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QUANTUM TECHNOLOGY

THIS ARTICLE COVERS 'DAILY CURRENT AFFAIRS' AND THE TOPIC DETAILS OF "QUANTUM TECHNOLOGY" THIS TOPIC IS RELEVANT IN THE "SCIENCE AND TECHNOLOGY" SECTION OF THE UPSC CSE EXAM.

UPSC MAINS GS3 SYLLABUS: ACHIEVEMENTS OF INDIANS IN SCIENCE & TECHNOLOGY, DEVELOPMENTS IN SCIENCE AND TECHNOLOGY

WHY IN THE NEWS?

The **Mission Governing Board (MGB)** of the National Quantum Mission (NQM) recently met to discuss NQM's execution strategy and deadlines, as well as the development of the **Mission Coordination Cell (MCC)**. The MCC will be established in an institution chosen by the Department of Science and Technology (DST) based on merit and existing infrastructure.

ABOUT NATIONAL QUANTUM MISSION:

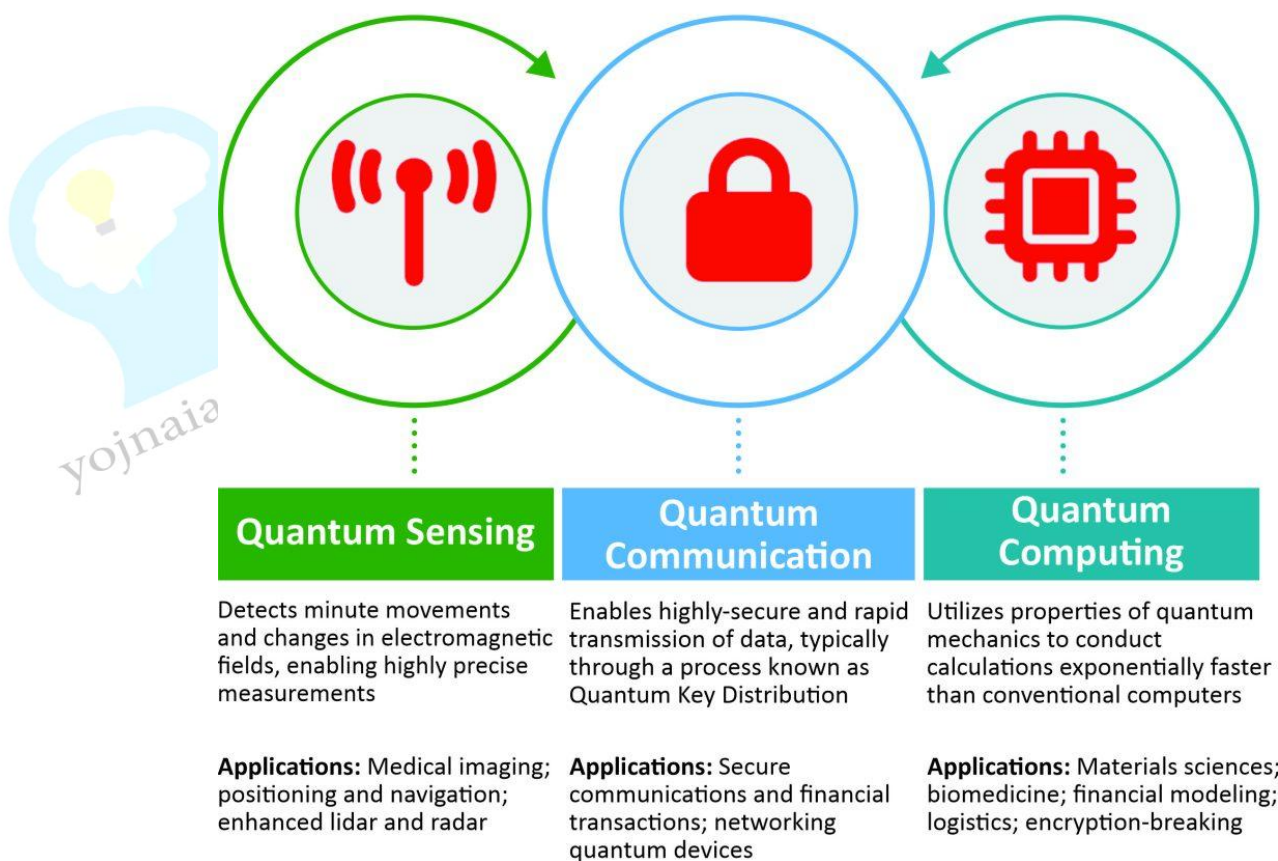
- The **National Quantum Mission (NQM)**, scheduled for the period **2023-2031**, is a visionary initiative aimed at fostering scientific and industrial research and development (R&D) in Quantum Technology (QT).
- Under the purview of the Ministry of Science & Technology, the Department of Science and Technology (**DST**) will spearhead the implementation of this mission. India's adoption of the NQM makes it the seventh country globally, following in the footsteps of the US, Austria, Finland, France, Canada, and China.
- **Mission Objectives:** The **NQM** seeks to cultivate and amplify scientific and industrial **R&D in Quantum Technology**, with a specific focus on creating a dynamic and innovative ecosystem. Its overarching goal is to position India as a leading player in the realm of quantum technologies.

