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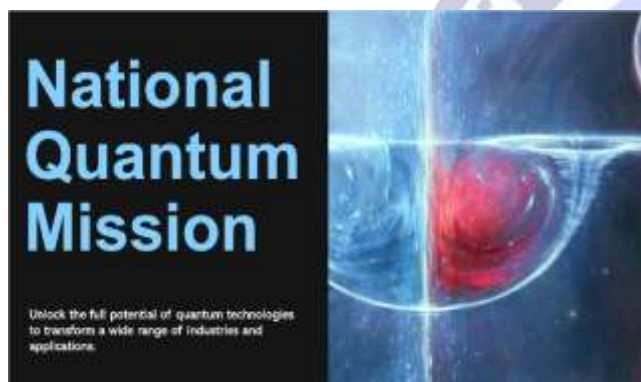
The Road Map to Mussoorie...

PRELIMS EDGE 2026

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## NATIONAL QUANTUM MISSION

**Context:** Union Minister for Science & Technology announced that the National Quantum Mission (NQM) has achieved a historic 1,000-km secure quantum communication milestone in less than two years.



### National Quantum Mission (NQM):

- Implemented by **DST from 2023-2031** to nurture, and scale up scientific and industrial R&D and create a vibrant & innovative ecosystem in quantum technology.
- India is the **7<sup>th</sup> country to have a quantum mission** after USA, Austria, Finland, France, Canada and China.

### Objectives of NQM:

- Developing **intermediate scale quantum computers** with **50-100 physical qubits in 5 years** and **50-1000 physical qubits in 8 years**.

- **Help develop magnetometers** with high sensitivity for precision timing, communications, and navigation.
- Support **design and synthesis of quantum materials** such as superconductors and materials for fabrication of quantum devices.

### What is Quantum Computing ?

- It is a rapidly-emerging technology that harnesses the **laws of quantum mechanics to solve problems too complex for classical computers**.
- While today's classical computers store information as binary 0 and 1 states, they **carry out calculations using quantum bits (qubits)**.
- Unlike a bit that has to be a 0 or a 1, a **qubit can be in a combination of states** – this allows for exponentially larger calculations and gives them the potential to solve complex problems which even the most powerful supercomputers are not capable of.

### About Quantum Satellites

- In Dec 2024, the Mission Governing Board of the National Quantum Mission, stated that India plans to launch a quantum satellite in 2-3 years for quantum communications.
- Quantum satellites **use principles of quantum mechanics, such as quantum entanglement & quantum key**

**distribution (QKD)**, to establish secure communication channels.

- Quantum satellites use QKD, a secure communication method that applies the principles of quantum mechanics to share encryption keys. These **satellites generate and transmit quantum particles, such as photons, which encode the encryption keys**.
- Through QKD, the encryption keys are distributed securely as any **attempt to intercept the particles alters their quantum state**, immediately signalling a breach.
- The benefits of using quantum satellites include **enhanced cybersecurity**, as they are immune to traditional hacking; enabling **global-scale quantum networks**; facilitating **growth of quantum communication research**; and potential applications in **military and financial sectors** where data security is paramount.

#### About Quantum Hubs:

- Quantum Hubs, also called Thematic Hubs (T-Hubs), are **research centres established under the NQM**. They aim to drive innovation, research, and development in different aspects of quantum technology. **4 T-Hubs have been created** in major institutions.
  - Quantum Computing (IISc Bengaluru).
  - Quantum Communication (IIT Bombay).
  - Quantum Sensing & Metrology (IIT Delhi).
  - Quantum Materials & Devices (IIT Madras).

- **IIT Kanpur serves as the central coordinating institution**, overseeing administration and funding allocation.



Quantum Technology is a field that deals with principles of quantum mechanics (study of behaviour of matter and energy at atomic and subatomic levels). Quantum Key Distribution is a secure communication technology that uses the laws of quantum physics to generate and exchange encryption keys between two parties. Unlike traditional encryption, it ensures that any attempt to intercept or observe the key instantly alters the system, making intrusion detectable.

