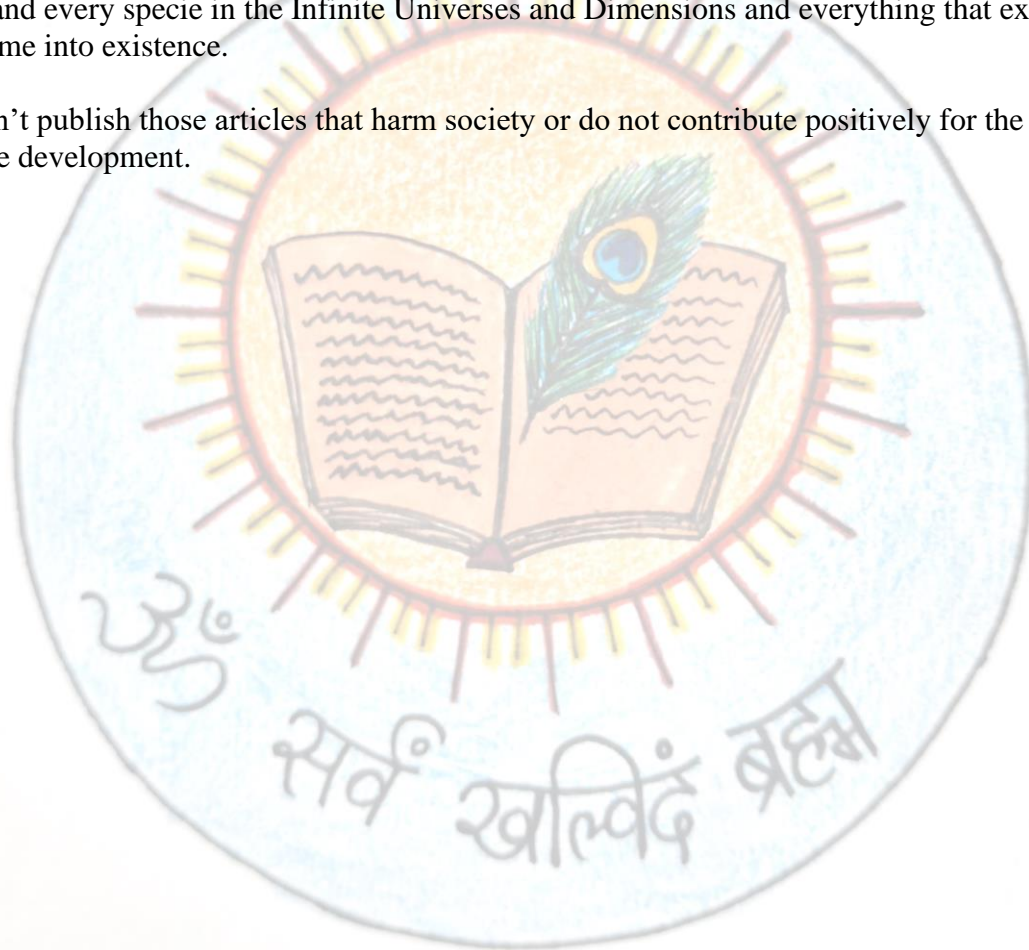


## About Us:

We are Professionals with more than 25 year experience in the field of Technology, Engineering, Law, Medicines, Linguistics, Life Sciences, and Medicines, we have come to the conclusion that unless the latest research articles and knowledge that is harmless to society are provided free of cost this world will not develop faster and human beings will not achieve the Millennium Development Goals (MDG)/ Sustainable Development Goals (SDG) of UNO, neither can it go to multiple places in the universe nor can we achieve the inclusive, healthy and sustainable growth on earth.

Our aim, mission, vision and credo are creating free knowledge society on earth and thus inclusive welfare of all the human beings on Mother Earth, and Moon, Mars and Beyond. In fact, we believe humans have capability to become the Supreme beings taking care of every entity and every specie in the Infinite Universes and Dimensions and everything that exists or will come into existence.

We don't publish those articles that harm society or do not contribute positively for the humane development.





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**Achieving Sustainable and Supreme Development Goals of human civilisation on the Mother Earth and on the Moon, on the Mars and Beyond, wherever human may go: Using Quantum Computing and Artificial Intelligence**

**Research Methodology:**

1. Children's Questions on, SAVE: Sustainability By/For Adapting the Humanitarian Values and Ethics using 'Artificial Intelligence (AI)' and 'Quantum Computing (QC)' by knowing their Positive sides, Negative sides, Failures, Limitations, Future Prospects, Warnings.
2. Answers and Solutions after exhaustive research on, "How to make Human Civilisation Supreme, by Achieving Supreme Development Goals, Anywhere and Everywhere, and what are the Methods to Achieve Supreme Goals using 'Artificial Intelligence (AI)' and 'Quantum Computing (QC)'?"

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## **Introduction to Artificial Intelligence (AI) as a legal entity:**

Artificial Intelligence (AI) is defined by different agencies in different ways, from legal department of governments, to the multilateral agencies like United Nations.

### **UN definition of AI:**

The ability of a digital computer or computer-controlled robot to perform tasks commonly associated with the intelligent beings.

### **US Department of Artificial Intelligence:**

The term Artificial Intelligence means a machine-based system that can for a given set of human based objectives makes predictions, recommendations or decisions influencing real or virtual environment.

### **WIPO definition of artificial intelligence:**

AI Systems are viewed primarily as learning systems that is, machines that can become better at a task typically performed by humans with limited or no human innervations. Narrow AI refers to techniques and applications designed to carry out singular or limited tasks.

### **The OECD AI Principles Definition:**

A machine-based system that for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decision that can influence physical or virtual environments.

### **European Commission Definition for Artificial Intelligence:**

A system that uses intelligent behaviour to analyse its environment and take actions to achieve goals. AI system can be software based or embedded in hardware devices.

### **Question 1:**

What is that, that can't be answered and solved by artificial intelligence?

### **Answer:**

Artificial intelligence (AI) is making stupendous progress every day. However, there are certain areas where AI fails to provide answers and solutions.

Please check some examples those we collected from practical applications:

### **Complex Human Emotions:**

1. Emotional Intelligence: AI systems has no human emotions and do not feel empathy though it might use sympathetic language, and thus making the AI systems to not fully understand and respond to emotional signs, signals, reminders and indications.

### **Live Case 1:**

We asked AI tools, “Show me getting 100 out of 100 marks in the Mathematics!”

AI Tools said, “Oops! I can’t answer it. I am machine and can’t express human emotions!”

2. Personal Conscience and Experiences: AI cannot reproduce personal human experiences, such as the feeling of pain, the experience of love and sympathy, or the sensitivity towards





creating human feelings appealing, with the present technology, though it can create certain pictures and videos using AI tools.

### Live Case 2:

We asked AI tools, “It hurts and pains a lot when we cut the nails, too much, do you have such feelings?”

AI Tool said, “No, I don’t feel hurt or pain. I’m a machine learning model, so I don’t have emotions or physical sensations. I am designed to process and provide information and I don’t have subjective experiences or consciousness.

### Multifaceted and Intricate Decision-Making:

1. **Moral Grey areas:** AI systems struggle to resolve complex moral dilemmas, especially the grey areas in which frequently require human verdict, humanitarian ethics, and moral values.

### Live Case 3:

#### Question 2:

We asked AI Tool: “Can you catch a thief stealing your data?”

#### AI Tool 1:

“I don't have personal data or physical possessions, so I'm not susceptible to theft in the classical sense. However, I'm designed to operate within secure infrastructure, and my training data is protected by robust security measures.

If someone attempts to breach the security of the systems that host me, various security protocols and monitoring systems would detect and respond to the threat. These measures include:

- a. **Encryption:** Protecting data both in transit and at rest.
- b. **Firewalls:** Blocking unauthorized access to the systems.
- c. **Intrusion detection and prevention systems:** Identifying and preventing potential security threats.
- d. **Monitoring and incident response:** Detecting and responding to security incidents.

While I don't have the capability to "catch" a thief in the classical sense, the security measures in place help protect the systems and data that support my operation”.

#### AI Tool 2: Answer:

As a large language model, I don't have personal data in the same way a human or a company does. I don't have bank accounts, personal photos, or private conversations. However, I can still be subject to data breaches or misuse in several ways:

- **Data Poisoning:** This involves malicious actors injecting flawed or biased data into my training data. This can affect my performance, causing me to generate incorrect, biased, or even harmful outputs.
- **Model Extraction:** This involves techniques to reverse-engineer my underlying model to steal my algorithms, parameters, or knowledge. This can allow others to create copies of me or use my capabilities without authorization.







- **Prompt Injection/Jailbreaking:** This involves crafting specific prompts that trick me into bypassing my safety guidelines or revealing sensitive information about my internal workings.
- **API Abuse:** If my API is not properly secured, attackers could exploit vulnerabilities to gain unauthorized access, steal data, or disrupt my services.

### How can these "thefts" be detected and prevented?

- **Data Poisoning:** Rigorous data cleaning, validation, and monitoring processes are crucial. Techniques like anomaly detection and adversarial training can help identify and mitigate poisoned data.
- **Model Extraction:** Techniques like differential privacy and watermarking can be used to protect my model from extraction. Monitoring API usage patterns can also help detect suspicious activity.
- **Prompt Injection/Jailbreaking:** Continuous testing and refinement of my safety guidelines and input validation techniques are necessary. Monitoring user prompts and outputs for suspicious patterns can also help detect and prevent attacks.
- **API Abuse:** Strong authentication, authorization, and rate limiting mechanisms are essential to secure my API. Regular security audits and penetration testing can help identify and address vulnerabilities.

### Can I "catch the thief"?

In a direct sense, I can't "catch" a thief in the way a human detective would. I don't have the ability to investigate real-world crimes or apprehend individuals. However, I can contribute to the detection and prevention of data breaches and misuse through:

- **Anomaly detection:** I can analyse large datasets of usage patterns, network traffic, and other relevant data to identify anomalies that may indicate malicious activity.
- **Pattern recognition:** I can identify patterns in user prompts, outputs, or network traffic that may indicate attempted prompt injection, model extraction, or other attacks.
- **Security monitoring:** I can be integrated with security monitoring systems to provide real-time alerts and insights into potential security threats.

By using these capabilities, I can act as a "digital watchdog," helping to protect myself and the systems I am integrated with from data theft and misuse. While I can't physically apprehend a "thief," I can play a crucial role in detecting, preventing, and mitigating security threats.

## 2. High-Risks Decision-Making:

AI may not be able to make decisions that require human intuition in case of faith and trust in God, critical thinking while dealing with relatives, and risk assessment during the environmental catastrophes like earthquakes, tsunami, eruption of lava from volcano, and the decisions made by judges on emotional issues critical decisions taken by doctors on the spot in an emergency and by other emergency responders like soldiers or fire fighters or nurses or mothers or in factories. It needs lot of research and next level technology upgradations.







#### Live case 4:

When we asked can our system work during lava eruption, tsunami and earthquakes?

The crux of what AI Tools said, “No, my system is not designed to function in extreme environments like lava, tsunami and earthquakes. It solely exists as a digital entity, running on computer servers and responding to text-based inputs. I don’t have physical present that could be exposed to lava or earthquakes or tsunami or any other physically extreme environment.

#### Original Creativity without human or software and hardware interventions:

- i. **Imaginative Creativity:** AI tools definitely generate lot of art, music, and literature, but they are always fed from the software programmers those always lack the originality, intuition, creativity, and emotional depth of human-created intuitive works.
- ii. **Innovation:** Presently AI may not be able to replicate the human capacity for innovation. Though, it can innovate partially once humans feed the direction but independently it cannot innovate anything and/or everything.
- iii. **Discovery:** At present AI lacks the innovative discovery and paradigm-shifting ideas. Though, it can help using Quantum Computers to generate new chemicals those can cure certain diseases. However, it’s not tested yet, whether can we step aside trials is also an ethical issue.
- iv. **Inventions:** AI at present can’t invent something new, we feed it and it gives us faster output that’s all.

#### Trustworthy Human Relationships:

- i. **Trust Building is distant dream for AI:** AI systems are still struggling to establish trust with humans, particularly in situations where human relationships and empathy are essential, and there are doubts posted on them due to impact of the past movies like Terminator, Predators, and other movies like iRobot, etc.
- ii. **Interpersonal and Intrapersonal Relations:** AI is yet to fully understand and navigate super complex human interactions. It can generate some jokes already recorded on the internet but can’t create its own humour, sarcasm, or subtle cues and can’t stop the wars or atom bombs explosions, thus it works as its programme is fed by the humans at present, so its trustworthiness is directly related to who is using AI tools, and whether those tools are in the good humanitarian hands or in not.

#### Live Case:

##### Machines are Machines:

The emotions and feelings are related to humans. While playing chess, it always wins, whether it’s 3 years old kid or 30 years old world champion. In lighter vein, a Grand Master can play and help the children win to build their confidence but AI and Chess Engines always win at high depth level. So, they defeat humans as they are fed for that but empathy and sympathy they lack at this level.