KEY FEATURES:

1. The mission outlines ambitious targets, including the development of intermediate-scale quantum computers featuring **50-100 physical qubits within five years** and scaling up to **50-1000 physical qubits within eight years**.
2. Unlike traditional computers that process information using bits (1 and 0), quantum computers leverage 'qubits' or 'quantum bits' as fundamental processing units.

3. The NQM envisions advancements in various facets of quantum technology. This includes the development of high-sensitivity magnetometers for applications such as **precision timing (atomic clocks), communications, and navigation.**
 4. Additionally, it will support the design and synthesis of quantum materials like superconductors, novel semiconductor structures, and topological materials for the fabrication of quantum devices.
- **Quantum Communications Development:** One of the key thrust areas of the mission is the establishment of **secure quantum communications.** This involves satellite-based quantum communication between ground stations within India over a 2000 km range, facilitating secure quantum communications with other nations, and implementing inter-city quantum key distribution over 2000 km. The mission also envisions the creation of a multi-node Quantum network with quantum memories.
 - **Four Thematic Hubs:** To facilitate focused research and development, the **NQM will establish four Thematic Hubs (T-Hubs)** in leading academic and National R&D institutes. These hubs will specialize in Quantum Computation, Quantum Communication, Quantum Sensing & Metrology, and Quantum Materials & Devices.

ADVANTAGES OF QUANTUM TECHNOLOGY



QUANTUM COMPUTING POWER:

Quantum computers have the potential to **execute complicated calculations** much quicker than traditional computers. This could lead to groundbreaking advancements in fields like cryptography, optimization problems, and drug discovery.

ENHANCED COMPUTATIONAL CAPABILITIES:

Quantum technology allows for the simultaneous processing of multiple possibilities, significantly enhancing computational capabilities. This could lead to solving intricate problems that were previously deemed unsolvable.

QUANTUM COMMUNICATION SECURITY:

Quantum communication ensures highly secure information transfer. **Quantum key distribution (QKD)** offers a level of security that is theoretically immune to hacking attempts, providing a robust solution for secure communications.

QUANTUM SENSORS AND IMAGING:

Quantum sensors exhibit **unprecedented sensitivity, enabling precise measurements** beyond classical limits. Quantum imaging technologies have the potential for enhanced resolution, benefiting fields such as medical imaging and geological exploration.

QUANTUM METROLOGY FOR PRECISION MEASUREMENTS:

Quantum technology facilitates precision measurements with minimal uncertainty. This can significantly impact areas such as navigation, timekeeping, and the development of advanced sensors.

QUANTUM MATERIALS AND DEVICES:

Quantum materials offer unique properties that can be harnessed for the development of novel devices. Superconductors and topological materials, for instance, hold promise for creating advanced electronics and quantum devices.

