1. Picking up the Quantum Technology Baton

Context:

- In the Budget 2020, the Government proposed spending of ₹8,000 crore on a National Mission on Quantum Technologies and Applications over the next Five Years.

What is Quantum Technology?

- Quantum mechanics was **developed in the early 20th century to describe nature in the small — at the scale of atoms and elementary particles.**
- It provided the foundations of our understanding of the physical world, including the interaction of light and matter, and led to ubiquitous inventions such as lasers and semiconductor transistors.
- **Quantum technology is a class of technology that works by using the principles of quantum mechanics (the physics of sub-atomic particles), including quantum entanglement and quantum superposition.**
- Quantum entanglement is when two atoms are connected, or entangled, despite being separated.
- Quantum superposition is the theory that sub-atomic particles exist in multiple states simultaneously.
- It concerns the control and manipulation of quantum systems, with the goal of achieving information processing beyond the limits of the classical world.

Promising Future of Quantum Computing:

- Besides computing, the quantum promises other dramatic applications including the creation of novel materials, enhanced metrology, secure communication, etc.
- For example, China recently demonstrated secure quantum communication links between terrestrial stations and satellites.
- Beyond these applications, some of the deepest foundational questions in physics and computer science are being driven by quantum information science. This includes subjects such as quantum gravity and black holes.

National Mission on Quantum Technologies and Applications:

- The mission will oversee the development of quantum technologies for communications, computing, materials development and cryptography.
- It will coordinate the work of scientists, industry leaders and Government Departments.

- The areas of focus for the Mission will be in fundamental science, translation, technology development, human and infrastructural resource generation, innovation and start-ups to address issues concerning national priorities.
- It will be implemented by the Department of Science & Technology (DST).

Challenges:

- On the experimental front, the challenge lies in harnessing the weird and wonderful properties of quantum superposition and entanglement in a highly controlled manner by building a system composed of carefully designed building blocks called quantum bits or qubits.
- These qubits tend to be very fragile and lose their "quantumness" if not controlled properly, and a careful choice of materials, design and engineering is required to get them to work.
- On the theoretical front lies the challenge of creating the algorithms and applications for quantum computers.
- Other constraints such as lack of sufficient resources, high quality manpower, timeliness and flexibility are hindrance to effectively pursuing the Mission.

Way Forward:

- Private funding, both via industry and philanthropy, can play an outsized role even with much smaller amounts. For example, unrestricted funds that can be used to attract and retain high quality manpower and to build international networks.
- Further, connections with Indian industry from the start would also help quantum technologies become commercialised successfully, allowing Indian industry to benefit from the quantum revolution.
- We must encourage industrial houses and strategic philanthropists to take an interest and reach out to Indian institutions with an existing presence in this emerging field.

Source: The Hindu