



TECHNOLOGY

PRE-CONTEXT

QUANTUM TECHNOLOGY

THE HINDU, PG.NO: 1.

News: "Microsoft unveils new quantum chip."

Quantum Computing:

- Advanced type of computing that **uses the principles of quantum mechanics to perform certain calculations** more efficiently than classical computers.
- Classical computers use bits (0 or 1) as the basic unit of data, **quantum computers use quantum bits or qubits.**
- Qubit:**
 - Qubit is not made of a specific material; rather, it is implemented using any physical system that behaves like a two-level quantum system.
 - Eg. Quantum Dots: Electrons confined in nanoscale semiconductor structures (quantum dots) can also act as qubits by exploiting their discrete energy levels.

Key concepts in quantum computing:

- Superposition:**
 - Unlike classical bits, qubits can exist in multiple states (**both 0 and 1**) at the same time, allowing quantum computers to perform many calculations at once.
- Entanglement:**
 - Two or more qubits become linked** in such a way that state of one particle directly influences the state of other **no matter how far apart they are in space.**
 - This property is key to the power and efficiency.
- Quantum Tunnelling (QT):**
 - Unlike classical physics, QT **allows an electron or atom passes through a potential energy barrier.**
 - This allows quantum computers to explore many possible solutions to a problem simultaneously.
- Photon-based Communication:**
 - Photons are used as **carriers of quantum information** due to their robustness in long-distance transmission.
- Quantum Key Distribution (QKD):**
 - Ensures **secure encryption keys** are shared between users. Provides virtually unbreakable security based on quantum mechanics.

National Mission on Quantum Technologies and Applications.

- Budget 2020-21 allocated **Rs.8000 crore** for focus on development of quantum computing and related technologies.
- Implemented by:** **Dept. of Science & Technology.**
- Objectives:** **Setting up 4 thematic Hubs:**
- Quantum computing.**
 - Developing intermediate scale quantum computers with 50-1000 physical qubits in 8 years.
- Quantum communication.**
 - Developing satellite based secure quantum communications between ground stations over range of 2000km.
 - Quantum Satellites:** They facilitate quantum information transmission (qubits) and secure communication via quantum key distribution (QKD).
- Quantum sensing & Metrology.**
 - Developing magnetometers with high sensitivity atomic systems and Atomic clocks for precision timing, communication and navigation.
- Quantum material devices.**
 - Development of quantum materials like superconductors novel semiconductor structures.

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GS II

SYLLABUS: PROBITY IN GOVERNANCE: CODES OF CONDUCT.

LOKPAL

THE HINDU, PG.NO: 1.

News: "SC stays Lokpal order on powers over HC judges."

About Lokpal:

- Central Vigilance Commission:** relies on CBI for investigation under **Prevention of Corruption Act 1988** and only oversees the bureaucracy, **Ministers. MPs are out of its purview.**
- Based on the **recommendations of the Administrative Reforms Commission**, Lokpal and Lokayukta were established as **independent statutory body** under the **Lokpal and Lokayukta Act 2013.**
 - It deals with complaints against **MPs, Ministers and Secretaries at Central level.**

Composition:

- Composed of a **chairperson and a maximum of eight members**, with **half of them being judicial members.**
 - 50% of members belong to Scheduled Castes, Scheduled Tribes, Other Backward Classes, minorities, and women.
- Selection Committee:** which includes the Prime Minister as Chairperson, Speaker of Lok Sabha, Leader of Opposition in Lok Sabha, Chief Justice of India or a Judge nominated by him/her and one eminent jurist appointed by President.
- The term of office for the Lokpal of India is five years, or until the member turns 70 years old.**

Powers of Lokpal:

- Jurisdiction** to inquire corruption cases:
 - Against current & former Ministers(including PM).
 - Allegations on PM related to IR, Atomic energy etc exempted.
 - Current and former MPs.
 - Secretaries at central level, union govt officials under group A, B,C, D; All institutions receiving funds from govt.
- Can **recommend transfer or suspension** of official accused of corruption.
- Power to **Search and Seizure.**
- Powers to **take up preliminary Inquires under PCA 1988.**
- Supervise and instruct any central investigating agencies** like CBI.