#### Terms related to Quantum Computing

- **Qubit:** The basic unit of quantum information, analogous to a classical binary bit but capable of representing both 0 and 1 at the same time due to superposition.
- **Superposition:** Feature of quantum mechanics where quantum system can exist in multiple states at once until it is measured.
- **Entanglement:** A phenomenon where two or more quantum particles become interconnected, such that state of one particle always influences state of the other, regardless of their distance.
- **Decoherence:** Process by which a quantum system loses its quantum properties, such as superposition and entanglement, due to interactions with its environment.
- **Quantum Supremacy:** The point at which a quantum computer can perform a calculation or solve a problem that is

infeasible for classical computers to achieve.

Source: National Quantum Mission achieves 1,000-km secure communication milestone (Business Standard)

## WIND ENERGY IN INDIA

**Context:** India's wind energy sector reached a new milestone in FY 2025-26 with a record addition of 6.05 GW, reflecting a significant 46% increase over FY 2024-25.



### Current Status of Wind Power in India:

- India has attained **4th position globally** in wind power installed capacity.
- India has a **cumulative installed wind power capacity of 56 GW** as of April 2026, trailing only China, USA and Germany.
- This current installed capacity accounts for **almost 10% of total installed capacity of India**.
- India had **initially set a target of achieving 60 GW of installed wind energy capacity by 2022**, but CoVID-19 related economic challenges and supply chain disruption issues have led to the target being unfulfilled.
- The Union Govt, through the National Institute of Wind Energy (NIWE), has installed **over 800 wind-monitoring stations all over the country** and issued

wind potential maps at 100m, 120m and 150m above ground level.

- Wind resource assessment by the NIWE has revealed an estimated wind power **potential of approximately 302 GW at 100 meters, 695.5 GW at 120 meters and 1,164 GW at 150 meters above ground level** across the entire nation.
- **Gujarat has the highest installed wind power capacity** in India (12.6 GW), followed by Tamil Nadu (11.7 GW) and Karnataka (7.3 GW).

### Govt Initiatives for Wind Energy:

- **National Offshore Wind Energy Policy of 2015:**
  - MoNRE has been authorised to use offshore areas within India's Exclusive Economic Zone for this purpose.
  - NIWE has been authorised as the nodal agency for the implementation of this.
  - Target of 30 GW offshore wind installations by 2030.
- **National Wind-Solar Hybrid Energy Policy:**
  - Framework for promotion of large grid connected wind-solar hybrid system for optimal and efficient utilization of transmission infra and land.
  - Wind Turbine Generators and Solar Photo-Voltaic systems are configured to operate on same grid connection.
- **Green Energy Corridor Project:**
  - Aims at synchronizing electricity produced from renewables with conventional power stations,

leading to an integrated grid across India.

- **Foreign Direct Investment (FDI):**
  - GoI has permitted FDI up to 100 percent under automatic route.
- **Policy for Repowering of the Wind Power Projects, 2016:**
  - Provides additional interest rate rebate of 0.25% over existing rebates for new wind projects financed by IREDA (Indian Renewable Energy Development Agency).
- **Guidelines for Disposal of Fiber Reinforced Plastic (FRP):**
  - Central Pollution Control Board issued guidelines for disposal of FRP used in wind turbines.
- **Viability Gap Funding (VGF) scheme for offshore wind energy projects:**
  - It aims to reduce power costs from offshore wind projects, making them viable for DISCOMs through govt support.
  - It seeks installation and commissioning of 1 GW of offshore wind energy projects (500 MW each off the coast of Gujarat & Tamil Nadu).

