

National Quantum Mission [UPSC Notes]

The National Mission on Quantum Technologies & Applications (NM-QTA) was announced by the Finance Minister in the Union Budget 2020. Government schemes are important for the [UPSC exam](#) and in this article, you can read all about the NM-QTA, its impact, objectives and significance.

National Quantum Mission

The Union Cabinet approved the National Quantum Mission with an outlay of Rs. 6000 crores. Through this mission, India has joined an elite club of 6 other nations that have a dedicated quantum mission. These countries include the US, Canada, France, Finland, China and Australia.

The NM-QTA was first announced by the Government of India with an outlay of Rs.8000 crore for five years in the [Budget 2020](#).

Main features:

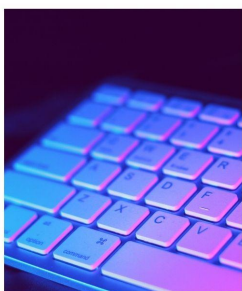
- **Mission period:** It is planned for the period of 2023-24 to 2030-31, with an outlay of Rs. 6003.65 crore
- **Objective:** The aim is to expand research and development and establish an innovative ecosystem for quantum technology within the nation.
 - Four thematic hubs (T-Hubs) will be established at leading academic and national research and development institutes. These T-hubs will be in the following fields,
 - Quantum computing
 - Quantum communication
 - Quantum sensing and metrology
 - Quantum materials and devices
- **Nodal Ministry:** This mission will be implemented by the Department of Science and Technology (under the Ministry of Science and Technology) in collaboration with others.
- **Main deliverables of the Mission**
 - Within the next 3 years, the mission aims to develop quantum computers with a minimum of 20-50 qubits.
 - The objective is to create quantum computers at an intermediate scale containing between 50 and 1000 physical qubits within an 8-year timeframe.
 - These quantum computers will be built using various platforms, including superconducting and photonic technology.
 - It also aims to establish secure quantum communication networks between various entities. For example,
 - Establish satellite-based secure quantum communication between ground stations within a range of 2,000 kilometres in India.

- To create secure quantum communication networks between India and other countries over long distances.
- Establish inter-city quantum key distribution over a distance of 2,000 kilometres.
 - It means that secure cryptographic keys will be distributed between different cities using quantum communication technology.
- To create a multi-node quantum network with quantum memories.
 - It means that a network of multiple quantum computers will be established, and quantum information will be stored in quantum memories.
 - This will enable more complex quantum computations to be performed and will help advance the field of quantum computing.

National Quantum Mission Impact

- **Enables large-scale simulations:**
 - In a nation such as India, where technology is utilized by the government to address problems on a massive scale, the integration of quantum computing could prove highly advantageous, as it enables the execution of extensive simulations.
- **Value addition in the economy:**
 - The adoption of quantum technologies by different industries in India has the potential to contribute a value of \$280-310 billion to the economy by the year 2030.
- **Boost to R&D initiatives:**
 - It will provide the necessary push to the institutions involved in the research and development in the field of quantum computing.
- **Benefits to government schemes:**
 - This mission will also provide a boost to other priority schemes such as Digital India, Make in India, Stand up India, Skill India and achieving the [Sustainable Development Goals \(SDGs\)](#).

Quantum Technology Applications



secure communications

research in fundamental physics

disaster management

pharmaceuticals

industrial revolution 4.0

weather prediction

securing financial transactions

aerospace engineering

cybersecurity

advanced manufacturing

NM-QTA Significance

A government thrust in this field will go a long way towards helping India become a lead player in this field and experience multi-dimensional growth. It is also expected to spur job creation. The government's organizational and financial support will also ensure that both public and private sectors will benefit. The mission will establish standards to be applied to all research and help stimulate a pipeline to support research and applications well into the future.

What is Quantum Mechanics?

Quantum mechanics is a branch of physics that was developed in the early 20th century.

- It is a fundamental branch of science that describes the physical properties of nature at the atomic and subatomic scale.
- It has offered the foundation for our understanding of the physical world, the interaction between light and matter, etc.
- At the microscopic scale, the laws and equations of classical physics fail to explain the movement of particles. In classical mechanics, objects (of everyday sizes and speeds) exist at a specific time and at a specific location. However, at the quantum level, objects exist in a haze of probability.
- Quantum physics has led to the invention of such useful technologies as semiconductor transistors and lasers.

Quantum Technology

Quantum technology is based on the principles of quantum physics/mechanics. It concerns the manipulation and control of quantum systems, which will help achieve information processing that goes beyond the limits of the classical world. Quantum technology exploits some of the properties of quantum mechanics – such as quantum entanglement, superposition and tunnelling – in developing practical applications like computing and cryptography.

Quantum Computing

Quantum computing is basically harnessing the laws of quantum mechanics to process information. A conventional computer processes in bits (0s and 1s), while a quantum computer uses qubits or quantum bits. A qubit is a quantum system that encodes the zero and the one into two distinguishable quantum states. Capitalising on the phenomenon of superposition and entanglement, quantum computers can mimic several traditional computers in parallel. This can exponentially increase the processing power and speed of computers.

FAQ about National Mission on Quantum Technologies & Applications

Q. Which office of the Indian government will be responsible for NM QTA?

National Mission on Quantum Technologies & Applications project will be implemented by the Department of Science and Technology (DST).

Q. What is quantum computing?

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