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# OPTICAL FIBRECOMMUNICATION SYSTEM

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**KEYWORDS:** Pulse Code Modulation, TDM, WDM, Attenuation.

## ABSTRACT
The study takes a pedagogical stance in demonstrating how results from theoretical Electrical Engineering may be applied to yield significant insight into the behavior of the devices Electrical Engineering practice seeks to put in place, and that this is immediately attainable with the present state of the art. The focus for this detailed study is provided by the type of solid state signaling and various communication systems currently being deployed throughout mainline railways. Safety and system reliability concerns dominate in this domain. With such motivation, two issues are tackled: the special problem of software quality assurance in these data-driven control systems, and the broader problem of design dependability. In the former case, the analysis is directed towards proving safety properties of the geographic data which encode the control logic for the railway interlocking; the latter examines the fidelity of the communication protocols upon which the distributed control system depends.

## INTRODUCTION
In the old optical communication system, the bit rate distance product is only about 1 (bit/s)-km due to enormous transmission loss (105 to 107 dB/km). The information carrying capacity of telegraphy is about hundred times lesser than a telephony. Even though the high-speed coaxial systems were evaluated during 1975, they had smaller repeater spacing. Microwaves are used in modern communication systems with the increased bit rate distance product.

However, a coherent optical carrier like laser will have more information carrying capacity. So the communication engineers were interested in optical communication using lasers in an effective manner from 1960 onwards. Through optical fibers, light could be transmitted by the phenomenon of total internal reflection. During 1950s, the optical fibers with large diameters of about 1 or 2 millimeter were used in endoscopes to see the inner parts of the human body.

Optical fibers can provide a much more reliable and versatile optical channel than the atmosphere. The fibers produced an enormous loss of 1000 dB/km. But in the atmosphere, there is a loss of few dB/km. These high losses were a result of impurities in the fiber material. Using a pure silica fiber these losses were reduced to 20 dB/km in 1970 by Kapron, Keck and Maurer. At this attenuation loss, repeater spacing for optical fiber links become comparable to those of copper cable systems. Thus the optical fiber communication system became an engineering reality.

Optical fibres have to be joined together to make longer lengths of fiber or existing fiber lengths which have been broken have to be repaired. Also the ends of the fiber have to be fitted with convenient connectors (terminations) to allow them to be easily plugged into equipment such as power meters, data transmitters, etc. Unlike electrical cables where all that is needed is to solder lengths of cable together, the process of joining two fibers (splicing) or terminating the end of a fibre is more complex and requires special equipment

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## METHOLODOLOGY

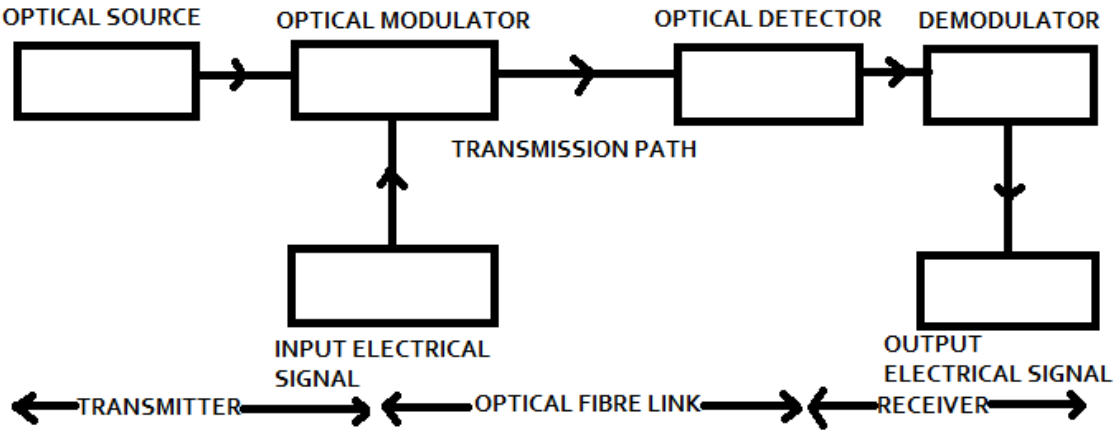


***Fig:- Analog Optical Fibre Communication System***

The input electrical signal modulates the intensity of light from the optical source. The optical carrier can be modulated internally or externally using an electro-optic modulator (or) acousto-optic modulator. Nowadays electro-optic modulators (KDP, LiNbO3 or beta barium borate) are widely used as external modulators which modulate the light by changing its refractive index through the given input electrical signal.

In the digital optical fiber communication system, the input electrical signal is in the form of coded digital pulses from the encoder and these electric pulses modulate the intensity of the light from the laser diode or LED and convert them into optical pulses. In the receiver stage, the photo detector like avalanche photodiode (APD) or positive-intrinsic negative (PIN) diode converts the optical pulses into electrical pulses. A decoder converts the electrical pulses into the original electric signal.

## PROCEDURE

Two basic light sources are used for fiber optics: laser diodes (LD) and light-emitting diodes (LED). Fiber optic sources must operate in the low-loss transmission windows of glass fiber. LEDs are typically used at the 850-nm and 1310-nm transmission wavelengths, whereas lasers are primarily used at 1310 nm and 1550 nm.LEDs are typically used in lower-data-rate, shorter-distance multimode systems because of their inherent bandwidth limitations and lower output power. They are used in applications in which data rates are in the hundreds of megahertz as opposed to GHz data rates associated with lasers. Two basic structures for LEDs are used in fiber optic systems: surface-emitting and edge emitting.

Laser diodes (LD) are used in applications in which longer distances and higher data rates are required. Because an LD has a much higher output power than an LED, it is capable of transmitting information over longer distances.

The fiber optic detector converts light emanating from the optical fiber back into an electrical signal. The choice of a fiber optic detector depends on several factors including wavelength, responsively, and speed or rise time. Figure 8-30 depicts the various types of detectors and their spectral responses.

The process by which light is converted into an electrical signal is the opposite of the process that produces the light. Light striking the detector generates a small electrical current that is amplified by an external circuit. Absorbed photons excite electrons from the valence band to the conduction band, resulting in the creation of an electron-hole pair. Under the influence of a bias voltage these carriers move through the material and induce a current in the external circuit. For each electron-hole pair created, the result is an electron flowing in the circuit. The most commonly used photo detectors are the PIN and avalanche photodiodes (APD). The material composition of the device determines the wavelength sensitivity.

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Splicing is the process of joining the two bare ends of two fibers together. The ends of the fiber must be precisely lined up with each other, otherwise the light will not be able to pass from one fiber across the gap to the other fiber. There are four main alignment errors and any splicing technique is designed to deal with ends of these errors.

## CONCLUSION

Indian Railways, as an organization is a very vast center of telecommunication in itself. Today the telecommunicating world is getting its roots, grabbing the new era more firmly. We think that our training was an success and we think that Indian Railways was an excellent training institute for inquisitive emerging engineers. In Indian Railways, training is given to engineering aspirant desiring to secure future in the dynamic world of Telecommunication.

The main achievements of the training at Indian Railways are that we got familiar with the latest technologies and principles of networking. The main achievement could be said to get knowledge about recent technologies of LAN. We got experience as to how to organize the things. After the completion of the training we consider ourselves capable of facing any other challenge of that type. The training at Indian Railways cultivated the zeal of inquisitiveness and the excitement to know more than more about this field in limited duration.

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