5G & Fiberisation

For Prelims: 5G, Fiberisation, Components of Optical Fibre, Related Government Initiatives

For Mains: Significance of Internet in Economy, Evolution of Internet, Challenges in Fiberisation, Government's Initiative

Why in News?

India is preparing to auction off airwaves to rollout **5G** services in the country.

- The infrastructure needed for such a rollout requires existing radio towers to be connected via **optical-fibre cables.**

What do we know about Optical Fibre?

- **About:**
  - Optical fibre is the **backbone of the digital infrastructure** — the data is transmitted by **light pulses travelling through long strands of thin fibre.**
  - **Metal wires** are preferred for transmission in optical fibre communication as **signals travel with fewer damages.**
    - The optical fibre works on the principle of **total internal reflection (TIR).**
  - **Light rays** can be used to transmit a huge amount of data (In case of long straight wire **without any bend).**
    - In case of a bend, the optical cables are designed such that **they bend all the light rays inwards (using TIR).**

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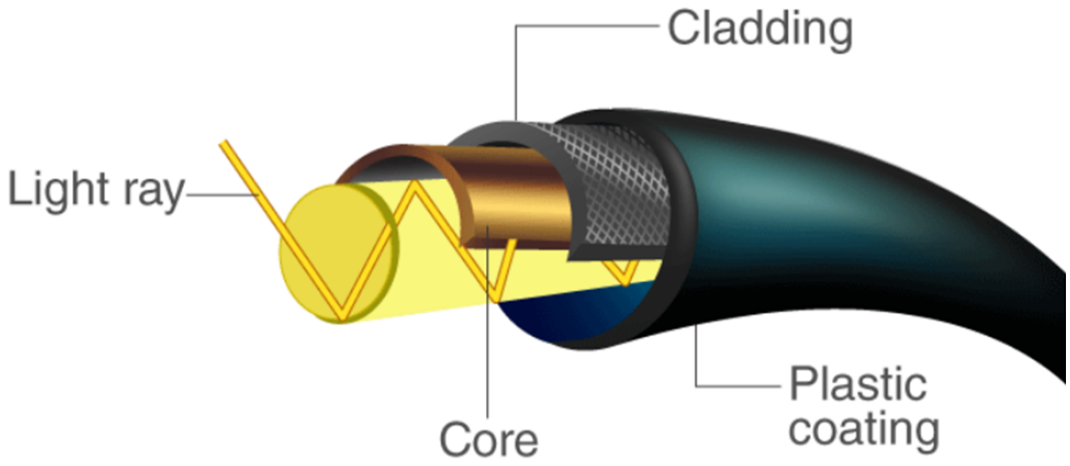

- **Benefits:**

- **High Speed:**
    - Fiber provides **more bandwidth** and has standardized performance up to 10 Gbps and beyond, something that it is **impossible to achieve when using copper.**
    - More bandwidth means that fiber can **carry more information with far greater efficiency** than copper wire.
- **Range of Transmission:**
    - Since data travels in the form of light in fiber-optic cables, **very little signal loss occurs during transmission** and data can move at higher speeds and greater distances.
- **Not susceptible to interference:**
    - Fiber-optic cable is also much **less susceptible to noise and electromagnetic interference than copper wire.**
    - It is so efficient, in fact, that **roughly 99.7% of the signal reaches the router in most cases.**
- **Durability:**
    - Fiber-optic cable is **completely immune to many environmental factors** that affect copper cable.
    - The core is made of **glass, which is an insulator, so no electric current can flow through.**

What do we mean by Fiberisation?