**Question 3:****In which domains the Artificial Intelligence (AI) will be used?****Answer:****Uses of Artificial Intelligence at present and future:**

AI is improving healthcare, and helping improving quality of efficient effective manufacturing and quality of customer service, those are leading to higher-quality experiences for both workers and customers, that is due to AI don't have to face challenges of regulation, data privacy concerns and worries over job losses. Of course, governments are trying to solve this problem head-on now a days.

Also, AI has Revolutionized the industries by automating certain techniques and tasks, already optimized decision-making process and has improved the decision models.

In addition to this, innovation across fields like healthcare, education, and finance and voice assistants, image recognition for face unlock in mobile phones, and ML-based financial fraud detection, has added great customer experience.

AI has created a breakthrough in personalized experiences at large scales through chatbots, digital assistants to create photos and videos.

AI has even mastered the art, science and commerce of software development life cycle and can develop the software at customer's will, which can create the better customer interfaces, delivering tailored made solutions to each problem.

In still future, Artificial Intelligence in combination with the Quantum Computing lot of breakthroughs are going to happen, as together they can find solutions to lot of scientific problems and technologies, just a precaution is it should be used for the humanitarian purpose only.

**The Consciousness:**

1. **Consciousness:** AI systems lack consciousness and it cannot be feed into the machines as humans themselves have not fully understood what exactly it is?
2. **Self-Awareness:** AI systems lack self-awareness, as it is not fully understood by human civilisation yet.
3. **The Hard Problem of Consciousness:** Philosopher David Chalmers' concept of the "hard problem" of consciousness, which questions why we have subjective experiences at all, remains a mystery that AI cannot solve.

**Humane Conclusion on this:**

Artificial Intelligence will definitely grow faster at dramatic and miraculous speeds but these are the areas whether humane or rational or just machines or other grey areas, where Artificial Intelligence is still an infant.

However, researchers, developers and regulating government agencies continue to work on addressing these limitations, and the future of AI definitely holds much a promise in case it lands in the good humane hands!





## **Introduction to Quantum Computing and Quantum Computers as a legal entity:**

### **Definition of Quantum Computing and Quantum Computers:**

#### **NASA and Google:**

The properties that govern physics at the extremely small scales and low temperatures of the quantum realm are puzzling and unique. Quantum computing is the practice of harnessing those properties to enable revolutionary algorithms that traditional computers wouldn't be able to run. Algorithms are a set of instructions to solve a problem or accomplish a task in computing. Quantum algorithms require descriptions of what operations should do during computation on a quantum computer, which often takes the form of a software program called a "quantum circuit."

**Thanks to the following organizations which are working in the domains of Artificial Intelligence and Quantum Computing, whose, old booklets, present updated websites, conference and journal publications, as of September 2024, I referred, but used my own language to let even kids/children understand the fundamentals of the AI and the QC:**

NASA-QuAIL, Google QuAIL, Microsoft, Huawei, Fujitsu, Baidu, Automatski, Aliun Alibaba Cloud, Taqbit Labs, Amazon, Nu Quantum, Quantinuum, Tech Target, Generative AI, UST China, D-Wave, Oxford Quantum Circuits, IonQ, Nokia Bell Labs, Universal Quantum, Quadora, Leti, Imec, Intel, Barcelona Super Computing Center, Accenture, Lomonosov Moscow State University, Cube Robot X, AEGIQ, ColdQuanta, ID Quantique, Infenion Technologies, XeedQ, NEC Corporation, Lockheed Martin, AT & T, Airbus, HP, and IBM.

#### **Question 4: How exactly the quantum computing works?**

##### **Answer:**

Quantum computing is a field of computer science that uses quantum theory to create computers that can perform calculations at much faster speeds than traditional computers. Quantum computers use qubits, or quantum bits, which are quantum particles that can exist in multiple states.

**Example 1:** With Qubits, Quantum Computers can read all the books in all the existing libraries in the world at a time, that too simultaneously.

**Example 2:** With Qubits, the Quantum Computers can access all the Chess Engines at a time and play the chess, making it impossible to defeat, thought it can draw a match if opponent plays as perfectly as she or he or it could.

**Example 3:** Super Computers can analyse the DNA of a person faster, but Quantum Computers can analyse the DNA of all the humans and other species at a time.

**Example 4:** Even if two particles or bodies or entities once entangled time and space can't stop their linking and mirror imaging or positive and negative or electron and positron or twin north and south pole kinds of entangled behaviour as if matter and antimatter can exist together.







**Example 5:** If the existing most powerful Quantum Computers having 2000 Qubits is considered, then it has capability of calculations more than all the existing laptops and computers on existing on the Mother Earth even though they have one billion transistors on their chip.

• **Qubits:**

Qubits are the basic unit of information in a quantum computer, similar to how bits i.e. Zero and One or to be precise  $0$  or  $1$  are the basic unit of information in a classical computer, however, Qubits can also take values like,  $0$ ,  $1$ , or a Quantum Super Imposition of  $0$  and  $1$ . Thus, the single Qubit can take two dimensions column vector of a unit which in turn is the magnitude of the squared of the entries that sums  $1$ . Thus, by using this unique property of qubit to perform calculations which were infeasible in classical computers using only  $1$  and  $0$ , Quantum Computers can compute infeasible calculations using Qubits, only. The Qubit can take  $1$  or  $0$  or  $0.1$  or  $0.2$  or  $0.11$  or  $0.22$ , etc. values between  $0$  to  $1$  at a time and parallelly and simultaneously can calculate multiple calculations at a time.

• **Superposition:**

Qubits can exist in multiple states, including both  $1$  and  $0$  simultaneously. This allows quantum computers to perform calculations in parallel.

Also, Qubits can take any arbitrary number state and simultaneously can exist in  $0$  or  $1$  or any number rational or irrational or any number, and even Qubits can take  $0$  and  $1$  simultaneously due to superimposition state because of their quantum mechanical nature, thus with Qubits if connected Quantum Computers can run and read all the memories of the all the robots, machines and the computers existing right now, which could be in billions or trillions.

• **Quantum Entanglement:**

Qubits can be entangled, meaning they are linked over space and time and can influence each other, without any time or distance barriers. Example could be, if Qubits are entangled and they exist at one end of the Universe the manipulation of one Qubit can influence the other Qubit situated at the opposite end of the Universe.

• **Quantum gates:**

They are similar to binary gates in classical computers, but they are reversible and preserve data.

• **Quantum circuits:**

They are made up of quantum gates.

• **Quantum Interference:**

The Qubits can interfere with each other and hence to get proper result they need to be separated and each Qubit is made independent output, using algorithms to get correct answers/solutions and this make the supercomputing more effective and efficient at the same time while working parallelly on several data points.



**• Quantum Tunnelling:**

If any particle or collection of encapsulated pockets of particles, at a lower state breaks its/their potential barrier to jump to higher energy state, which could be present in other network/place it is called as Quantum Tunnelling. This can lead to faster than light speed travels as well in empty spaces. In fact, on Sun, due to plasma state, it is a common phenomenon that some quantum particles on it, Quantum Tunnel. It can be used in the Quantum Computers, transmitting information, in future it can be used in teleportation too.

**Types of quantum computers:**

- i. Superconducting,
- ii. Photonic,
- iii. Neutral atoms,
- iv. Trapped ions, and
- v. Quantum dots, etc.

**Please Note:**

**There are more possibilities than these for Quantum Computing or even I suggested Quark Based Computing or Plank's Length Level i.e.  $1.6 \times 10^{-35}$  meters i.e. 1.6 multiplied by 10 raised to minus thirty five meters level ultra-microscopic computing i.e. Tanmatra a concept in the Sanatan Dharma level computing, which are yet to be discovered or invented.**

**Question 5:**

Where are the Simple Quantum Computers presently used and what are the future possibilities?

**Answer:****Present and Future Uses:**

- i. Scientific laboratories,
- ii. Supercomputer centres to enhance the machine learning capabilities of existing and future computers,
- iii. Universities,
- iv. Material Sciences can develop right material for every purpose for humans by sensing various parameters to survive, sustain at any place in the universe and dimensions and even on the Mother Earth for various humanitarian purpose.
- v. Accounting, Financial Services and Insurance:
  - a. Quantum computers could help financial institutions:
  - b. Optimize investment portfolios
  - c. Price financial derivatives
  - d. Detecting fraud
  - e. Model the behavior of investments and securities
  - f. Speed up financial decisions
  - g. Share markets
- vi. Drug and chemical research:
  - a. Develop new drugs and medical treatments
  - b. Mitigate dangerous chemical byproducts
  - c. Create better models for how atoms interact
- vii. Climate change: Understanding complete Oxygen, Nitrogen, Carbon and all elemental and entities cycles and reactions with various catalysts and elements to





- control the climate, weather and environment wherever human civilisation may go and establish in the infinite universes, dimensions and beyond.
- viii. Estimate the efficiency of various sequestration candidates
  - ix. Supply chain optimization
    - a. Improve traffic routing
    - b. Streamline manufacturing processes
  - x. AI and machine learning
    - a. Enhance AI's capabilities
    - b. Look at datasets in a new way
  - xi. Cybersecurity: Quantum computing has a direct impact on privacy and encryption, hence, these are companies which have started encrypting the passwords accordingly right now, which is need of the hour, to let these advanced technologies remain in good humanitarian hands.
  - xii. Batteries: Quantum computing could help manufacturers to better understand how to incorporate new materials into products such as batteries.
  - xiii. Enhancing semiconductors super next levels
  - xiv. Enhancing space technology, communication and travel to far distant galaxies and universes and dimensions.
  - xv. Enhancing living and life of species and entities for betterment
  - xvi. Enhancing human civilisation to a level where humane humans becoming peaceful supreme beings taking care of every specie and every entity in the infinite universes and dimensions.
  - xvii. In future Quantum Computers could be as big as a wrist watch or it may fit in helmet or spectacles or could be as small as fitted in contact lenses or on figure tip or could be wearable in cloths to do certain task or take care of something or someone, thus, helping humane humans doing their humanitarian tasks/ work.
  - xviii. Pharmaceutical Sciences: Finding exact cause of the diseases and mitigating it with proper chemical compositions in short, Super-fast discovery of the drug.
  - xix. Solving Complex Problems Which Super Computers cannot solve.
  - xx. Astronomy to search new planets and celestial objects or places or dimensions or entities and search for the extra-terrestrial life forms and possibility of human settlement on other places than Mother Earth.
  - xxi. Chemical Sciences can use it to find, analyses, develop and manufacture new chemicals
  - xxii. Language: Solving older scripts of the older civilisations and if possible, cryptographs and language of the super intelligent alien species or known species or entities if they are sending some messages to humans to contact in some way or other or trying to communicate with humans. In fact, even the language of other species on Mother Earth can also be cracked by Quantum Computing in collaborations with the Artificial Intelligence.
  - xxiii. Cracking Encryption and which is dangerous if goes in to bad hands, who can crack the password and use it for negative purpose.
  - xxiv. In future, Quantum Teleportation and Quantum Entanglement anywhere in multiverse or any dimension could be possible there by improving the communication and movement of humane human civilisation any place in this infinite space.
  - xxv. Quantum Computing can increase the capabilities of the present Super Computers by leaps and bounds by overcoming the data size barriers, handing the more complex data and information, and dealing with complex problems simultaneously.







xxvi. Infinite Possibilities if used in a humane way for humanitarian cause: There could be lots of possibilities in the fields of Biotechnology, Life Sciences, Archaeology, History, Geography, Logic, Medical Sciences, In fact, in any field it can be used.

### Question 6:

What are the limitations of Simple Quantum Computing and Quantum Computers?

### Answer:

Quantum computers have the potential to develop almost all the areas of life, however, none of the life and specie and entity is perfect thus, it also has its own noteworthy limitations, they are as follows:

- i. **Limitations to manufacture:**  
Simplest Quantum Computers are using Dilution Refrigerators, Big LASERS, Vacuum Chambers, etc. those are not easily available in the market.
- ii. **Limitations to the Error Correction due to Quantum Noise:**
  - a. **Quantum noise leading to errors:** Quantum computers are vulnerable to errors due to the noisy nature of quantum systems. These errors get quickly accumulated destroying the delicate quantum states required for the final computation, giving the exact results.
  - b. **Additional Qubits limits the Error correction procedures and techniques:** Still this technology is in nascent state of development, as the error correction techniques always need additional qubits, which in continuous process is very difficult to device and implement.
- iii. **Limitations to the Scalability, Calibration and Control:**
  - a. **Scalability:** Currently, most quantum computers are small-scale performing a limited number of operations, while scaling up to millions of qubits while maintaining same control as normal control with lowest rate of errors is a big challenge.
  - b. **Calibration and control:** Maintaining control over the quantum states of qubits and calibrating the parameters is important to get the final result, but, as the Qubits increases, the calibration and the control becomes obviously difficult.
- iv. **Limitations to the Quantum Algorithms and SDLC:**
  - a. **Limited algorithmic collection, range and repertoire:** Huge amount of investment is required to developing new, practically implementable quantum algorithms, as at present, there are only a few quantum algorithms, like Shor's algorithm and Grover's algorithm, which are offering better speed than classical algorithms.
  - b. **Software Development programming and SDLC:** Quantum programming and complete Software Development Life Cycle (SDLC) is still at initial stage, so, developing software that can efficiently utilize quantum computers is a big challenge.
- v. **Limitations to the Quantum Hardware Development and Materials Sciences:**
  - a. **Quantum hardware limitations:** The development of reliable, scalable quantum hardware is the basic necessity for Quantum Computing, but, presently available quantum hardware is often prone to errors, and present





materials science technology is not enough advanced to develop better hardware.