Issues in functioning:

- As of 2025, Lokpal has ordered investigation in just 24 cases in 5 years** and granted prosecution sanction in six cases.
- No Suo Motu powers** against any public servant.
- Ineffective Whistle blower protection:** Anonymous complaints not allowed, heavy fines for false complaints.
- Selection committee and the issue of Leader of Opposition.**
- Limitations on investigations:** Eg. Investigation on PM need two-third support of lokpal bench.
- 2016 Amendment:** Public officials spouses and children are not needed to disclose assets public. This goes against anti corruption.
- Rejection of complaints for incorrect format:** Nearly 90% of the complaints were rejected as they were not in correct format in 2024.
- One cannot file complainants after 7 years of incident.**
- Judiciary is out of its ambit.**

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PYQs: CSE (M).

GS IV 2013: 'A national Lokpal, however strong it may be, cannot resolve the problems of immorality in public affairs'. Discuss.



ENVIRONMENT

PRE-CONTEXT

CLEAN GANGA MISSION

THE HINDU, PG.NO: 8.

News: "Watering down."

About National Mission for Clean Ganga (NMCG):

- **Ministry:** Jal Shakti & MoHUA.
- **States involved:** UK, UP, BH, JK, WB.
- **NMCG is chaired by Prime Minister.**
- NMCG is created under **Environment Protection Act 1986** and registered under **societies Act 1860**.
- It aims to ensure effective abatement of pollution and conservation of river Ganga.
- NMCG replaced earlier **National River Ganga Basin Authority (NRGPA)**.
- Act envisages five tier structure at national, state and district level to take measures for prevention, control and abatement of environmental pollution in river Ganga and to ensure continuous adequate flow of water.
- Mission is supported by World Bank.

Objectives:

- **Abatement of Pollution**—Ban on Waste disposal by NGT in 2017, Treatment plants, Pollution control boards.
- **Conservation of river Ganga.**
- **Rejuvenation of river Ganga**—Clean Ganga Fund constituted for this purpose.

Sewage Treatment in India:

- Water is a '**State Subject**'.
- **Laws associated:** EPA 1986 and the Water (Prevention & Control of Pollution), Act 1974.
- **74th CAA(12th schedule):** decentralised the water supply and sanitation services to **Urban Local Bodies**.
- **Initiatives:** Atal Mission for Rejuvenation & Urban Transformation (AMRUT), Smart Cities Mission, Namami Gange program and National River Conservation Plan.
- **Nature Based solutions:** wetlands rejuvenation, vermifiltration etc.

Measurement of Pollution:

Biological Oxygen Demand:

- Amount of dissolved oxygen needed by aerobic organisms to **break down organic pollutants** at certain temperature in specific time period.
- Expressed in **milligrams of oxygen per litre of water**.
- **BOD for drinking water** should be less than 3 mg/L.
- **High BOD (>5 mg/L)** indicates polluted water.
- High BOD results in Eutrophication, hypoxia conditions (oxygen depletion).

Chemical Oxygen Demand:

- COD refers to total amount of oxygen **needed by chemical oxidants** to break down **both organic and inorganic pollutants** in water.
- Especially used for **determination of POPs** (organic pollutants which are not easily biodegradable).
- **Time required for COD is 2-3 hours**, for BOD 5 days.

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CPCB:

- **Statutory body** created under Water (Prevention and Control of Pollution) Act 1974.
- Also entrusted with powers and functions under the **Air Act, 1981**.
- Works under **Ministry of Environment, Forest, and Climate Change**.
- Responsible for monitoring and controlling air, water and land pollution and advises Central govt., on them.

