

# EDITORIALS DISCUSSION

FRIDAY

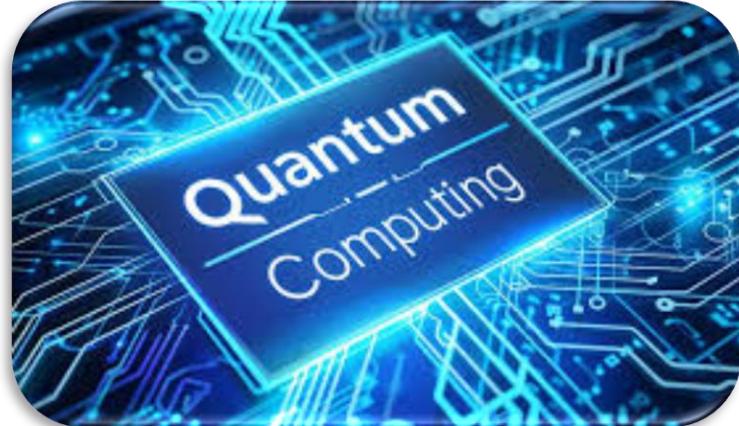
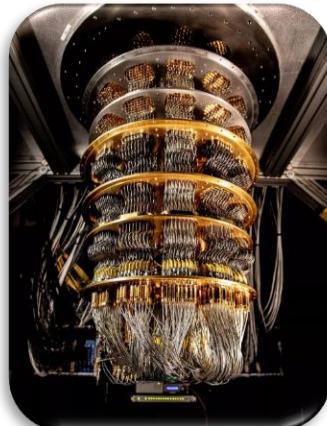


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## SIGNIFICANT DEVELOPMENTS UNDER THE NATIONAL QUANTUM MISSION



## 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?

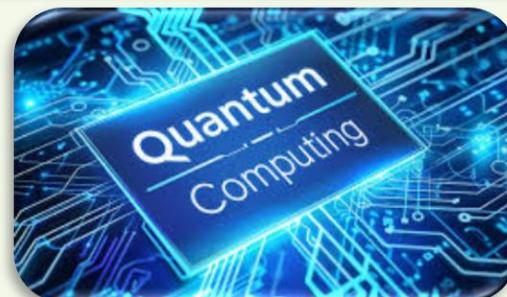
- Google's Willow Chip is a quantum processor that paves way for large scale quantum computers.
- Willow has been shown to perform in 5 minutes computing that the fastest classical computer will take "1 followed by 25 zeros" number of years.
- Today, India has a small-scale quantum computer at the Tata 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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