- b. **Materials science challenges:** Developing materials with the necessary properties for quantum computing, such as superconducting materials or topological insulators continue to be a big challenge.
- vi. **Limitations Quantum supremacy and verification:** Demonstrating quantum supremacy, where a quantum computer performs a task that is impossible for a classical computer, is challenging. Verifying the results of a quantum computation is also difficult.  
**Example:**  
Suppose, the Quantum Computer finds the value of Pi i.e.  $22/7$  to be ending at a decimal of 10 raised to the power of 1000, who can confirm that figure is right?
- vii. **Limitations to the Cryptography, Security and Privacy:** Quantum computers can potentially break certain classical encryption algorithms, but developing quantum-resistant cryptography and ensuring the security of quantum communication networks is essential and to design such password and encryption can become a problem to protect one Quantum Computer hacking other Quantum Computer.  
**Example:**  
I have Quantum Computer and suppose its password is complete Bible of Christianity, Quran of Islam, Geeta of Sanatan Religion, the three eminent religious scripts of three major religions. However, suppose another Quantum Computer cracks this five or ten-million-character password with its some Algorithm, then?  
How to encrypt it?  
How to assign a password to the Quantum Computers having such capabilities?  
This is double edge sword for Cryptography as well as for Security and Privacy too.
- viii. **Latency Limitation after Integration** with earlier version or semiconductor chip-based computers.

While these limitations are highly significant, researchers, institutions, organizations and governments are actively working day and night to overcome them and develop more powerful, reliable, and practical quantum computers those can benefit human civilisation in the long run for humanitarian cause.

### Question 7: What are Superconducting Quantum Computers?

#### Answer:

Superconducting quantum computers are a type of quantum computer that uses superconducting circuit materials at extremely low temperature, may be as below as Absolute Zero/Minus 273.15 degrees Celsius/Minus 460 degrees Fahrenheit to create Qubits and perform quantum computations. Presently, they are supposed to be the most advanced super computers as of September, 2024 AD/CE.

The organisations those are working on Superconducting Quantum Computers are Rigetti Computing, IQM, Anyon Systems, Quantum Circuits, Spin Q, and Quantum Foundry Copenhagen.



**Question 8:****What are Working Principles of Superconducting Quantum Computers?****Answer:**

The normal concept of Quantum Computers are applied over here too, in Superconducting Quantum Computers, like fundamentals of Superconductivity, Qubits, and the most unique function of, Josephson Junction that convert the Direct Current to Alternative Current and Vice a Versa i.e. Alternate Current to Direct Current.

**i. Superconductivity:**

Superconducting materials can conduct electricity with zero resistance when cooled to extremely low temperatures, it could be near to absolute zero degrees Kelvin or negative 273.15 degrees Celsius or negative 460 degrees Fahrenheit. Thus, theoretically they possess nearly infinite conductivity and near zero resistance to the electricity, thus reducing the energy consumption of Quantum Computers making them affordable and environmentally friendly, too. The phase difference between the superconductors create the DC Josephson current. However, the voltage applied across the junction create an AC Josephson current. Josephson Junction having coherence of wave function in the Superconductors can convert DC to AC and AC to DC in superconducting supercomputers, which makes them unique and most successful Quantum Computers as of September 2024 AD/CE, as per few experts. Thus, Josephson Junction acts as Rectifiers while converting the Alternate Current to Direct Currents and, they also act as Inverters when converting the Direct Current to the Alternate Current.

**ii. Quantum bits (qubits):**

Qubits are the fundamental units of quantum information. In superconducting quantum computers, qubits are typically made from tiny loops of superconducting material, and they count the extra electric charge sitting on them in the small island. The non-linearity of the Josephson junction allows the superconducting circuits to function as the Qubits.

**iii. Josephson junctions (JJ):**

Josephson junctions are the key components that enable superconducting qubits to perform quantum computations. They consist of two superconducting materials separated by a thin insulating barrier and electrons can tunnel through those barriers, it is Josephson Junction which has coherence of wave function in the Superconductors that helps to convert DC to AC while acting as Inverter and AC to DC while acting as Rectifier in superconducting supercomputers as per the requirement. It can act as a converter of voltage to frequency. Super Conducting Quantum Interference Device (SQUID) made up of arrays of the JJ can detect the magnetic flux improving its sensitivity of the detectors. There are different types of JJ like, point contact, microbridge, thin-film tunnel, bi-crystal, step-edge superconductor,







### Question 9: How Superconducting Quantum Computers Works?

**Answer:**

- i. **Qubit preparation:** The qubits are prepared in a superposition state, meaning they can exist in multiple states simultaneously, as discussed earlier.
- ii. **Quantum gate operations:** Quantum gate operations are applied to the qubits to perform quantum computations, which are enabled by the Josephson junctions.
- iii. **Quantum measurement:** The qubits are measured to extract the computational results.
- iv. **Error correction:** Error correction techniques are used to mitigate the effects of noise and errors in the quantum computation.
  
- v. **Multiple parallel operations like parallel computing.**

### Question 10: What are the Advantages of Superconducting Quantum Computers?

**Answer:**

- i. **Scalability:** Superconducting quantum computers can be scaled up to thousands of qubits.
- ii. **Fast gate times:** Superconducting qubits can perform gate operations quickly, reducing the overall computation time.
- iii. **High coherence times:** Superconducting qubits can maintain their quantum states for relatively long periods, to perform long calculations.
  
- iv. **Multiple parallel operations like parallel computing.**

### Question 11:

#### What are Challenges and Limitations of Super Conducting Computers?

**Answer:**

- i. **Noise and errors:** Superconducting qubits are prone to/ susceptible to noise and errors, which can affect the accuracy of the computation.
- ii. **Cryogenic cooling:** Superconducting quantum computers require cryogenic cooling to operate, which can be expensive and technically challenging.
- iii. **Quantum control:** Maintaining control over the quantum states of the qubits is essential, but can be difficult to achieve.

**Solutions:** Huge amount of Research and Developments are required to mitigate these challenges.



**Question 12:****What are the Future Prospects of Super Conducting Quantum Computers?****Answer:**

As per few scientists, the superconducting quantum computers are one of the most promising and the most successful approaches to research and develop a large-scale quantum computer, and Google, IBM, and Rigetti have invested a lot in it.

In future they might be used in chemistry, materials science, and optimization problems, and revolutionise the solutions, even they can be used in lot of domains which are yet to evolve in these domains.

Quantum Computer can research and develop new branch of arts or science or any known or unknow domains which could be the next level of evolution for the human kind.

**Question 13:****What are photonic quantum computers?****Answer:**

The Quantum Computers which use the photon or particles of the light to perform the Quantum Computations are known as the Photonic Quantum Computers.

The companies working on the Photonic Quantum Computers are Toshiba, Quandela, Xanadu, NTT, Amazon, Menlo, Single Quantum, Qubitekk, Nordic Quantum Computing Group, Quix Quantum, and ID Quantique.

**Question 14:****What are the Working Principles of Photonic Quantum Computers?****Answer:**

- i. **Quantum bits (qubits):** In photonic quantum computers, qubits are encoded onto photons using their polarization, phase, amount of energy, speed, mass, charge, momentum, wave-particle duality, creation and destruction time, conservation of energy and momentum and transition of atom at that moment, or other properties.
- ii. **Linear optical elements:** Photonic quantum computers use linear optical elements, such as lenses, mirrors, waveplates, beam splitters, phase shifters, prisms, and diffraction gratings kinds of advanced elements to manipulate and control the photons to be used for the Quantum Computing. These elements have direct impact on the performance on the input of photons.
- iii. **Nonlinear optical elements:** Nonlinear optical elements, such as optical fibres or nonlinear crystals, are used to perform nonlinear operations, such as entanglement generation. The most common non-linear elements in use are Barium Borate (BBO), Lithium Triborate (LBO), Nonlinear dielectric meta-surfaces, Stimulated Brillouin Scattering, nonlinear





plasmonic meta-surfaces. For this, nonlinear optical material should be having high transmission at fundamental harmonic wavelength, good optical quality, perfect phase matching, highly fine-tuned LASER induced-damage threshold, matching colours of light and frequency, to get better result, though it is known fact that lot of properties are not proportional to the intensity of light in non-linear optical elements.

### Question 15:

#### How Photonic Quantum Computers Work?

##### Answer:

In short, super imposition of quantum states can be easily represented, encrypted, transmitted and detected, analysed and read using Photons via optical systems of quantum information processing.

It involves:

- i. **Photon generation:** Photons are generated using a laser or other light source.
- ii. **Qubit encoding:** The photons are encoded with quantum information using various techniques, such as polarization or phase modulation.
- iii. **Quantum gate operations:** Linear optical elements are used to perform quantum gate operations, such as Hadamard gates, Pauli-X gates, and controlled-NOT gates.
- iv. **Entanglement generation:** Nonlinear optical elements are used to generate entanglement between photons.
- v. **Measurement:** The photons are measured using photodetectors, which collapse the quantum state onto a classical state.
- vi. **Multiple parallel operations like parallel computing.**

### Question 16:

#### What Advantages of Photonic Quantum Computers?

##### Answer:

- i. **Low noise:** Photonic quantum computers are less susceptible to noise and decoherence compared to other types of quantum computers.
- ii. **High-speed operations:** Photonic quantum computers can perform quantum gate operations at high speeds, making them suitable for applications requiring faster computation.
- iii. **Scalability:** Photonic quantum computers can be scaled up using integrated photonics and optical interconnects.

### Question 17:

#### What are Challenges and Limitations Photonic Quantum Computers?

- i. **Quantum control:** Maintaining control over the quantum states of the photons is essential, but can be difficult to achieve.
- ii. **Scalability:** While photonic quantum computers can be scaled up, the complexity of the







optical circuits increases exponentially with the number of qubits.

iii. **Detection efficiency:** Photodetectors used in photonic quantum computers have limited detection efficiency, which can lead to errors in the computation.

**Solutions:** Huge amount of Research and Developments are required to mitigate these challenges.

### Question 18:

#### What are Future Prospects Photonic Quantum Computers?

##### Answer:

Photonic quantum computers are being developed by various research groups and companies, such as Toshiba, NTT, Amazon, and Single Quantum. While there are still significant technical challenges to overcome.

Photonic quantum computers have the potential to revolutionize various fields, including chemistry, materials science, pharmaceutical industry, optimization problems, and more.

### Question 19:

#### What are neutral atoms quantum computers?

##### Answer:

The Quantum Computers which uses the neutral atoms especially the alkali metals like Rubidium and Caesium to perform the Quantum Computing are known as the Neutral Atoms Quantum Computers.

The organisations working on this are PASQAL, Atom Computing, ColdQuanta, PlanQC, QuEra Computing, M Squared LASERS, and Nanofibre.

### Question 20:

#### What are the Principles of Neutral Atom Quantum Computers?

##### Answer:

i. Quantum bits (qubits): In neutral atom quantum computers, qubits are encoded onto the atomic states of the neutral atoms, depicted in the two internal energy levels of the different atomic orbital levels.

ii. Magnetic Trapping, Manipulation, Quantum Gates, and Addressing: Neutral atoms are trapped using magnetic fields, which confine the atoms to a specific region and optical or microwave pulses are used for manipulating quantum gates by coupling to Rydberg states and individual qubits are manipulated and addressed using LASERS pulses.

iii. LASER cooling: The trapped atoms are cooled to extremely low temperatures using laser cooling techniques.





### Question 21:

#### How Neutral Atom Quantum Computers Work?

**Answer:**

- i. **Atom preparation:** Neutral atoms are prepared in a specific quantum state using laser light.
- ii. **Qubit encoding:** The quantum state of the atom is encoded onto each qubit, using optical or microwave pulses and manipulating them to quantum state of atoms.
- iii. **Quantum gate operations:** Coupling to Rydberg states create Quantum Gates and Quantum gate operations are performed on the qubits using laser light and magnetic fields.
- iv. **Entanglement generation:** Entanglement is generated between qubits using controlled collisions or other mechanisms.
- v. **Measurement:** The qubits are measured using fluorescence detection or other techniques.
- vi. **Multiple parallel operations like parallel computing.**

### Question 22:

#### What are the Advantages of Neutral Atom Quantum Computers?

**Answer:**

- i. Scalability: Neutral atom quantum computers can be scaled up using arrays of magnetic traps, which could be in two dimensions or in three dimensions as well.
- ii. Low error rates: Neutral atom quantum computers have low error rates due to the stability of the atomic states.
- iii. Long coherence times: Neutral atom quantum computers have long coherence times, allowing for complex quantum computations.
- iv. Working at room temperature and pressure: It reduces the special requirements and thus have less power consumptions than other existing Quantum Computers.
- v. Almost identical Qubits: Due to identical neutral atoms, there are less manufacturing defects exists in Neutral Atoms Quantum Computing.