- **About:**
    - The process of **connecting radio towers with each other via optical fibre cables** is called fiberisation.
    - The backhaul is a component of the **larger transport that is responsible for carrying data across the network.**
        - It represents the part of the network that **connects the core of the network to the edge.**
    - It is necessary to **increase the density of mobile towers** to provide better coverage to consumers and businesses.
- **Challenges in Fiberisation:**
    - **Resources:**
        - To reach the targeted level of fiberisation, **India requires about Rs 2.2 lakh crore of investment to help fiberise 70% towers.**
            - About Rs 2.5 lakh crore will be needed to set up **15 lakh towers in the next four years.**
    - **Demand:**
        - Government programmes like **BharatNet** and **Smart Cities** adds to the demand of **fibre deployment**, necessitating a **complete tower fiberisation.**
        - India laid out the vision in 2020 to **connect every village in the country with optical fiber cable (OFC) in 1,000 days.**
            - To achieve that vision, cables must be laid at a **speed of 1,251 km a day**, around **3.6 times the current average speed of 350 km a day.**
    - **Right to Way (RoW) Rules:**
        - **The Indian Telegraph RoW Rules 2016** were gazette notified by the **Department of Telecommunications (DoT),** Govt. of India in 2016.
            - The rules aim to incorporate nominal **one-time compensation and uniform procedure** for establishment of **Overground Telegraph Line (OTL)** anywhere in the country.
                - While all States/UTs are required to implement these rules, **they are not in complete alignment** and still require certain amendments to align.
                - Several districts and local bodies **have not agreed to the RoW policies** as notified in those respective States and are following **their own bylaws** overriding the State RoW policies aligned with the RoW rules, 2016.

What is India’s Status in Fiberisation?

- To transition into 5G, India needs at least **16 times more fibre, according to estimates by STL**, a technology company specialised in optical fibers and cables.
- India at present connects **only 30% of India's telecom towers.**
    - India **exported optical fibre worth USD138 million to over 132 countries** between April 2020 and November 2021.
    - Indian optical fibre cable consumption is **predicted to increase to 33 million fibre km by 2026 from 17 million fibre km in 2021.**
    - A little more than 30% of mobile towers have fibre connectivity; **this needs to be scaled up to at least 80%.**
- The **fibre kilometer (fkm)** per capita in India is **lower than other key markets.**
    - Ideally, a country needs **1.3 km of fibre per capita to ensure good fiberisation.**
        - India's fkm is just **0.09 compared to 1.35 in Japan, 1.34 in the U.S. and 1.3 in China.**
- These tower sites which are connected via fibre are called **fibre point of presence (POP).**
    - Currently these fibre POPs at a tower site can handle **data at one to five Gbps speed.**

How can Satellite Communication assist in 5G Deployment?

- As **Processing power needs to be distributed from centralised data centres to edge servers closer to users**, Satellite communication can provide **high-capacity backhaul connectivity** to large numbers of edge servers over wide areas.
- It can facilitate 5G broadband connectivity to **underserved areas where it is not feasible to deploy terrestrial infrastructure like remote villages, islands or mountainous regions.**
- **Satellite-based networks** are the **only means for delivering 5G broadband to users on board moving vessels,** including cars, ships, airplanes and high-speed trains.
    - Space-based broadcast capabilities support **over-the-air software updates** for connected cars anywhere in the world.

Way Forward

- **Production-Linked Incentive:**
    - In order to **boost domestic manufacturing of optical fibre**, the government should consider introducing a **PLI** scheme that aims to give companies **incentives on incremental sales** from optical fibre manufactured in domestic units.
- **Right to Way (RoW) Rules:**
    - **GatiShakti Sanchar online portal** can enable centralisation of RoW approvals for telecom infrastructure projects, including 5G and help operators to deploy required infrastructure for the upcoming 5G rollout in a timely manner.
    - Recently, DoT revised the RoW rules, making it easier to install aerial optical fibre cable in the country.
        - This can enable infrastructure providers to deploy cables overhead via street light poles and traffic light posts.
- There is also a need to increase data capacity in the fiberised towers.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Q. The emergence of the Fourth Industrial Revolution (Digital Revolution) has initiated e-Governance as an integral part of government. Discuss. **(2020)**

Source: TH