DISADVANTAGES OF QUANTUM TECHNOLOGY

TECHNICAL COMPLEXITY:

Quantum technology involves complex theoretical concepts and intricate experimental setups. The development and maintenance of quantum systems require specialized knowledge, making it challenging for widespread adoption.

QUANTUM DECOHERENCE:

Quantum systems are susceptible to decoherence, where the fragile quantum states become disrupted by external influences. Maintaining coherence over extended periods, essential for computing tasks, remains a significant challenge.

HIGH COST OF IMPLEMENTATION:

Building and maintaining quantum systems entail significant costs. The specialized equipment, ultra-low temperatures required for certain quantum operations, and the need for isolation from external factors contribute to the high cost of implementation.

LIMITED SCALABILITY:

Achieving scalability in quantum systems, especially in quantum computing, remains a formidable challenge. As the number of qubits increases, the probability of errors and the need for error correction mechanisms escalate, impacting the overall scalability.

SENSITIVITY TO EXTERNAL CONDITIONS:

Quantum systems are highly sensitive to their environment. Any interference, such as temperature fluctuations or electromagnetic fields, can lead to errors in quantum computations, posing a challenge for real-world applications.

LACK OF QUANTUM SOFTWARE AND ALGORITHMS:

The development of efficient quantum algorithms and software lags behind hardware advancements. The absence of a comprehensive suite of quantum software limits the practical utilization of quantum computers for specific applications.

CONCLUSION:

WHILE QUANTUM TECHNOLOGY PROMISES UNPRECEDENTED ADVANCEMENTS, ADDRESSING THE ASSOCIATED CHALLENGES IS CRUCIAL FOR REALIZING ITS FULL POTENTIAL. ONGOING RESEARCH AND DEVELOPMENT EFFORTS AIM TO OVERCOME THESE HURDLES, PAVING THE WAY FOR A FUTURE WHERE QUANTUM TECHNOLOGY TRANSFORMS VARIOUS ASPECTS OF COMPUTING, COMMUNICATION, AND SENSING.

PRELIMS PRACTICE QUESTIONS**Q1) Consider the following statements regarding the Quantum Technology**

- 1) Qubit is the fundamental unit of information in quantum computing.
- 2) Superposition property allows qubits to exist in multiple states simultaneously.
- 3) Entanglement phenomenon is responsible for the secure communication offered by quantum key distribution (QKD)

How many statements given above is/are correct?

- a) One
- b) Two
- c) Three
- d) None

ANSWER: C

Q2) In the context of quantum sensing, what distinguishes quantum sensors from classical sensors?

- (a) Quantum sensors have lower sensitivity.
- (b) Quantum sensors can only measure one property at a time.
- (c) Quantum sensors exhibit unprecedented sensitivity, enabling precise measurements.
- (d) Quantum sensors are not affected by external factors.

Answer: C

MAINS PRACTICE QUESTIONS

Q1) How can quantum communication help in bolstering national security, particularly in securing critical infrastructure and communication channels.

Q2) Assess the potential impact of quantum technology on healthcare, including advancements in medical imaging, drug discovery, and personalized medicine.

Himanshu Mishra

POST OFFICE BILL 2023

SOURCE - THE HINDU AND PIB.

GENERAL STUDIES - MINISTRY OF INFORMATION AND BROADCASTING, POST OFFICE BILL 2023 PUBLIC DISTRIBUTION SYSTEM.

WHY IN THE NEWS?