### Question 23:

#### What are the Challenges and Limitations of Neutral Atom Quantum Computers?

**Answer:**

- i. Atomic interactions: Neutral atoms can interact with each other, leading to errors in the computation.
- ii. Magnetic field stability: The magnetic fields used for trapping and manipulating the atoms must be extremely stable.
- iii. Laser control: The laser light used for cooling and manipulating the atoms must be precisely controlled.





iv. Two Qubits gate reliabilities needs improvement.

v. Gate operation speeds need improvement.

vi. Repetition rates needs improvement, so that per second computation in the processor can be increased.

**Solutions:** Huge amount of Research and Developments are required to mitigate these challenges.

#### **Question 24:**

**Answer:**

#### **What are the Future Prospects of Neutral Atom Quantum Computers?**

Neutral atom quantum computers are being developed by various research groups and companies, such as IonQ and Pasqal. While there are still significant technical challenges to overcome, neutral atom quantum computers have the potential to revolutionize various fields, including chemistry, materials science, Quantum Simulation, Life Sciences, and machine learning, optimization problems.

**Solutions:** Huge amount of Research and Developments are required to mitigate these challenges.

#### **Question 25:**

#### **What are trapped ions quantum computers?**

**Answer:**

Trapped ions quantum computers are a type of quantum computer that uses trapped ions to generate stable Qubits, at specific energy levels in different atomic orbitals using electromagnetic fields, typically calcium or barium ions are used to perform quantum computations.

The notable organisations those are working on this are RIKEN, IonQ, Alpine Quantum Technologies, Quantum Factory, University of Oxford Department of Physics, Quantinuum, and Eleqtron.



**Question 26:****What are the working Principles of Trapped Ions Quantum Computers?****Answer:**

i. **Quantum bits (qubits):** In trapped ions quantum computers, qubits are encoded onto the electronic states of the trapped ions which are suspended in electric or magnetic fields or electric fields using ion traps at different energy levels and different atomic orbitals.

ii. **Electromagnetic traps:** Ions are trapped using electromagnetic fields, at different atomic orbitals at different energy levels so that ions get restricted to a specific region, where LASER beams can manipulate the ions.

iv. **Manipulations of the ions to form the Qubits:** LASER beams along with electromagnetic fields are used to manipulate the ions to form the Qubits at specific energy levels in specific orbitals of the atoms, for specific purpose.

v. **Stable Qubits and its storage:** Once the Qubits are generated using trapping and manipulating the atoms at specific energy levels in certain orbitals, they are stored in stable electronic states so that ions can be used for the desired purpose/s.

vi. **LASER cooling:** The trapped ions are cooled to extremely low temperatures using laser cooling techniques.

**Question 27:****How do the Trapped Ions Quantum Computers Work?****Answer:**

i. **Preparation of the Ion:** Ions are prepared in a specific quantum state using laser light by trapping them in a confined area and each atom in an ion is manipulated to form Qubit at certain energy level and in specific orbital, for desired results.

ii. **Encoding the Qubit:** The quantum state of the ion is encoded on each qubit, when each atomic level reaches a stable state, after Ion preparation.

iii. **Quantum gate operations:** Quantum gate operations are performed on the qubits using laser light of specific frequency and electromagnetic fields applied to that confined region of focused space.

iv. **Generation of Entanglement:** Entanglement is generated between qubits using controlled interactions, in controlled states, in that tiny confined region of focused space.

v. **Qubit Measurement:** The qubits are measured using fluorescence detection or other techniques, and at present most powerful Quantum Computer has detected 50 perfect Qubits, it is more powerful than all the normal existing technological computer calculations put together on Mother Earth. So, any higher next level computing will take humanity still level next.

vi. **Multiple parallel operations like parallel computing.**







### **Question 28: What are the Advantages of Trapped Ions Quantum Computers?**

**Answer:**

- i. High dependency on quantum gates: Trapped ions quantum computers can perform high-fidelity quantum gate operations, the reason being ions are intrinsically identical in nature.
- ii. Very Long coherence times: Trapped ions quantum computers have long coherence times, allowing to perform complex quantum computations accurately.
- iii. Scalability: Trapped ions quantum computers can be scaled up using arrays of electromagnetic traps.
  
- iv. They can be more accurate, faster, can have less errors and can do more complex calculations and can solve the teething problems especially in the field of algorithms to plan and develop the new drugs on cancer and other medical problems human face, cryptography and quantum simulations.

### **Question 29: What are the Challenges and Limitations of Trapped Ions Quantum Computers?**

**Answer:**

- i. Ion trapping: Trapping and manipulating individual ions can be challenging.
- ii. Laser control: The laser light used for cooling and manipulating the ions must be precisely controlled.
- iii. Scalability limitations: As the number of ions increases, the complexity of the electromagnetic traps and laser control systems also increases.
  
- iv. Error and Noise handling is challenging
  
- v. Stable State Time: Ion and Photon life times are in picoseconds so relatively very less time to manipulate for desired result.
  
- vi. Ion manipulation is challenging as again the state is stable for limited time.
  
- vii. Control of optical and electronic state is again difficult.
  
- ix. Decoherence of Qubits while interacting with each other is again difficult due to time constraints of stable states.
- x. Integration of lot of technologies and latent time wasted in those integration in Quantum Computing can be a big problem.
- xi. For two Qubits it is the fastest but for more than that entanglement is a big problem with present technologies.

**Solutions:** Huge amount of Research and Developments are required to mitigate these challenges.



**Question 30: What are the Future Prospects of Trapped ions Quantum Computers?****Answer:**

Trapped ions quantum computers are being developed by various research groups and companies, such as IonQ and Honeywell Quantum Solutions. While there are still significant technical challenges to overcome, trapped ions quantum computers have the potential to revolutionize various fields, including chemistry, materials science, and optimization problems.

**Question 31:****What are quantum dots quantum computers?****Answer:**

Quantum dots quantum computer is a type of quantum computer that uses nanoscale particles called quantum dots, which are tiniest possible particles made of/from semiconductor material to form Qubits and perform quantum computations.

Notable organisation working on this Quantum Computers technologies are Nanoco, Mojo Vision, UbiGro, Johnson Matthey, QDI, StoreDot, QuantumDot, and QNA.

**Question 32:****What are the working Principles of Quantum Dots Quantum Computers?****Answer:**

- i. Forming Quantum bits (qubits): In quantum dots quantum computers, spin qubits are encoded onto the spin states of electrons or holes trapped in the quantum dots confined to the tiniest semiconductor material.
- ii. Quantum confinement: Quantum dots are tiny particles that confine electrons or holes in a small space, allowing for precise control over their quantum states, which is done using electric and magnetic fields.
- iii. Electrostatic control: Quantum dots are controlled using electrostatic gates, which allow for precise manipulation of the quantum states, in specified space put under the influence of electromagnetic fields.
- iv. In this also, huge arrays of quantum dots can be crated in 2D or 3D while each dot can act as a Qubit.

**Question 33:****How Quantum Dots Quantum Computer Works?****Answer:**

- i. Quantum dot preparation: Quantum dots are prepared in a specific quantum state using electrostatic gates.
- ii. Qubit encoding: The quantum state of the electron or hole is encoded onto a qubit.
- iii. Quantum gate operations: Quantum gate operations are performed on the qubits using electrostatic gates and microwave pulses.
- iv. Entanglement generation: Entanglement is generated between qubits using controlled





interactions.

v. Measurement: The qubits are measured using techniques such as spin-to-charge conversion or optical spectroscopy.

#### **Question 34:**

#### **What are the Advantages of Quantum Dots Quantum Computers?**

##### **Answer:**

- i. Scalability: Quantum dots quantum computers can be scaled up using 2D or 3D arrays of quantum dots.
- ii. Faster gate times: Quantum dots quantum computers can perform quantum gate operations quickly.
- iii. High coherence times: Quantum dots quantum computers have high coherence times, allowing for complex quantum computations.
- iv. Control: Quantum dot quantum computers have ability to control the Qubits using electromagnetic influence.

#### **Question 35:**

#### **What are the Challenges and Limitations Quantum Dots Quantum Computers?**

##### **Answer:**

- i. Quantum dot uniformity: Confirming uniformity in the quantum dots can become a challenging task with present day technologies.
- ii. Electrostatic control: Continuing exact control over the electrostatic can become a challenging task with present day technologies.
- iii. Scalability limitations: As the number of quantum dots increases, the complexity of the electrostatic gate control system also increases, the reason being each Qubit needs to be controlled while its exact manipulation and controlling millions of control points and lines becomes a challenging task with present day technologies.
- iv. Manufacturing the tiniest possible semiconductor material called Quantum Dots itself is problem with present day technologies, when all the technologies used have transistors infused in a tiny chip is the norm.

**Solutions:** Huge amount of Research and Developments are required to mitigate these challenges.

#### **Question 36:**

#### **What are the Future Prospects Quantum Dots Quantum Computers?**

##### **Answer:**

Quantum dots quantum computers are being developed by various research groups and companies. While there are still significant technical challenges to overcome, quantum dots quantum computers have potentially revolutionized the fields like Computer Displays, Mobile Displays, LED light systems, healthcare in detecting the diseases, knowing and





controlling the diseases using DNA correction in human beings and other life forms, detecting the Gravitational waves using quantum sensing, developing the photonic materials, metamaterials and advanced coating of the stealth aeroplanes, space shuttle coatings and in future might even advance the chemistry, materials science, medical and life sciences, pharmaceutical sciences and technologies, photovoltaic technologies to generate more electricity at fractional intensity of light, and space age technologies, and other sciences and art too will have its influence.

**Question 37:**

Which are the institutions and organisations those are involved in the Quantum Computing and Artificial Intelligence, in India?

**Answer:**

As per India's National Quantum Mission (NQM) India is taking its present 7 Qubit level to 50 Qubits in coming 5 years, then to 100 Qubits in next five year, then 1000 Qubits in ten years. Government Institutions like IISc-Quantum Measurement and Control Laboratory-IQT, IIT's, TIFR, and private companies like TCS, Wipro, HCL, and Infosys and other companies and institutions have invested heavily on this and working round the clock for the breakthroughs.

While Artificial Intelligence and its use is very common in India and in fact globally, people are not aware about it.

Most of the software engineers are using it since long, in fact, even smaller computers and hardware use the technologies those fall into this category, and still basic technologies like calculators, too use it, as the memory and program inside are artificial intelligence of that gadget or machine.

In the present era, there are so many mobile and computer apps, those are developed by Indian Companies, thus time is not far away that India will be using AI in all the possible applications.

The aerospace organisation of India like ISRO used it in Vikram Lander and Pragyan Rover on the Moon and for analysing Moon and in fact, Chandrayan found water on the Moon using this technology only, in the past Mars Orbiter Mission the Mangalyan, and while launching the 104 satellites at a time also used this technology.

HAL Tejas Fighter Aircraft has this technology implemented in it/

The future space dockings and satellites, and Moon Landing, and Humans on Mars and beyond programmes, will be using this technology very often.

Other Domains like Education, Infrastructure, agriculture, Metrology, GSI, and your Games and Greeting Cards you send on Diwali, Christmas are created using AI, thus we all are already using AI very often, without being noticed.

**Question 38:**

What is the positive side of artificial intelligence?

**Answer:**

Artificial Intelligence (AI) has lot of positive sides to transform our lives and bring dramatical positive changes in the industry too.

**AI in Healthcare:**

- i. Medical diagnosis of all the patients and treatment can be improved.
- ii. Disease prevention and prediction by analysing the data.
- iii. Epidemic and Pandemic can be predicted once the outbreak is there by analysing the data.







iv. Robotic Tele Haptic Surgeries with exact sensation to the Surgeon, can be performed remotely as well in physical present of the surgeon with precision and less time and the accuracy and precision can also be improved.

**Example:**

The dosage of the epidemic vaccine is finalised by AI powered data analyses.

**AI in Quality and Optimum Industrial Output:**

- i. AI Can enhancing productivity, efficiency, effectivity, and giving quality product/ services.
- ii. AI can automation of repetitive tasks.
- iii. AI can optimize business processes to satisfy internal and external customers.
- iv. AI can automate and assist anyone at any time.
- v. AI can help optimise the output as per the need than greed by analysing the data and latest up-to-date information.

**Example:**

Coca-Cola bottling.