Source: India achieves highest-ever annual wind energy addition of 6.05 GW in 2025-26 (PIB)

## PLACES IN NEWS

### Philippines



- It is an **archipelagic nation in South East Asia**, bordered by Philippine Sea to the east, South China Sea to the west & Celebes Sea to the south.
- It consists of **7,641 islands**, with Luzon and Mindanao the largest.
- Capital: Manila (on Luzon Island).
- **Mount Apo** (2,954 m) is the highest peak, and it is an active volcano.
- Philippines is **part of the Pacific Ring of Fire**, which makes it geologically active. It has >20 active volcanoes, including **Mayon, Taal, & Pinatubo**.
- In the **1540s, Spanish explorers conquered the archipelago** and named them Las Islas Filipinas in honor of King Philip II of Spain.
- After the Spanish–American War, in 1898, **Spain ceded the territory to the USA**. The USA controlled Philippines until **Japan invaded and conquered the islands during World War II**.
- After the USA retook the Philippines from the Japanese, the **Philippines became independent in 1946**.

- With a population of over 110 million, it is the world's **twelfth-most-populous country**.
- It is an **emerging market and a developing and newly industrialized country**. Its economy is transitioning from being agricultural to service- and manufacturing-centered.

**Lohit River**



- Recently, the Union Cabinet approved the investment proposal for the construction of the **1200 MW Kalai-II Hydro Electric Project** on the Lohit River in Arunachal Pradesh.
- It is a perennial river which flows through **Arunachal Pradesh and Assam**. It originates in the Zayal Chu range in **eastern Tibet**.
- It flows through Arunachal Pradesh, passing through the **Mishmi Hills**. It then enters Assam, where it joins the Brahmaputra River near Sadiya.
- Its catchment area experiences mostly a tropical wet season and supports dense mixed forest.
- The **Dhola-Sadiya Bridge (Bhupen Hazarika Setu)**, the third longest bridge in India, spans the Lohit River and connects Assam and Arunachal Pradesh. It is designed to ease the movement of armed forces to Arunachal Pradesh.

**TERMS IN NEWS**

**Exercise Cyclone-IV**



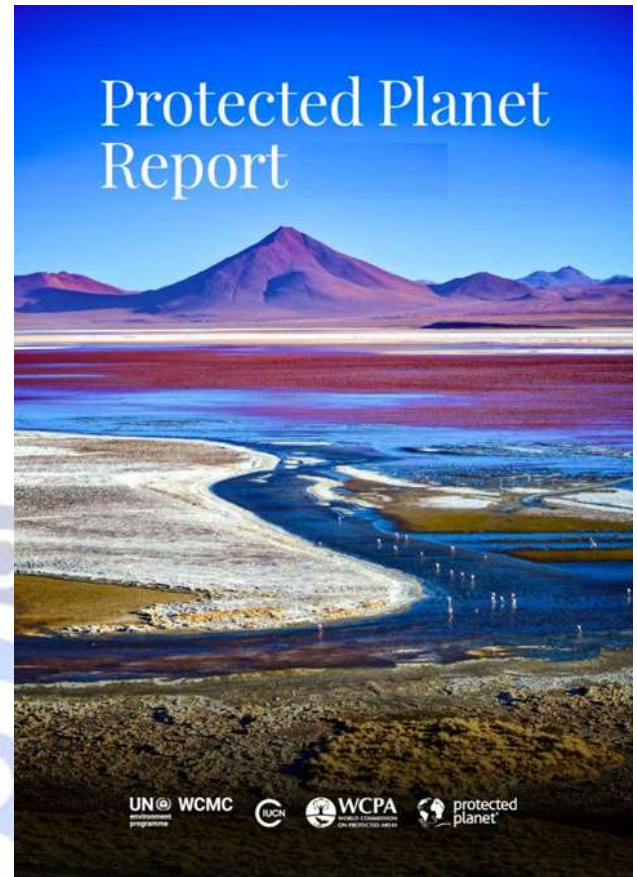
- An Indian Army contingent departed for **Egypt** to participate in **Exercise Cyclone-IV**, scheduled from 09 to 17 April 2026.
- It is a joint special forces exercise conducted between India and Egypt. The first edition was held at **Jaisalmer in Rajasthan in 2023**.
- It aims to **enhance joint mission planning capabilities and improve interoperability** through the exchange of best practices in special operations.