Powers of Board:

- Has **nationwide jurisdiction** but works in coordination with **State Pollution Control Boards**.
- Advices, coordinates & technical assistance for prevention of water pollution.
- **Amended in 1977:** imposes "**Cess**" on industries.
- Power to **punish, fine & imprisonment**.

Functions:

- Setting standards for notified pollutants under **National Ambient Air Quality Standards** for air quality.
- Sets environment criteria for products under **Ecomark scheme**.
- Monitors the usage of **single use of plastics**.

Initiatives by CPCB:

- **Comprehensive Pollution Index:** ranks industrial clusters based on the level of the environmental pollution they cause.
- **National Air Quality Monitoring Program (NAMP):** Monitors ambient air quality at various locations across India.
- **National Water Quality Monitoring Program (NWMP):** Monitors water quality at different rivers, lakes and water bodies.
- **Graded Response Action Plan (GRAP):** dealing with severe air pollution levels in the National Capital Region (NCR).
- **National Clean Air Programme (NCAP):** to reduce PM10 & PM 2.5 by 20-30% by 2024.

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PRE-CONTEXT

LINE OF ACTUAL CONTROL

THE HINDU, PG.NO: 8.

News: "The long and winding road of India-China relations."

About LAC:

- The concept of the LAC emerged after the **1962 Sino-Indian War**, it separates Indian-controlled territory from Chinese-controlled territory in Himalayan region.
- **Unlike** the Line of Control (**LoC**) with Pakistan, the **LAC with China is not a legally recognized international boundary.**
- **LAC passes through** Ladakh, Kashmir, Uttarakhand, Himachal Pradesh, Sikkim, Arunachal Pradesh.
- **LAC is divided into three sectors:**
 - **Western Sector (Ladakh Region):** The most contentious area, including Aksai Chin.
 - **Middle Sector (Himachal Pradesh and Uttarakhand):** least disputed sector.
 - **Eastern Sector (Arunachal Pradesh):** China claims this area as part of South Tibet (McMahon Line).
- Grabbing of land inch-by-inch is known as '**Salami Slicing**'.

Recent Incidents:

- **Doklam Standoff (2017):** A 73-day military standoff near the India-Bhutan-China tri-junction.
- **Galwan Valley Clash (2020):** First deadly confrontation in over four decades, resulting in casualties on both sides.
- **Current Situation:** China has agreed to restore troops to pre-2020 levels.

Geographical features along LAC

Mountain Ranges & Glaciers

- Karakoram Range, Salto Ridge, Ladakh Range, Greater Himalayas.
- Eastern Himalayas.

Rivers:

- Shyok River, Indus (passes through Ladakh), Pangong Tso (lake in Ladakh).
- Sutlej (Western sector).
- Brahmaputra (Eastern sector).

Strategic Points: Glaciers, Valleys and Plains:

- **Siachen Glacier** (North of Depsang Plains).
- **Daulat Beg Oldie** (Air strip of Indian Army).
- **Depsang Plains** (Eastern Ladakh).
- Karakoram Pass.
- Galwan Valley (Eastern Ladakh).
- Chang Chenmo Valley (eastern Ladakh).
- **Nubra Valley** (located north to Leh).
- Finger-4 (on banks of Pangong Tso).
- **Demchok** (Village).
- Spiti Valley (in Himachal Pradesh).
- **Doklam Plateau** (Sikkim-Bhutan Border).
- Tawang Valley (Arunachal Pradesh).
- Yangtse (Arunachal Pradesh).

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Infrastructure:

- **National Highway 1:** Strategic movement towards western LAC.
- **Darbuk-Skyok-DBO road.**
- **Atal Tunnel:** enhances connectivity in Ladakh near LAC.

Wildlife sanctuaries and National Parks:

- Hemis National Park (Ladakh).
- Khardung La Wildlife Sanctuary (Ladakh).
- Eaglenest Wildlife Sanctuary (Arunachal Pradesh).
- Changlang Tiger Reserve (Arunachal Pradesh).

Tribes:

- **Changpa or Rebos** a semi-nomadic community of Changthang region.

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Thank you!