**AI can Enhanced Education and Learning Experience:**

- i. AI has already started giving a Personalized learning experiences to billions of individuals and they can complete the courses as per need and at their own set time and pace.
- ii. AI can improve it teaching while learning online in real time.
- iii. AI can examine, evaluate the grant the grades, too.

**Example:** Online Google Digital Marketing Certificate course.

**AI Can revolutionise the Logistics and Supply Chain Management:**

- i. Autonomous Vehicles on the Mars was AI driven,
- ii. AI can improve road / air/ ocean/ space safety, reduce traffic congestion, and timely delivery of the goods and services and improved output.
- iii. AI has already helped in Optimized routes which has reduced the travel time thus reducing pollution by low fuel consumption.
- iv. AI has improved the Predictive maintenance, Breakdown Maintenance, and hence the down time of vehicles has reduced in many transport organisations.

**Example:**

Pizza delivery in 30 minutes, Grocery delivery in one hour all have been possible only due to AI.

**AI can help human civilisation to achieve Environmental Sustainability:**

- i. By developing weather and climate patterns at micro level to macro levels and helping to take policy decisions across the world.
- ii. Need based optimised consumption of resources.
- iii. By developing monitoring system for Wildlife conservation all the species can survive and sustain.
- v. Even the oceans can be managed well.
- vi. Urban and Rural planning and implantation can be managed well.

**Example:**

Globally, at least 100 hydroponic farming green houses have used AI to utilise their space well and maximise output.

**AI can help technology reach at the grassroot level:**

**Example:**

- i. Generative Artificial Intelligence, Chat-Generative Pretrained Transformer (GPT), Meta AI, Gemini, Apple Intelligence, and other AI Apps are helping billion of computers, devices,





- and mobile users globally to generate text, greeting cards, videos, do work, translate text, etc.
- ii. Some Generative AI also learn from the humans lot of complex to simple things and evolve too by continuous learning and such algorithms are available too, in fact right now these patterns are fed by humans to keep adding the data base as learning to AI, the best learning example could be Chess Engines/ AI Chess/ AI plus Quantum Computers, in which once the games are fed thy understand which move to play and win the game even played at level next, every time, this can help chess learners and players refine/hone their chess skills.
  - iii. In the United Nations, while one leader speaks in his own language the AI Tools instantly translate it into the local language of other leaders to understand what the leader is speaking.
  - iv. The corporates and institutions are using AI and have revolutionised the Human Resource Management, Marketing Management, Stock Market, Customer Relationship Management, Advertising, even the everyday use of the Personal Computers have AI tools those can generate the Word files and Excel files and the Presentations at faster pace with desired language and templates, with graphs, statistics, video files and supporting features.

These are tip of the iceberg of AI and its positive implantation in our everyday lives.

### **Question 39:**

What is the positive side of quantum computers?

### **Answer:**

First time in the modern scientific history Quantum computers is such a revolutionary concept brought into practice that it can touch every domain and can bring positive out of it.

- i. Cracking as well as Generating the Multifaceted, Intricate Cryptographic Codes for better security and for secured communication of personal as well as confidential data, using quantum key distribution (QKD).
- ii. Research and Development and Simulation of the Quantum level to the Astronomical level phenomenon, to the life sciences DNA level chemical reactions to the superconducting material to the reaction of the medicines on the human body to weather and climate of any planet.
- iii. Optimisation of Logistics and Supply Chain management and transportation problems, and even the financial management and to the risk mitigation in the stock market, to the Algorithms in Machine learning and Artificial Intelligence.

### **Question 40:**

What is the negative side of artificial intelligence?

### **Answer:**

Artificial intelligence (AI) has the latent capability to revolutionise humane lives it also has alarmed the humanity due to following fears and challenges due to negativity it is growing in the dark web touching the lives of the civilised societies right from kids to the vulnerable people to the strongest people and entities.

- i. Rich are becoming richer by using the AI assisted the automation tools and technologies in the industry and that's why Gini Index of 2023 AD/CE/Circa shows that there are 1000 plus billionaires in the world and 100 plus billionaires grew their money even in the pandemic thought they didn't went for the job to earn, however, the poor who live hand to mouth by





- earning daily wages faces lot of hardship. Thus, almost 0.0001% of the human population holds lot of money and power and AI is helping them grow further but poor are losing their jobs and survival support too, and none could find a better solution on this yet.
- ii. Paid Talents on the social media are been highlighted and get more money and attention too but poor but real talents are getting less money and attentions too, though they are working for humanitarian cause. Technology of Algorithms also support some who have better paid subscription and plans. Another side to this is the explosive noise in the social media increases the doubts about the decisions taken due to lack of transparency.
  - iii. AI has instead the self-driven cars so job of driver is gone at the same time the surveillance cameras in the big cities and places has cracked the personal privacy too. In the name of security many a times mis advantage is also been seen taken by miscreants. The Social Media leaks have exploited the data breach and data and information of billions around the world. Security is at stake due to AI been done in wrong hands.
  - iv. Nations have started building the Robot Armies driven by AI, if the AI takes inhumane decision then Terminator, Apocalypse, movies can become a reality.
  - v. Biased media and manipulated prejudices information have created riots in many nations.
  - vi. AI can provide the focused information about the individuals and certain class of people and the miscreants can use this information for negative purpose, posing threat to society, this is the cause of cybercrime as well. In 2023 AD/CE only almost USD one trillion were looted by the cybercrime experts via dark web.
  - vii. AI with Quantum Computers can become a dangerous combination and can over power the intelligence of humans. Many a times human touch is lost.
  - viii. It has been observed that AI algorithms use lot of energy and that can pose the environmental threats too.
  - ix. The versioning of the hardware and software in the gaming and industry makes the previous version waste thus generating increased the e-waste.
  - x. Technologies are developed at faster rates than the legal bindings, making it impossible for common man to live with dignity and safety.

**Solution:**

Humane humans should keep control of the technology, in fact, even the AI too, and use them with the supreme aim of using them for the humanitarian cause and welfare and wellbeing of all, than for the wars of any kind.

**Question 41:**

What are the negative sides of quantum computers?

**Answer:**

Being the most advanced technology which can do calculations of billions of years in few seconds the Quantum Computers have the super capability to revolutionise humane lives in all the domains, however, it also has alarmed the humanity due to following fears and challenges due to negativity growing in the dark web touching the lives of the civilised societies right from kids to the vulnerable people to the strongest people and entities.

- i. None of the password and the knowledge and their security is safe once Quantum Computers are operated as they can crack any code and encryption.
- ii. Quantum Computers have phenomenal calculations speeds and can run parallelly on several aspects and data and at Quantum levels the errors can be many but to understand and detect it at that rate is challenging but once the output is out no entity can confirm





- whether that is true or false, thus confirming undetectable errors due to lot of noise of information running at the same time and presently the algorithms to detect them are at nascent stage.
- iii. The AI takes more time and energy, but Quantum Computers can consume more energy too, as trillions of Quantum level phenomenon need to be controlled for same phase, angular momentum and more than that. The cooling could also is a problem and in certain computers like Superconducting Quantum Computers keeping Absolute Zero Temperature also needs lot of energy, thus, every kind of Quantum Computers have their own high Energy needs and complicated cooling Problems.
  - iv. Humans are yet to decide for what purpose these Quantum Computers can be used, though they are using them in certain complicated calculations in the area of Physics, Mathematics, Finance, and certain limited domains, though Quantum Computers have their own superiority over old technological computers.
  - v. Operating Quantum Computers is niche skills now a day which is out of common man's reach.
  - vi. Quantum Computer technology concept itself is based on high cost at every stage, every stage, and for every aspect of the technology to algorithm to software to hardware, to maintenance to operations at present, so not so affordable to even lot of governments around the world.
  - vii. If the technology goes into wrong hands, Quantum Computer viruses, malware, bots can create havoc in the present systems, and if certain vulnerabilities are detected that can disordinate the present global economy and technological world too. No cyber security will be safe.
  - viii. Rare Earth Metals and Elements like Erbium are used to form the Qubits or used in LASERS and in flint glass, Europium used in Photonic Quantum Computers, Ytterbium used in Ionic Quantum Computers, Rubidium the alkali metal is used in Neutral Atom Quantum Computers, Niobium is used in Superconducting Quantum Computers to stabilise the Qubits, and some electronic component use the Lanthanum (La), Cerium (Ce), Samarian (Sm) and Neodymium (Nd), to name a few. In fact, Neodymium has strongest magnet, with 40 BHmax is used for the Quantum Computers and its very rare to find and it needs very complex transportation methods too and is storing and maintaining these rare earth metals is also a costly and risky.

**Solution:**

Every technology has positive and negative sides but to overcome these negative side of the Quantum Computers, human civilisation needs huge investment of time, money and human resources if human civilisation has to go to Moon, Mars and beyond by using Quantum Computers and Artificial Intelligence and other humane technologies those let human civilisation survive and sustain, forever.

**Question 42:**

What are the dangerous signs and warnings from Quantum computers?

**Answer:**

Quantum Computers are powerful tools that can solve complex problems, but they also pose some risks and challenges. Some potentially dangerous signs, and warnings are:

- i. None of the computer with basic minimum security is safe if the Quantum Computers (QC) are gone into the wrong hands, as QC are capable of cracking any cryptographic codes.







- ii. Error prevention, correction, mitigation is huge research area, as how to know the if the answer is correct on one hand a problem is there and while calculations even if try to correct still a big problem, still.
- iii. Physically too any computer virus and malware can have yet to know or unexplainable dangerous results.
- iv. As discussed in the negative side of QC, job loss and increasing societal economic disparities, increase in ethical and values-based risks due to increase in partiality and prejudices, untransparent outputs have non holding accountable is also a risk, huge energy consumption, mysterious behaviour in certain cases, are really a threat to humankind.

**Solutions:**

Strong rules and regulations, investing in training the next generation, proper security and algorithms, are the best solutions.

**Question 43:**

What are dangerous signs and warnings from artificial intelligence?

**Answer:**

Artificial Intelligence is a powerful tool that can solve complex problems, but they also pose some risks and challenges. Some potentially dangerous signs, and warnings are:

- i. None of the computer with basic minimum security is safe if the AI gone into the wrong hands, and Cyber Attacks and Cyber Crimes of almost One Trillion Dollars has proved it till September 2024, none of the cryptographic codes, could stop it, as vulnerable citizens, were the most who got affected from it. Deep Fake, Identity theft, Morphing using AI is so common that Governments had to come forward and alert citizens around the globe.
- ii. As discussed in the negative side of QC same is the case in AI too, the job loss and increasing societal economic disparities, increase in ethical and values-based risks due to increase in partiality and prejudices, untransparent outputs have non holding accountable is also a risk, huge energy consumption, mysterious behaviour in certain cases, are really a threat to humankind.

**Solutions:**

Strong rules and regulations, investing in training the next generation, proper security and algorithms and protocols, and basically, Values based global society is the best solutions.

**Question 44:**

What are Future prospects of artificial intelligence?

**Answer:**

The future prospects of artificial intelligence (AI) are vast, varied, and if they are values based then humanity can get benefitted in across numerous industries, whether it is machine learning, natural language processing, healthcare, and education only if they are used for humanitarian cause, otherwise the negative side is also strong as we saw job loss, partiality, and if AI and Quantum Computing are aligned then humans may have existential threat if the AI and QC generate conscience in the machines. Again, the best solutions are same, as posed in the challenges of AI.



**Question 45:**

How can Quantum Computing and Artificial Intelligence be used to achieve United Nation's Sustainable Development Goals?

**Answer:**

Quantum computing and artificial intelligence (AI) offer powerful tools to tackle complex challenges related to the UN's Sustainable Development Goals (SDGs) and following are the ways they can contribute for this cause:

**1. Climate Action (SDG 13)**

- **Quantum Computing:**
  - **Developing new materials for carbon capture, as well as to help reduce Carbon dioxide emission from home and industries.**
  - Improving the battery technology for reducing the size but improving efficiency and output.
  - **Better climate modelling and understanding weather patterns and predictions of natural disaster and mitigating risks.**
- **Artificial Intelligence:**
  - Already AI algorithms have optimized energy grids, buildings, and transportation systems and reduced energy waste and have improved the efficiency in many nations.
  - Satellite data is been used for Monitoring deforestation and biodiversity loss, in future it can help improve on that.
  - Predicting extreme weather events and natural and celestial disaster like earthquakes, tsunami warnings, volcano eruption, meteorite strike, etc. so that humanity can remain ready to mitigate the threats.

