

EDITORIALS DISCUSSION

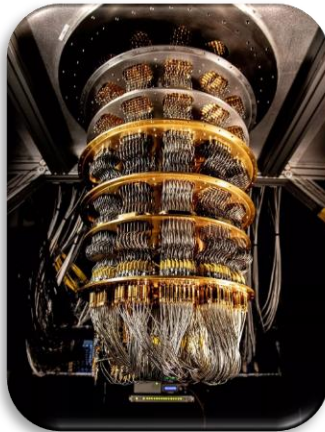
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SIGNIFICANT DEVELOPMENTS UNDER THE NATIONAL QUANTUM MISSION



SYLLABUS FROM UPSC CSE PERSPECTIVE

GS - III - SCIENCE & TECHNOLOGY

QUESTION(S) FOR PRACTICE

What is National Quantum Mission (NQM)? What are its goals? What are the recent developments on this front?

Under the National Quantum Mission, India aims to develop intermediate-scale quantum computers of 50-1,000 qubits.



WHAT DO YOU KNOW ABOUT GOOGLE'S WILLOW CHIP?

- Google's Willow Chip is a quantum processor that paves way for large scale quantum computers.
- Willow has been shown to perform in 5 minutes computing that the fastest classical computer will take "1 followed by 25 zeros" number of years.
- Today, India has a small-scale quantum computer at the Tata Institute of Fundamental Research (TIFR), which is a seven-qubit machine.
- Qubits can exist in more than one state (superposition) and can be entangled so that the state of one qubit affects the state of another.
- In terms of quantum computing, India is somewhat behind the US and China, which have intermediate-scale quantum computers, but not far behind the European Union, Japan and Australia.

QUBITS ARE THE INFORMATION HOLDERS

- Just like transistors in a classical computer, Qubits are the information holders in a quantum computer.
- In a classical computer, the 'off' and 'on' states of the transistors represent 0 and 1, any information is encoded in terms of 0s and 1s.
- There are many types of qubits:
 - ✓ Energy levels of atoms.
 - ✓ Spin of a particle.
 - ✓ Polarization of a photon.
 - ✓ Superconducting circuits.

COMPUTING IS ONLY ONE OF THE MANY APPLICATIONS

- Computing is only one of the many applications of quantum technology, others include communication, measurement and sensing.
- One can apply quantum technology in cryptography to transmit data safely.
- We can make medical devices that are more accurate. In these areas, an ecosystem is rapidly evolving in India.



WHAT ABOUT NATIONAL QUANTUM MISSION?

- The Mission was conceived four years ago. However, on August 19, 2023, Cabinet approved the Mission with a budget of Rs. 6,003 crore for 2023-24 to 2030-31.
- In January 2024, the mission governing board was set up.
- The NQM has set up four Section 8 companies across four verticals of quantum technologies that the mission aims to incubate - computing, communication, measurement, and sensing.



WHAT ARE THE DEVELOPMENTS IN RECENT MONTHS?

- The Government recently picked up eight 'pioneering startups' in quantum computing for grants under the National Quantum Mission (NQM). Each selected startup gets Rs. 25 crore under the NQM.
- In its first meeting, the governing board of the NQM decided to issue Request For Proposal (RFP) to set up four thematic hubs.
- The four hubs will come up at the:
 - ✓ IISc, Bengaluru for quantum computing.
 - ✓ IIT-Madras for quantum communications.
 - ✓ IIT-Bombay for quantum sensing and metrology.
 - ✓ IIT-Delhi for quantum materials and devices.

There is also the Quantum Technology Foundation (QTF) at IISER-Pune, under the National Mission on Interdisciplinary Cyber-Physical Systems.

INDIA ALSO PROPOSED NATIONAL QUANTUM SATELLITE



- India is set to join an elite group of countries with quantum satellite capabilities, securing communication networks against hacking and cyber attacks. The satellite will play a key role in the larger quantum communications network under the National Quantum Mission (NQM).
- A quantum satellite solves the problem of low-energy photons by using Quantum Key Distribution (QKD) technology and transferring encrypted information to various points in the country.

China, the US and EU have already launched programs for quantum satellites.

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