भारत का राजपत्र
The Gazette of India

Notification अधिसूचना

The POST OFFICE Act, 2023

- **The Post Office Bill 2023 was introduced in the Rajya Sabha on - 10 August 2023 and the Bill was passed by the Rajya Sabha on - 04 December 2023.**
- **Passed in Lok Sabha - 18 December 2023.**
- **On December 24, 2023, the President of India passed the Post Office Bill, 2023, which replaced the colonial-era Indian Post Office Act, 1898.**
- **During the debate in Parliament, the opposition expressed apprehensions about the provision over uncontrolled powers of interception of any item by post office authorities, including the conditions of interception.**

- There are no procedural safeguards in the Act to prevent any liability in the event of arbitrary use or abuse of the power of detention by officials. The existing Post Office Act has unbridled powers of interception.
- **On December 24, the Telecommunications Bill, 2023 also received the assent of the President, which will replace two Central Acts the Indian Telegraph Act, 1885 and the Indian Wireless Telegraphy Act, 1933.**
- The Telecommunications Act contains a provision on interception of messages, i.e. section 20(2), which is identical to section 5(2) of the Telegraph Act of 1885, except that the contents of section 7(2)(b) of the Act of 1885 Which empowers the Central Government to notify rules on precautions to be taken to prevent unreasonable interception or disclosure of messages, has now been included in Section 20(2).
- Under this, unless such procedure and security measures are prescribed, Section 20(2) cannot be implemented. This is important because although there was a provision for making rules in the 1885 Act, the relevant rules (Section 419A) were notified only in March 2007.
- This Bill will replace the Indian Post Office Act, 1898. According to the provisions of the Bill, the government can stop any material sent by post for examination for special reasons including security.
- 'Post Office Bill-2023' has been brought to further expand the postal service network in the country.
- It aims to simplify the legislative framework to facilitate the development of India Post into a citizen-centric service network.

BACKGROUND OF POST OFFICE BILL :

- **Postal services come under the Union List of the Constitution.** The Indian Post Office Act, 1898 regulates postal services provided by the Central Government. It grants special privileges to the Central Government over the transmission of letters. Postal services are provided through India Post, a departmental undertaking.
- Even before the present Bill, a similar Indian Post Office (Amendment) Bill, 1986 was introduced. The Bill was passed by both Houses of Parliament and sent to the President for his assent in December 1986. However, President Giani Zail Singh neither gave his consent to this bill nor returned the bill. The bill was tabled in Parliament until he left office in July 1987. Later, President Venkataraman returned it to Parliament for reconsideration in January 1990, and the bill was withdrawn by the Vajpayee government in 2002. The bill which was introduced in 2002 and which was referred to the Standing Committee. That Act included amendments to regulate private courier services. Ultimately the bill died. In 2006 and 2011, draft bills were released which also proposed amendments to regulate private courier services under the Act. However, the relevant bills were not introduced in Parliament. In 2017, the Act was amended to delegate the power to decide tariffs to the central government. Earlier this power was with the Parliament only. Recently, the Public Trust (Amendment of Provisions) Act, 2023 has removed all the offenses and penalties under this Act.

COMMENDABLE STEP TAKEN BY POSTAL DEPARTMENT :



- Minister of State for Communications Devusingh Chauhan, while replying to the discussion on the bill, said that the Postal Department is doing commendable work towards fulfilling the concept of Antyodaya. Now its role has changed and changes are necessary accordingly. The postal department is now providing banking and other services. Changes in the bill will be helpful in this direction.

IMPORTANT CHANGES IN POST OFFICE :

- In the present times, postal services, post offices and postmen are not limited to mere correspondence but have turned into service providing institutions. Over the years, post offices have become banks in a way.

POSTAL DEPARTMENT IS THE BACKBONE OF THE COUNTRY IN THE FIELD OF COMMUNICATION :

- For more than 150 years, the Department of Posts has been the backbone of the country. It has played an important role in the field of communication in the country. It is connected with the lives of common citizens of India in many ways. Such as delivering mail, accepting deposits



under small savings schemes, providing life insurance cover under Postal Life Insurance (PLI) and Rural Postal Life Insurance (RPLI) and providing retail services like bill collection, sale of forms, etc.

- The Indian Postal Department also acts as an agent for the Government of India in discharging other services to citizens such as Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) salary distribution and old age pension payments. With around 1,55,531 post offices, the Department of Posts has the most widely distributed postal network in the world.