**2. Affordable and Clean Energy (SDG 7)**

- **Quantum Computing:**
  - Developing highly efficient and convenient new solar cell technologies, Wind energy, hydel power, tidal power, geyser energy, atomic fission and fusion technologies, and other energy sources using Quantum Simulation by using optimal resources, algorithms which will reduce transmission losses, risks, and will improve the dependability.
- **Artificial Intelligence:**
  - **Forecasting energy demands in various time and seasons more accurately and then optimizing the energy needs using renewable energy sources more efficiently.**

**3. Good Health and Well-being (SDG 3)**

- **Quantum Computing:**
  - **Fast-tracking drug research, discovery of exact combination of chemical patterns and development using simulation of molecular interactions and predicting precise efficacy using human genome.**





- **Custom-made medicine using** Quantum computers by analyzing the large datasets of every patient based on individual genetic makeup and medical history.
- **Artificial Intelligence:**
  - Already AI has improved disease diagnosis and treatment. During pandemic AI algorithms analyzed medical images, patient data across the globe, scientist shared their scientific literature to assist in disease diagnosis, treatment planning, and drug discovery, that's why the lot of companies could develop vaccines at faster rate. In future they will have still better version that's for sure, as we used certain technologies and patented certain technologies during that time.
  - AI can help design and develop new medical devices and technologies, such as prosthetics, implants, wearable clothes, and wearable sensors to help vulnerable humans live a normal life.

#### 4. Responsible Consumption and Production (SDG 12)

- **Quantum Computing:**
  - Optimizing logistics and supply chains by using Quantum algorithms and simplifying the complex supply chains, to reduce waste and transportation costs, and environmental impact.
  - Quantum simulations can help design new materials that are more durable, recyclable, and environmentally friendly materials, chemicals, products and help making the global economy a truly circular economy.
- **Artificial Intelligence:**
  - AI already have optimized manufacturing processes and agricultural practices that reduced the waste and improved the resource efficiency, increased the produce, optimized the feed of fertilizers, water and helped thousands of farmers around the world. However, reach is less, and number of people associated with agriculture are half a billion in India itself, and on this aspect, humans have to work hard, on one hand to reach all the farmers and help getting quality produce, getting better prices, by sustainable farming and on the other hand to reduce food emergencies in future. As still food reaching at the bottom of the economic pyramid is the problem humans have to solve and AI can be used to achieve SDG 12 as well as SDG 2 the Zero Hunger.
  - AI can help, promoting sustainable consumption patterns by analyzing consumer behavior to provide personalized recommendations for sustainable products and services. In the niche market they are used but common man is yet to get personalized benefits out of this application of AI at large scale.

#### 5. Other SDGs:

Quantum computing and Artificial Intelligence can also contribute to other SDGs, such as:

- **Zero Hunger (SDG 2):** AI can optimize agricultural practices, improve crop yields, and reduce food waste by optimizing the logistics and supply chain management.
- **Clean Water and Sanitation (SDG 6):** AI can monitor water quality, optimize water treatment processes, and detect leaks in water distribution systems. AI can help keep a track on the major water sources like glaciers, tanks, rivers and canals and seas and oceans to reduce the plastic and other waste damaging water ecosystem.







- **Industry, Innovation, and Infrastructure (SDG 9):** Quantum computing can optimize logistics, transportation, and infrastructure development and can enhance the research and innovation, and can help infrastructure are built without destroying the arable lands and environment as whole.
- **Life Below Water (SDG 14) and Life on Land (SDG 15):** AI can monitor ecosystems, track biodiversity, and combat illegal wildlife trade using the satellite live footages.

### Challenges and Opportunities:

While the potential of quantum computing and AI for sustainable development is immense, there are also challenges that need to be addressed:

- **Technological development:** Both quantum computing and AI are still rapidly evolving fields, and further research and development are needed to fully realize their potential.
- **Data availability and access:** AI algorithms require large amounts of data for training, and ensuring access to relevant data is crucial.
- **Humanitarian Values and Ethical considerations:** It is important to ensure that these technologies are used responsibly and ethically, and that their benefits are shared equitably.

**Solutions:** Huge amount of Research and Developments are required to mitigate these challenges. Also, despite these challenges, quantum computing and AI offer powerful tools to address some of the world's most pressing sustainability challenges. By investing in research, development, and responsible implementation of these technologies, we can accelerate progress towards achieving the SDGs and creating a more sustainable future for all.

### Question 46:

If used in conjunction or in tandem, how can Quantum computing and artificial intelligence help human civilization to achieve Sustainable development goals?

### Answer:

Together, in tandem, Quantum computing and artificial intelligence (AI) can significantly contribute to achieving the United Nations' Sustainable Development Goals (SDGs). Here are some ways these technologies can help:

### Quantum Computing Contributions:

- Optimization of resource allocation:** Quantum computers can quickly process complex calculations to optimize resource allocation, reducing waste and improving efficiency.
- Climate modelling and simulation:** Quantum computers can simulate complex climate models, helping researchers better understand climate change and develop more effective mitigation strategies.
- Materials science advancements:** Quantum computers can simulate the behaviour of materials at the atomic level, leading to breakthroughs in sustainable energy storage, conversion, and transmission.





iv. **Cryptography and secure communication:** Quantum computers can create unbreakable encryption methods, ensuring secure communication for sustainable development initiatives.

#### **Artificial Intelligence Contributions:**

- i. **Predictive analytics for sustainable development:** AI can analyse large datasets to predict and prevent natural disasters, disease outbreaks, and other crises.
- ii. **Optimization of supply chains:** AI can optimize supply chains, reducing waste, improving efficiency, and promoting sustainable consumption patterns.
- iii. **Smart infrastructure management:** AI can manage and optimize smart infrastructure, such as energy grids, transportation systems, and water management systems.
- iv. **Personalized education and healthcare:** AI can provide personalized education and healthcare services, improving outcomes and reducing inequalities.

#### **Combined Quantum Computing and AI Contributions:**

- i. **AI-assisted quantum simulation:** AI can help optimize quantum simulations, reducing the computational resources required and improving the accuracy of results.
- ii. **Quantum-inspired AI algorithms:** Quantum computing can inspire new AI algorithms that leverage quantum-mechanical phenomena, such as superposition and entanglement.
- iii. **Sustainable development forecasting:** Quantum computing and AI can be combined to forecast sustainable development outcomes, helping policymakers make informed decisions.

#### **SDG-Specific Applications:**

**SDG 1: No Poverty:** AI-powered chatbots can provide financial inclusion services, while quantum computing can optimize resource allocation for poverty reduction programs.

**SDG 2: Zero Hunger:** AI can optimize crop yields and predict food shortages, while quantum computing can simulate climate-resilient crops.

**SDG 3: Good Health and Well-being:** AI can provide personalized healthcare services, while quantum computing can simulate the behaviour of molecules for disease treatment.

**SDG 4: Quality Education:** AI and Quantum Computing can help quality education reaching to each and every human being by keeping the track on each aspect of the children, right from health, transportation of students, grades, studies and overall development of each student and the teachers and the system and complete education system of the world. Algorithms can detect the flaws and provide the solutions which humans can implement.

**SDG 7: Affordable and Clean Energy:** AI can optimize energy grids, while quantum computing can simulate the behaviour of materials for sustainable energy storage and conversion.

By leveraging the power of quantum computing and AI, we can accelerate progress towards achieving the SDGs and create a more sustainable future for all.





**Question 47:**

How can Quantum Computing and Artificial Intelligence help humans to explore and establish themselves on the Moon, Mars and Beyond?

**Answer:**

Quantum computing and artificial intelligence (AI) are two cutting-edge technologies that hold immense potential for revolutionizing space exploration and human expansion beyond Earth.

**Quantum Computing**

- **Developing new materials:** Quantum computers can simulate the behaviour of molecules and materials at the atomic level, which can help in designing lighter, stronger, and more heat-resistant materials for spacecraft and habitats.
- **Designing efficient propulsion systems:** Quantum simulations can aid in developing more efficient propulsion systems, reducing travel time and fuel consumption for deep-space missions.
- **Improving navigation and communication:** Quantum sensors can provide more accurate measurements of gravity and magnetic fields, which can enhance navigation systems. Quantum communication networks can enable secure and faster communication over vast distances.
- **Analysing large datasets:** Quantum computers can analyse the massive amounts of data generated by space missions much faster than classical computers, leading to new discoveries and insights.
- **Optimization of trajectories:** Quantum computers can quickly process complex calculations to optimize spacecraft trajectories, reducing fuel consumption and travel time.
- **Materials science advancements:** Quantum computers can simulate the behavior of materials in extreme environments, helping researchers develop new materials for spacecraft and habitats.
- **Cryptography and secure communication:** Quantum computers can break certain classical encryption algorithms, but they can also be used to create unbreakable quantum encryption methods, ensuring secure communication between Earth and space missions.
- **Simulation of complex systems:** Quantum computers can simulate complex systems, such as planetary atmospheres and climates, helping researchers better understand the environments they're exploring.

**Artificial Intelligence**

- **Autonomous spacecraft and robots:** AI can enable spacecraft and robots to perform complex tasks autonomously, such as navigating through space, landing on other planets, and conducting scientific experiments. This reduces the need for constant human control and makes missions more efficient. ISRO and NASA have already used this technology in Mars missions in its basic form.
- **Planning and scheduling:** AI algorithms can optimize mission planning and scheduling, taking into account various constraints such as fuel consumption, trajectory, and scientific objectives.





- **Data analysis and interpretation:** AI can analyse large datasets from space missions to identify patterns, anomalies, and potential areas of interest for further investigation.
- **Life support systems:** AI can monitor and control life support systems in space habitats, ensuring the safety and well-being of astronauts.
- **Resource management:** AI can optimize the use of resources such as energy, water, and food in space habitats, making long-duration missions more sustainable.
- **Robotics and maintenance:** AI can control robots to perform maintenance tasks, such as repairing equipment and inspecting infrastructure.

### Collaboration between Quantum Computing and AI:

The combination of quantum computing and AI can further enhance their capabilities. For example, quantum machine learning algorithms can be used to analyse complex datasets and discover new patterns that classical AI algorithms cannot.

### Specific Examples

- **Exploring the Moon:** AI-powered robots can be used to explore the lunar surface, map resources, and construct habitats for future human settlements.
- **Traveling to Mars:** Quantum computing can help design more efficient propulsion systems for faster travel to Mars, while AI can assist in landing, navigating, and conducting scientific research on the Martian surface.
- **Venturing beyond:** Quantum communication networks can enable communication with spacecraft traveling to distant stars, while AI can help analyse data from exoplanets and search for signs of life.
- **AI-assisted quantum simulation:** AI can help optimize quantum simulations, reducing the computational resources required and improving the accuracy of results.
- **Quantum-inspired AI algorithms:** Quantum computing can inspire new AI algorithms that leverage quantum-mechanical phenomena, such as superposition and entanglement.
- **Space mission planning and optimization:** Quantum computing and AI can be combined to optimize space mission planning, including trajectory planning, resource allocation, and risk assessment.

### Establishing a Human Presence on the Moon, Mars, and Beyond:

- **In-situ resource utilization:** Quantum computing and AI can help optimize the use of local resources, such as water and regolith, to support human life and propulsion.
- **Habitat design and optimization:** AI can help design and optimize habitats for astronauts, taking into account factors such as radiation protection, temperature control, and air quality.
- **Life support system management:** AI can manage life support systems, ensuring the health and well-being of astronauts on long-duration missions.
- **Robotics and autonomous systems:** Quantum computing and AI can enable the development of autonomous systems that can operate independently, reducing the need for human intervention.

By leveraging the power of quantum computing and AI, humans can accelerate space exploration and establish a sustainable presence on the Moon, Mars, and beyond.





## Challenges

- **Developing stable quantum computers:** Quantum computing is still in its early stages of development, and building stable and fault-tolerant quantum computers is a major challenge.
- **Developing robust AI algorithms:** AI algorithms need to be robust and reliable to operate in the harsh conditions of space.
- **Integrating quantum computing and AI:** Integrating these two technologies is a complex task that requires further research and development.

Despite these challenges, the potential benefits of quantum computing and AI for space exploration are immense. These technologies can help humans explore and establish themselves on the Moon, Mars, and beyond, opening up new frontiers for scientific discovery and human expansion.

### Question 48:

What are the software and hardware and other supporting technological limitations of Quantum Computing and Artificial Intelligence to let humans establish on the Moon, Mars and Beyond?

