OPTICAL FIBER FOR COMMUNICATION SYSTEM

★ The most important application of optical fibers occurs in the field of communication.

★ In this system, a transmitter converts electrical signals to light signals. An optical fiber transmits the signals and a Receiver captures the signals at the other end of the fibers and converts them to electrical signals as the original voice.

★ This method allows for high-bandwidth, long-distance, and secure data transmission, making it a cornerstone of modern communication networks.

★ Main Components/Units:

★ Optical fibers communication system is very much similar to a traditional communication system and has 3 major components or sections or units. They are

1. Transmitter
2. Optical fibers
3. ReceiveInformation Signal Source

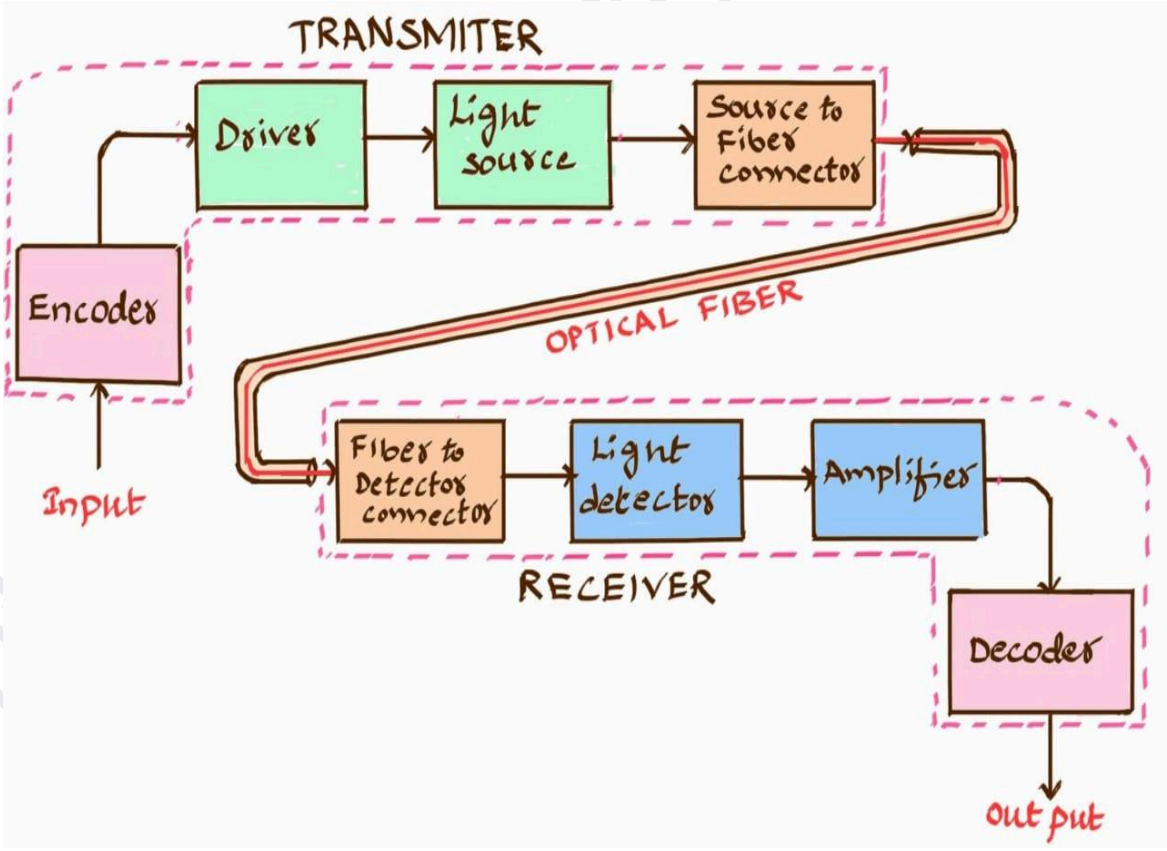

Fig: Block diagram of optical fiber communication system

1. Transmitter Section

★ **Input:**

★ This is where the original information (e.g., audio, video, data) enters the system as an electrical signal.

★ **Encoder:**

★ The encoder takes the input electrical signal and converts it into a digital format suitable for transmission over optical fiber.

★ This often involves processes like analog-to-digital conversion, modulation, and error coding to improve signal quality and reliability.

★ **Driver:**

★ The driver circuit amplifies and conditions the encoded electrical signal to suitable levels for controlling the light source. It ensures the light source operates correctly and efficiently.

★ **Light Source:**

★ This is the heart of the transmitter which converts the electrical signal from the driver into an optical signal (light pulses). Common light sources include Laser Diodes (LDs) or Light Emitting Diodes (LEDs).

★ The intensity or presence of light pulses represents the digital 1's and 0's.

★ **Source to Fiber Connector:**

★ This component precisely aligns the light source with the optical fiber, ensuring that the maximum amount of light is coupled into the fiber with minimal loss.

2. Optical Fiber

★ The optical fiber is used as a transmission medium between the transmitter and the receiver.

★ It has cylindrical shape consisting of 3- layers: core, cladding and outer jacket.

★ This is the physical medium through which the light signals travel. It's a very thin strand of glass or plastic designed to guide light over long distances using the principle of total internal reflection.

★ The light pulses/signals representing the data or voice transmitting a long distance and reach the receiver.

3. Receiver Section

★ **Fiber to Detector Connector:**

★ Similar to the source-to-fiber connector, this component precisely aligns the optical fiber with the light detector, ensuring efficient coupling of the received light into the detector.

★ **Light Detector:**

★ This component performs the reverse function of the light source. It converts the incoming optical signal (light pulses) back into an electrical signal.

★ Common light detectors include photodiodes (e.g., PIN photodiodes, APDs).

★ The intensity of the light determines the amplitude of the electrical current generated.

★ **Amplifier:**

★ The electrical signal produced by the light detector is usually very weak, especially after traveling long distances.

★ The amplifier boosts the strength of this electrical signal to a usable level, making it easier for the subsequent stages to process.

★ **Decoder:**

★ The decoder takes the amplified electrical signal and reverses the encoding process performed at the transmitter.

★ It reconstructs the original digital data from the electrical signal, including tasks like demodulation and error correction.

★ **Output:**

★ This is the final reconstructed electrical signal, which represents the original information that was fed into the system at the input.