HIGHLIGHTS OF THE BILL :

- This Bill replaces the Indian Post Office Act, 1898. This Act regulates India Post, a departmental undertaking of the Central Government.
- There will be no special privilege of communicating letters to the Government. The services to be provided by India Post will be prescribed under the rules.
- The Director General of Postal Services will be appointed as the head of India Post. It will have powers to make rules on various matters including charges for services and supply of postage stamps.
- The Government may stop any article being circulated through India Post on specified grounds, including security of the State and public order.
- India Post will not incur any liability in respect of its services, except any liability prescribed through rules.

KEY ISSUES AND ANALYSIS :

- The Indian Postal Bill does not specify procedural safeguards for prevention of articles transmitted through. The lack of safeguards may violate the freedom of speech and expression and the right to privacy of individuals.
- Grounds for interception include 'emergency', which may go beyond reasonable restrictions under the Constitution.
- The Bill exempts India Post from liability for defaults in postal services. Accountability may be determined through regulations by the Central Government, which also administers India Post. This may lead to conflict of mutual interests.
- There is no mention of any crime and punishment in this bill. For example – There are no consequences for unauthorized opening of postal articles by a postal officer. This may adversely affect the privacy rights of consumers.

INTERCEPTION OF ARTICLES SENT THROUGH INDIAN POST :

THE POST OFFICE BILL, 2023 EMPOWERS THE GOVERNMENT TO STOP ANY ARTICLE BEING TRANSMITTED THROUGH POST ON THE FOLLOWING GROUNDS:-

(I) SECURITY OF THE STATE

(II) FRIENDLY RELATIONS WITH FOREIGN STATES

(III) PUBLIC ORDER

(IV) EMERGENCY

(V) PUBLIC SAFETY

(VI) VIOLATION OF THE PROVISIONS OF THE BILL OR ANY OTHER LAW.

KEY FEATURES OF POST OFFICE BILL 2023 :

- **Special Privileges of the Central Government:** This Act provides that wherever the Central Government establishes any post, it shall have the special privilege of sending letters by post as well as of incidental services such as receiving, collecting, sending and delivering letters . The Bill does not provide for such privileges. The Act provides for the issue of postage stamps as per prescribed rules. The bill also states that India Post will have the exclusive privilege of issuing postage stamps.
- **Services to be prescribed :** This Act specifies the services to be provided by Indian Post, including – **(i) delivery of postal articles including letters, postcards and parcels, and (ii) money orders. The Bill provides that Indian Post will provide services as prescribed by the Central Government.**
- **Director General to make rules regarding services :** This Bill provides for the appointment of a Director General of Postal Services. Under the Act, the Director General has the powers to decide the time and manner of delivery of postal services. The Bill provides that the Director General may make rules in respect of any activity necessary for providing postal services. He may also make rules regarding charges for services, and the supply and sale of postal stamps and postal stationery.
- **Powers to intercept postal articles :** This Act allows interception of any article transmitted through post on certain grounds. Interception may be carried out in the event of any public emergency, or in the interest of public safety or peace. Such interception can be done by the Central Government, State Governments or any officer specifically authorized by them. Any detained material/shipment may be detained or disposed of by the officer in charge. The officer is also empowered to seize, detain or destroy goods/shipments carrying goods prohibited under the Act or any other law.
- **This bill provides that any article sent through post can be stopped on the following grounds – (i) security of the state, (ii) friendly relations with foreign states, (iii) public order, (iv) emergency. , (v) public safety, or (vi) violation of the provisions of the Bill or any other law. An officer empowered by the Central Government through a notification can carry out the interception.**
- **Examination of postal articles prohibited under law or liable to duty:** Under this Act, an officer-in-charge may examine a postal article. If he suspects that it contains goods which are prohibited, or is liable to pay duty. The Bill removes the powers of examination. Instead it provides that in such cases, the Central Government may authorize an officer of the Indian Post to deliver the postal article to a customs authority or any other specified authority. After this the authority will deal with the concerned item.
- **Exemption from liability :** This Act exempts the Government from any liability relating to loss, mis-delivery, delay or damage to postal articles. It does not apply where the liability is assumed in express terms by the Central Government. Officials are also exempt from such liability unless they have acted fraudulently or willfully. The Bill retains these exemptions. It also provides that the Central Government may determine the liability in respect of the services of India Post under rules.
- **To remove offenses and punishments :** The Act specified various offenses and penalties, all of which have been removed by the Public Trust (Amendment of Provisions) Act, 2023. For example, there was a provision of imprisonment of up to seven years and fine for theft,