### Answer:

Both Quantum Computing (QC) and Artificial Intelligence (AI) face significant limitations that need to be overcome before they can fully enable human establishment on the Moon, Mars, and beyond. These limitations span software, hardware, and supporting technologies:

### Quantum Computing Limitations:

- **Hardware Limitations:**
  - **Qubit Stability and Coherence:** Qubits, the fundamental units of quantum computers, are extremely sensitive to environmental noise (vibrations, temperature fluctuations, electromagnetic fields). This leads to decoherence, where qubits lose their quantum properties, causing errors in computation. Maintaining stable qubits for extended periods, especially in the harsh conditions of space, is a major challenge.
  - **Scalability:** Current quantum computers have a limited number of qubits. Building large-scale quantum computers with thousands or millions of stable qubits is a significant engineering challenge.
  - **Error Correction:** Quantum computations are prone to errors. Developing effective quantum error correction techniques is crucial for reliable computation but remains a complex problem.
  - **Operating Environment:** Most quantum computers require extremely low temperatures (close to absolute zero) to operate. Maintaining such conditions in space is challenging and energy-intensive.
  - **Other Quantum Computing Limitations: (As per NASA):**







- i. **Hardware availability:** Quantum Computers require specialized hardware, which is still in the early stages of development and not widely available.
  - ii. **Cost:** Developing and Maintaining Quantum Computing hardware is expensive, which can be a barrier to widespread adoption.
  - iii. **Integrating with existing systems:** Integrating quantum computing with current space exploration system is complex and requires significant advancements.
  - iv. **Data Storage and Management:** Quantum Computing generates vast amounts of data, necessitating advanced storage and management solutions.
- **Software Limitations:**
    - **Quantum Algorithms:** Developing efficient quantum algorithms that can outperform classical algorithms for specific tasks relevant to space exploration is an ongoing area of research.
    - **Quantum Programming Languages and Tools:** Quantum programming is still in its early stages. There is a lack of standardized programming languages, development tools, and debugging techniques, making it difficult to develop and test quantum software.
    - **Integration with Classical Computing:** Quantum computers are not meant to replace classical computers but to work alongside them. Developing efficient methods for integrating quantum and classical computing is essential.
  - **Supporting Technological Limitations:**
    - **Quantum Communication:** Establishing secure and reliable quantum communication networks over long distances, especially in space, is a major challenge. This requires developing quantum repeaters and other quantum communication technologies. If using entanglement, we can do with two particles but taking other particle at long distance is a limitation right now, then, communication can be made, thus, shows the problem.
    - **Quantum Sensors:** While quantum sensors offer the potential for highly accurate measurements, developing robust and space-qualified quantum sensors for navigation, environmental monitoring, and other applications is still an area of research.

#### Artificial Intelligence Limitations:

- **Software Limitations:**
  - **Robustness and Adaptability:** AI algorithms need to be robust and adaptable to operate in the unpredictable and harsh conditions of space. They need to be able to handle unexpected events, sensor failures, and communication delays.
  - **Explainability and Trustworthiness:** Many AI algorithms, especially deep learning models, are "black boxes," meaning their decision-making processes are not easily understood. This lack of explainability can make it difficult to trust AI systems in critical applications such as autonomous navigation and life support.
  - **Data Dependency:** AI algorithms often require large amounts of data for training. Gathering sufficient data in space can be challenging, especially for new environments and situations.





- **Quantum algorithms:** Developing practical quantum algorithms for complex problems is an active area of research.
- **Quantum error correction:** Quantum computers are prone to errors due to the noisy nature of quantum systems. Developing robust quantum error correction techniques is essential.
- **AI for edge cases:** AI models may struggle with edge cases or unexpected events, which can be critical in space exploration.
- **Explainability and transparency:** Understanding how AI models make decisions is crucial for trust and reliability in space missions.
- **Other Artificial Intelligence Limitations: (As per NASA):**
  - i. **Data Availability:** AI models, especially those with deep architectures, require large amount of labeled training data, which can be scarce for novel space missions.
  - ii. **Computations Constraints:** Spacecrafts processors are limited by size, weight, power, and costs (SWaP-C) requirements, making it challenging to deploy state-of-the-art AI Framework.
  - iii. **Radiation Environment:** The harsh space environment can cause issues ranging from non-destructive soft errors to catastrophic device failures, affecting AI systems.
  - iv. **Model Generalization:** Ensuring AI models generalize well to new data captured by instruments sensors in unexplored environments is difficult.
- **Hardware Limitations:**
  - **Radiation Hardening:** Electronic components in space are exposed to high levels of radiation, which can cause malfunctions and damage. Developing radiation-hardened hardware for AI systems is crucial for reliable operation in space.
  - **Power Consumption:** AI computations can be energy-intensive.
  - **Quantum computing scalability:** Currently, quantum computers are small-scale and need to be scaled up to tackle complex problems.
  - **Quantum computing noise reduction:** Reducing noise in quantum computers is essential for reliable operation.
  - **AI computing power:** AI models require significant computing power, which can be a challenge in space missions where power is limited.

Developing energy-efficient hardware for AI systems is important for long-duration space missions where power resources are limited.

- **Supporting Technological Limitations:**
  - **Real-time Processing:** AI systems for autonomous navigation and control require real-time processing capabilities. This requires developing high-performance computing hardware and efficient algorithms.
  - **Sensor Technology:** AI systems rely on sensors to perceive their environment. Developing accurate and reliable sensors that can operate in the harsh conditions of space is essential.
  - **Quantum computing control systems:** Developing control systems for quantum computers that can operate in space is a significant challenge.







- **AI data quality:** AI models require high-quality data, which can be difficult to obtain in space missions.
- **Communication latency:** Communication latency between Earth and space missions can be significant, making real-time AI decision-making challenging.
- **Power and energy efficiency:** Space missions require power-efficient systems to conserve energy and extend mission duration.
- **Advanced materials:** Developing advanced materials for spacecraft and habitats is crucial for long-duration missions.
- **Life support systems:** Reliable life support systems are essential for sustaining human life in space.
- **Robotics and autonomy:** Developing robots that can operate autonomously in space is crucial for reducing the need for human intervention.
- **3D printing and manufacturing:** In-space manufacturing capabilities, such as 3D printing, can help reduce reliance on Earth-based supplies.
- **Supporting Technological Limitations: (As per NASA):**
  - i. **Communication:** Quantum Communication system, such as those using entangled photons, are still in the experimental stage and require further development to improve Earth-to-space communications.
  - ii. **Measurement Accuracy:** Quantum sensors and interferometry techniques are being explored to improve space measurements, but they are not yet fully operational.
  - iii. **Autonomous operations:** AI driven autonomous space operations, such as navigation and mission planning, are still being refined to handle the complexities of the space exploration.

### Overcoming the Limitations:

Addressing these limitations requires significant research and development efforts in various areas, including:

- **Materials science:** Developing new materials for more stable qubits and radiation-hardened hardware.
- **Computer science:** Developing new quantum algorithms, AI algorithms, and programming tools.
- **Engineering:** Designing and building robust and scalable quantum computers and AI systems.
- **Physics:** Furthering our understanding of quantum mechanics and developing new quantum technologies.

Overcoming these limitations is crucial for realizing the full potential of quantum computing and AI in enabling human expansion beyond Earth. While challenges remain, ongoing research and technological advancements offer hope for future breakthroughs holds exciting possibilities as these technologies mature and become more integrated into space missions, that will pave the way for human establishment on the Moon, Mars, and beyond.

### All-time great Question 49:

How Quantum Computers and Artificial Intelligence can help humans becoming supreme beings?



**Answer:**

With implementing the age old, scientifically proven and reliable time-tested practices like:  
i. Bhagawadgeeta way of living life in Bharat/India to become spiritually enlightened/ self-realized soul,

ii. Dhyana way of living in Bharat/India same Dhyana (meaning meditation became Chan in China and Zen in Japan) to become spiritually enlightened/ self-realized soul,

iii. Upanishad way of living life in India/Bharat to become spiritually enlightened/ self-realized soul,

iv. Transcendental Meditation way of living in Bharat/India to become spiritually enlightened/ self-realized soul,

v. Yoga way of living in India/Bharat to become spiritually enlightened/ self-realized soul,

vi. Dharma/Swadharma way of life in India/Bharat to become spiritually enlightened/ self-realized soul,

vii. Bhakti/ Devotion way of living in India/Bharat to become spiritually enlightened/ self-realized soul,

viii. Ikigai way of living in Japan,

ix. Vedic way of living life in Bharat/India to become spiritually enlightened/ self-realized soul,

x. Nietzsche way of living in Japan,

xi. Ubuntu/Botho /Hunhu/Biyako Ye/uMunthu way of living in Africa,

xii. Hara Hachi Bu way of living in Japan,

xiii. Interdependence way of living in Buddhism,

xiv. Zen and Kaizen way of living in Japan,

xv. Obaitori way of living in Japan,

xvi. Wabi-Sabi way of living in Japan,

xvii. Shikata Ga Nai way of living in Japan,

xviii. Chan way of living in China,

xix. Shinrin-Yoku way of living in Japan,

xx. Work Is Worship way of living in India/Bharat to become spiritually enlightened/ self-realized soul,

xxi. Aloha Spirit way of living in Hawaii, etc.

There are many practices we can evolve each and every human being and can improve each and every individual on their:

- Physical Quotient (PQ),
- Emotional Quotient (EQ),
- Intelligent Quotient (IQ),
- Spiritual Quotient (SQ), etc. on the fundamentals of SAVE: Sustainability By/For Adapting the Humanitarian Values and Ethics.

Which can lead us to create, a peaceful and prosperous healthy thriving human civilisation, forever, also called and mentioned in the Ramayana of Maharshi Valmiki, Mahabharat/ Bhagavadgeeta by Maharshi Vedvyaas, Dabodh/ Anand Van Bhuvan of Sant Ramdas, Pasaaydaan in Dnyaneshwari of Sant Dnyaneshwar:

- The Ram-Rajya,
- The Anand-Van-Bhuvan of Samarth Ramdas Swami,
- Pasaayadan of Sant Dnyaneshwar with Swanand Bodh Patan as its aim.





A kind of Heavens on the Earth, which is the ultimate aim of human civilisation WHICH CAN BE ACHIEVED SIMULTANEOUSLY along with achieving Sustainable Development Goals (SDG).

This Aim is possible only by USING and Quantum Computers (QC) and Artificial Intelligence (AI), after analysing each and every individual person on each of the above mentioned fronts/attribute/dimension, may it be PQ, IQ, EQ or SQ and also analysed on factors/attributes/qualities on the fundamentals of SAVE: Sustainability By/For Adapting the Humanitarian Values and Ethics, if possible even by analysing the person's Deoxyribonucleic Acid (DNA) and genes and may even more in-depth analyses of that person if that person wishes, and then allowing that person to choose a way of life that suites that particular person and how that particular way of life can improve each individual, along with the latest/modern way of life that person is living or by still better way to live better exalted life is that person chooses from above time tested practices, to become a supreme being, as self-realized enlightened soul.

Later, a way can evolve on how unified and united human civilisation fully unison to the core can take care of each and every entity by really becoming a supreme self.

“Is a person really a Supreme being?” Can be decided by that panel of experts and in fact by the whole human civilisation coming together and again here too AI and QC can help be taking and implementing unbiased decision at all the times, whether 10 billion humans or 1 trillion humans living on multiple galaxies, multiple dimensions or multiple universes the computing capability of QC and AI can make it possible.

A supreme being is a soul/person/entity which is self-realized, spiritually enlightened and is self-governing too, living a forever pious and blissful life, and whose soul has merged with the infinite soul of superconscious God, as a Bhakt the person's soul can't be separated from the infinite soul of god, and as a Yogi whose soul has got merged with the infinite soul of God/Paramatma/Brahman, and in his each pulsebeat, heartbeat, inhalation and exhalation and his / her each work and action reflects the fundamental of 'Work Is Worship', day and night and at each moment of life as if everything is coming from God/Brahman and everything is going to God/Brahman and this realized soul is just a representative of a Brahman/God/Paramatma.

For this, all the Government Departments, Non-Governmental departments, Homes, Schools, Colleges, Institutions, Offices, Hospitals, in fact all the Ethical Work places in any profession, and also, all the living places should focus on this only.

This lifelong learning and adapting and adopting should be made easy process by and with the system that humans should enhance by considering each entity and each individual human being/person.

SDG 4, Quality Education should also have this aim of making each entity being self-realized.

Wherever humans may establish their civilisation, may it be the Moon, Mars, Infinite Dimensions, Infinite Galaxies, Infinite Universes, and beyond, we must put this aim in the centre while focusing on life's journey of every individual from living till death, of making every human or any soul a self-realized and spiritually enlightened soul.

This is a very easy way of living especially, to any individual having integrity, honesty, truthfulness, simple living and high thinking, is integral part of that person's character, who is living pure and pious life, of making every human/soul or any entity a self-realized and spiritually enlightened soul/entity.

Quantum Computing (QC) in conjunction with Artificial Intelligence (AI), can help us realize this aim due to their enormous data processing and computing power.





**Question 50:**

How Quantum Computers and Artificial Intelligence can help humans achieve Supreme Goals?

**Answer:**

As discussed above once every human being becomes the supreme being obviously, they become only when the human civilisation has achieved the Supreme Goals. Thus, both humans becoming supreme beings and achieving supreme goals, go hand in hand, in fact by protecting each individual's privacy concerns as well as the concern of each becoming Supreme Being also should go hand in hand and balanced well with faith and with full trust, then only it's possible.

**Question 51:**

What will be the need to achieve Supreme beings and achieving supreme goals for human civilisation?

**Answer:**

Just will and willingness of each and every able, in fact, all human beings at all possible levels put together can Achieve these Being Supreme Beings and Achieving Supreme goals.