**International Conference on Spacecraft Mission Operations**



- The **second edition of the conference** is being held in **Bengaluru** from April 8 to 10, 2026.
- It is a global conference, **organized by ISRO**, focusing on spacecraft, mission operations and future space mission management.
- Theme: **“Innovative Operations for Smart and Sustainable Space Mission Management – Next Generation.”**
- It aims to cover a wide range of topics such as **mission operations** management, **advanced design**, **automation**, **AI**, **robotics**, **cybersecurity**, and interplanetary exploration.
- It addresses issues like **increasing space traffic**, complex mission systems, and **human space missions**.
- It brings together space agencies, startups, academia, and industry for sharing knowledge and innovation.

### Protected Planet Report




- It is the first report to assess the global status of Protected and Conserved Areas (PCA) in the context of **Target 3 of the Kunming-Montreal Global Biodiversity Framework (KMGBF)**.
- It was launched by the United Nations Environment Programme (UNEP) and the International Union for Conservation of Nature (IUCN).

#### Major Findings:

- Around **10% of the global ocean** is now within **protected and conserved areas**.
- The world **still needs to protect an area almost the size of the Indian Ocean by 2030** to reach the 30% target under the KMGBF.
- Over the past two years, nearly 5 million km<sup>2</sup> of ocean have been newly protected.

New areas were added to the **World Database on Protected and Conserved Areas (WDCPA)**, which tracks global progress toward KMGBF targets.

- **Only 1.3% of the ocean is covered by protected areas** where management effectiveness has been assessed and reported. This shows gaps in monitoring.
- About **95% of Earth's habitat by volume lies in the high seas**, yet only 1.66% of these areas are protected, highlighting a major protection gap.

 The KMGBF was adopted during the 15th meeting of the Conference of the Parties (COP 15) to the Convention on Biological Diversity in 2022. The 30 by 30 (or 30x30) target is a global commitment under the KMGBF to effectively conserve and manage at least 30% of the world's land, inland waters, coastal areas, and oceans by 2030.

## PRACTICE QUESTIONS

Q1. Consider the following rivers that are part of the Brahmaputra basin:

1. Subansiri
2. Dhansiri
3. Lohit
4. Kameng
5. Kopili
6. Sankosh
7. Manas

How many of the above rivers are right bank tributaries of the Brahmaputra ?

- (a) Only two
- (b) Only three
- (c) Only four
- (d) Only five

Q2. Consider the following statements regarding the status of wind energy installations in India:

1. India has the 2<sup>nd</sup> largest installed wind capacity in the world, after China.
2. Wind power currently accounts for approximately 75 GW of India's total installed energy capacity.
3. Gujarat has the highest installed capacity of wind energy in India.
4. India aims to achieve 30 GW worth of offshore wind installations by 2030.

Which of the afore mentioned statements are correct ?

- (a) 1, 2 and 4
- (b) 3 and 4
- (c) 1, 2 and 3
- (d) 1, 3, and 4

Q3. Consider the following military exercises that India takes part in and the country that it is jointly held with:

1. Vajra Prahar: Russia
2. Cyclone: Egypt
3. Mitra Shakti: Bangladesh
4. Sada Tanseeq: UAE

How many of the above pairs are correctly matched ?

- (a) Only one
- (b) Only two
- (c) Only three
- (d) All four

Q4. The "Protected Planet Report" is released by:

- (a) UN Environment Programme (UNEP) & World Wide Fund for Nature (WWF)
- (b) UN Environment Programme (UNEP) & International Union for Conservation of Nature (IUCN)

- (c) UN Environment Programme (UNEP) & World Meteorological Organization (WMO)
- (d) World Wide Fund for Nature (WWF) & International Union for Conservation of Nature (IUCN)

Q5. Consider the following statements regarding India's "National Quantum Mission":

1. India is the first country in the world to have a dedicated mission for quantum technology.
2. Development of quantum computing will be aided by the National Supercomputing Mission.
3. Its implementation is overseen by the Ministry of Electronics and Information Technology (MEITY).

How many of the above statements are correct ?

- (a) Only one
- (b) Only two
- (c) All three
- (d) None

**Answers:**

1. C
2. B
3. A
4. B
5. D