misappropriation of postal articles, or destruction of any post office building by a postal officer. Sending certain prohibited items through post was punishable with imprisonment of up to one year, fine or both. The Bill does not provide for any offense or consequence except one. The amount not paid by the user will be recoverable as arrears of land revenue.

REGULATION OF POSTAL SERVICES OTHER THAN COURIER SERVICES :



- Currently, there are different frameworks for regulation of similar postal services by the public and private sectors. The Indian Post Office Act, 1898 establishes a monopoly of the central government on sending letters. Private courier services are not currently regulated under any specific laws. This creates some key differences. For example – the Act of 1898 provides a framework for intercepting articles transmitted through Indian Post. There is no such provision for private courier services. Another important difference is in the application of the consumer protection framework. The Act of 1898 exempts the Government from liability for any default in services, except when such liability is made in express terms. The Consumer Protection Act, 2019 does not apply to the services of India Post, but it does apply to private courier services. The Post Office Bill, 2023, while seeking to replace the Postal Act 1898, retains these provisions.

PASSPORT SERVICES AND AADHAAR ENROLLMENT SERVICES WILL GET LEGAL FRAMEWORK :

- It will provide a legal framework to passport services and Aadhaar enrollment services run by the Department of Posts. At present there are more than 26 crore accounts in Post Office Savings Bank, in which Rs 17 lakh crore are deposited. Indian Post is an integral part of the lives of the people of the country and in the last few years the Government has made significant reforms in this department.
- This Act regulates India Post, a departmental undertaking of the Central Government. Under the said bill, in the interest of emergency or public safety or in the event of any violation, the Center has been given the power to stop, open or detain any item and hand it over to the customs authorities.

SOLUTION/ WAY FORWARD :

INCORPORATING STRONG PROCEDURAL SAFEGUARDS :

- There should be provision for procedural safeguards to prevent articles sent through India Post. This should include surveillance mechanisms, judicial warrants and adherence to constitutional principles to protect freedom of speech and expression and the right to privacy of individuals.
- To reintroduce specific offenses and penalties within the Bill, addressing unauthorized opening of postal articles by postal authorities. Establish a legal framework to protect consumers' right to privacy and hold individuals accountable for malpractice, fraud, theft and other crimes.
- The grounds for 'emergency' cannot go beyond the reasonable restrictions permitted under the Constitution:
- The Bill allows stopping of postal articles on the grounds of 'emergency'. The 1898 Act has a similar ground of 'public emergency' for interception. The Law Commission (1968) while examining the 1898 Act had observed that the word emergency was not clearly defined, and thus it provided very wide grounds for obstruction. It was also observed that interception of postal articles may violate freedom of speech and expression in some cases, such as those involving letters, books, postcards and newspapers. It states that a public emergency cannot be a constitutionally acceptable ground for interception if it does not affect the security of the state, public order or any other ground specified in the Constitution.

The Supreme Court (2015) has held that arbitrary grounds for restricting freedom of speech and expression are unconstitutional.

RESPONSIBILITY FOR DEFAULT IN SERVICES SHOULD BE FIXED :

- The Bill states that, notwithstanding any other law in force, India Post shall not incur any liability in respect of the service provided by India Post. However, the Central Government may prescribe obligations in respect of a service through regulations. The question is whether the Bill itself should provide for liability. This fact also needs attention.
- While examining the application of the 1898 Act, the National Consumer Disputes Redressal Commission (2023) had held that the Consumer Protection Act, 2019 does not apply to postal services provided by the government. The Bill retains the provisions regarding liability under the 1898 Act. This means that the rights of consumers of India Post's postal services cannot be adequately protected. Accountability may be determined through rules by the Central Government, which also administers India Post. This may lead to conflict of interest.
- The framework under the Bill is contrary to the law applicable in the case of Railways, which is also a commercial service provided by the Central Government. The Railway Claims Tribunal Act, 1987 establishes tribunals to adjudicate complaints of defects in services against the Indian Railways. These include complaints such as loss, damage, or non-delivery of goods, and refund of fares or freight charges.