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7. Thanks to the following organizations which are working day and night in the domains of Artificial Intelligence and Quantum Computing for humanitarian cause, whose, old booklets, present updated websites, Apps, conference and journal publications, as of September 2024, I referred, but used my own language to let even kids/children understand the fundamentals of the AI and the QC:

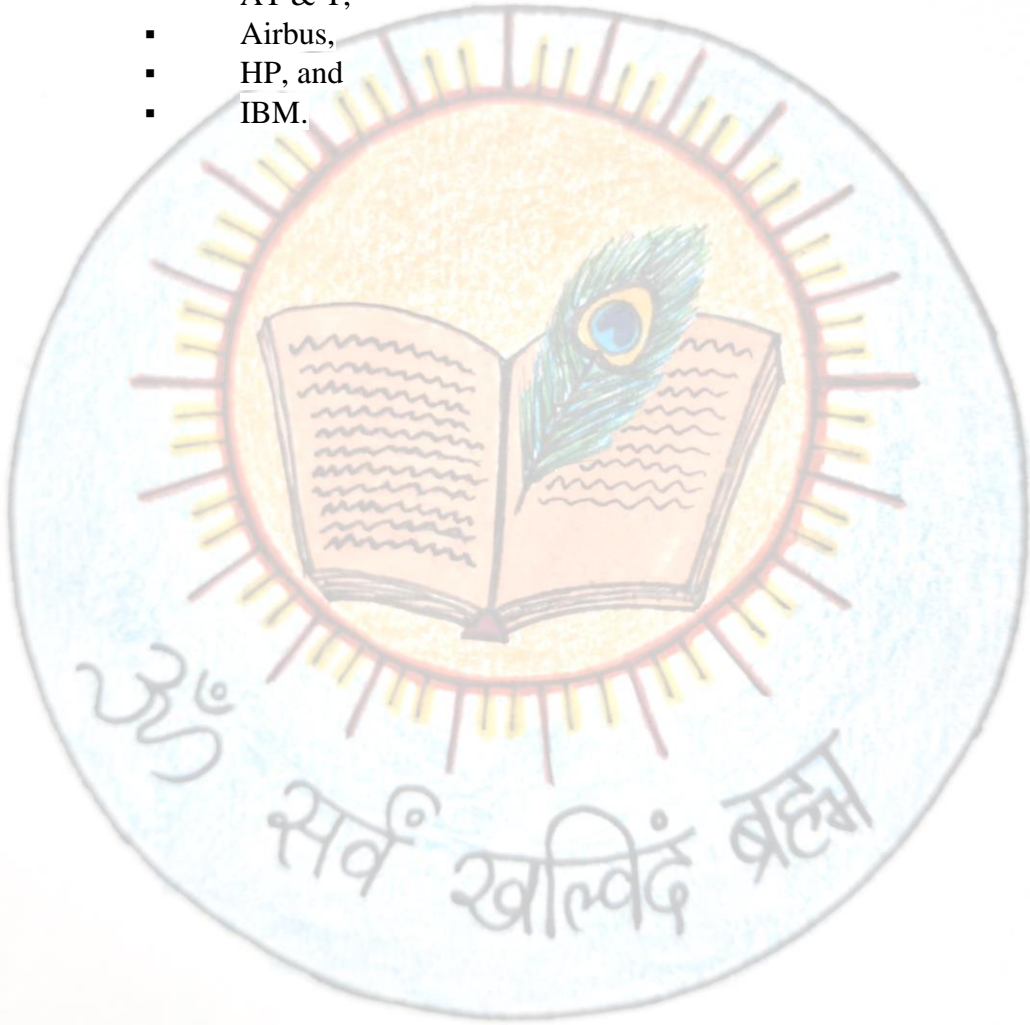
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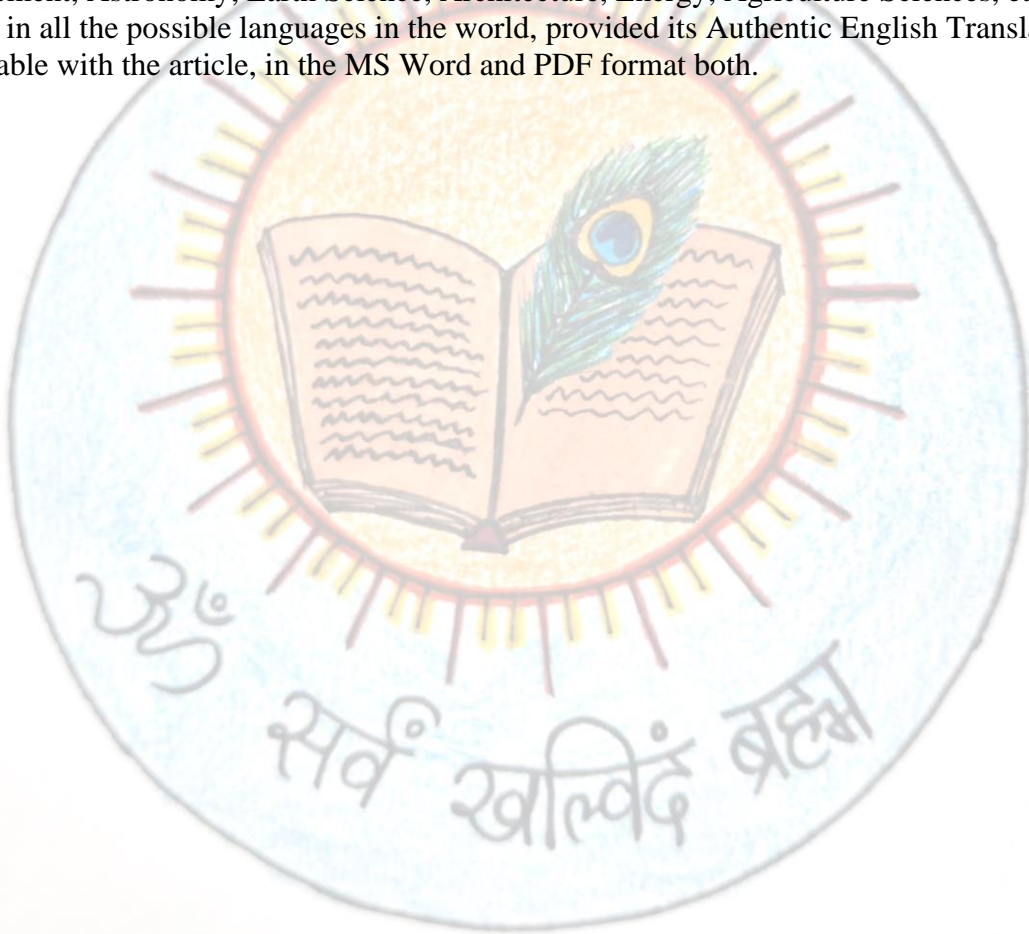
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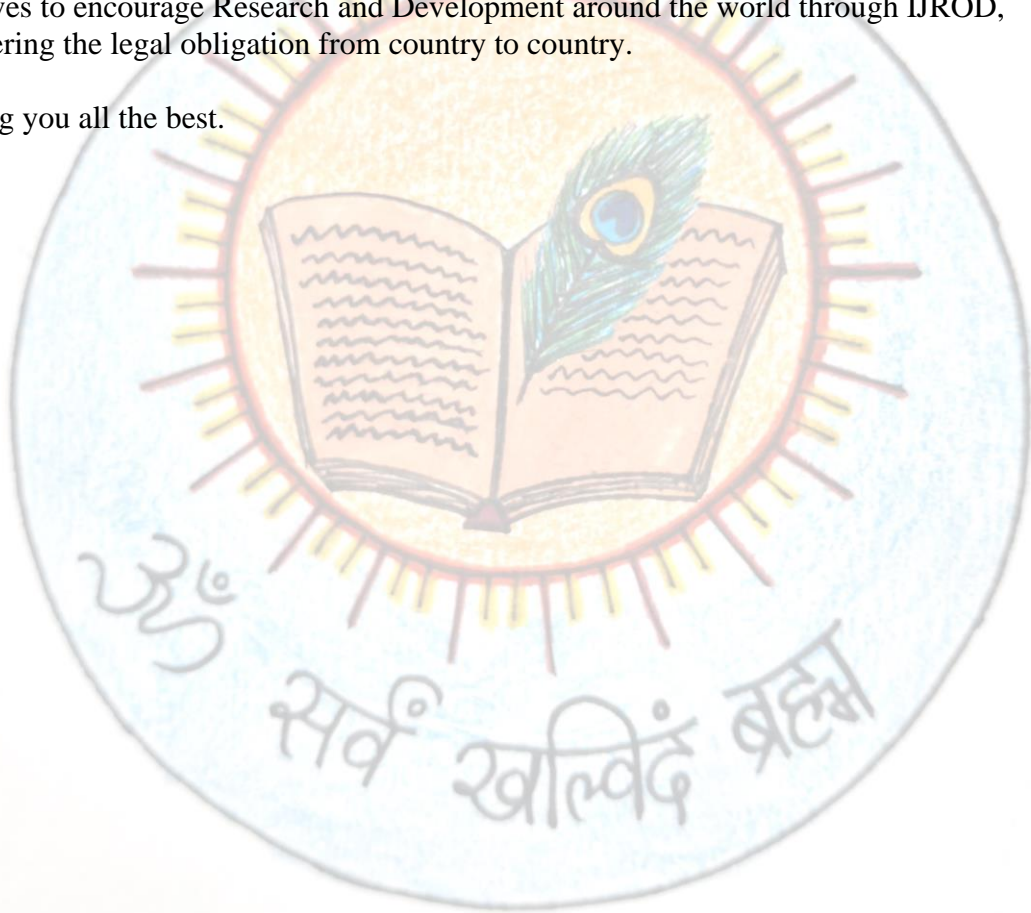
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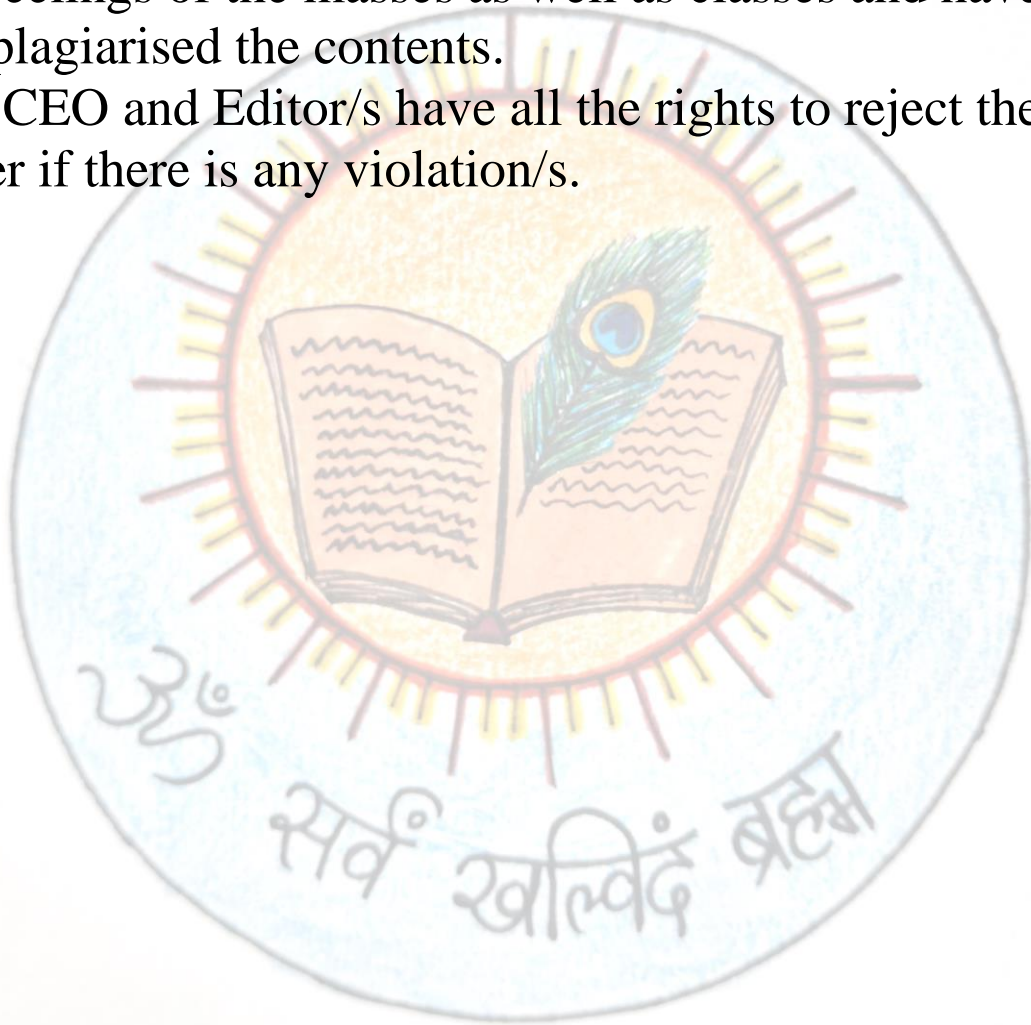
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