POSSIBILITY OF VIOLATION OF FUNDAMENTAL RIGHTS :

- The lack of procedural safeguards may violate the fundamental rights of individuals. The Bill does not specify any procedural safeguards against interception of postal articles. This may violate the right to privacy and freedom of speech and expression. In the case of telecommunications interception, the Supreme Court (1996) held that a fair and reasonable

procedure must exist to regulate the power of interception. Otherwise, it is not possible to protect the rights of citizens under Article 19(1)(a) (freedom of speech and expression) and Article 21 (right to privacy as a part of the right to life and liberty). To address this, the Court mandated a number of safeguards, including: (i) establishing the necessity of interception, (ii) limiting the validity of interception orders, (iii) authorization by high-ranking officials, and (iv) the blocking order will be examined by a review committee headed by senior government officials.

IMPROPRIETY OF REMOVING ALL CRIMES AND PUNISHMENTS :

- The Postal Bill (Amendment of Provisions) Act, 2023 removed all offenses and penalties under the 1898 Act. These included various crimes committed by Post Office officials. The Bill retains this status, that is, it does not provide for any offense and penalty. The question is, is it fair? The Central Government needs to pay more attention to this.
- Under the Act prior to the present Bill, illegal opening of postal articles by a postal officer was punishable with imprisonment of up to two years, fine or both. Apart from postal officials, other persons were also punished for opening mail bags. In contrast, there will be no consequences against such actions under the Postal Bill 2023. This may adversely affect the right to privacy of individuals. Specific violations related to postal services are not covered under other laws such as the Indian Penal Code (IPC). The IPC punishes such crimes only when accompanied by theft or misappropriation (sections 403 and 461).

LACK OF CLARITY ON RESULTS :

- The Bill states that no officer shall incur any liability in respect of the service provided by India Post. This exemption will not apply where the officer has acted fraudulently or willfully caused loss, delay or wrong delivery of service. However, the Bill does not specify what the consequences will be if an officer commits such an act. Under the 1898 Act, before amendment under the Public Trust Act, these offenses were punishable with imprisonment of up to two years, a fine or both.

FINANCIAL ASSISTANCE TO INDIA POST :

- The Financial Memorandum of the Bill states that the implementation of the Bill will not entail any recurring or non-recurring expenditure from the Consolidated Fund of India. However, India Post has consistently incurred losses, which have been adjusted and protected by the Consolidated Fund of India.

PRACTICE QUESTIONS FOR PRELIMINARY EXAM :

Q.1. Consider the following statements with reference to the Postal Bill 2023:

1. 'Post Office Bill-2023' has been brought to limit and cut the postal service network in the country.
2. In implementing the Post Office Bill-2023, expenditure is incurred not from the Consolidated Fund of India, but from the Consolidated Fund of India.
3. This Bill replaces the Indian Post Office Act, 1898. This Act regulates India Post, a departmental undertaking of the Central Government.
4. The Post Office Bill, 2023 will replace the colonial-era Indian Post Office Act, 1998.

Which of the above statement / statements are correct?

(A) Only 1, 2 and 3

(B) Only 2, 3 and 4

(C) Only 1 and 4

(D) Only 2 and 3

Answer - (D)

PRACTICE QUESTIONS FOR MAIN EXAM :

Q.1. Referring to the main provisions of the Post Office Bill 2023, discuss how this bill violates the fundamental rights of an individual like 'freedom of speech and expression' and 'right to privacy'?

Akhilesh Kumar Shrivastava



Yojna IAS
योजना है तो सफलता है