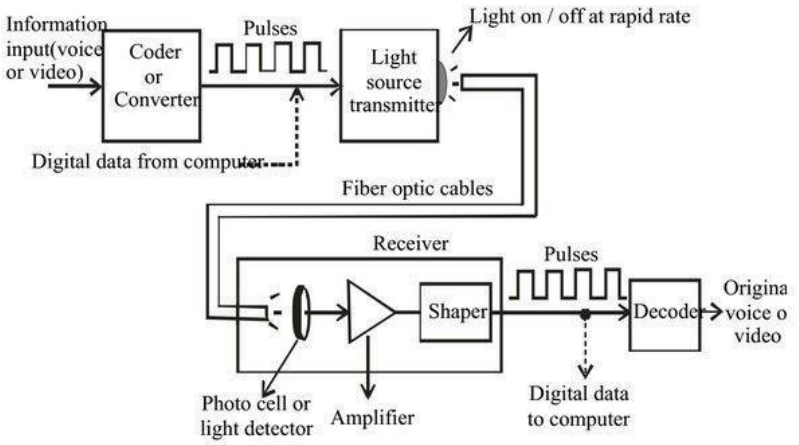
FIBRE OPTICAL COMMUNICATION SYSTEM



The information in the formofvoice or video to be transmitted will be inananalogelectricsignalformat. Thisanalog signalat first converted into digital electric (binary) signals in the form of electrical pulses using a Coder or converter and fed into the optical transmitter which converts digital electric signals into optic signals. An optical fibre can receive and transmit signals only in the form of optical pulses. The function of the light source is to work as an efficient transducer to convert the input electrical signals into suitable light pulses. An LEDor laser is used as the light source for this purpose. Laser is more efficient because of its monochromatic and coherent nature. Hence semiconductor lasers are used for their compact size and higher efficiency.

The electrical signal is fed to the semiconductor laser system, and gets modulated to generate an equivalent digital sequence of pulses, which turn the laser on and off. This forms a series of optical pulses representingtheinputinformation,which isc oupledin to the optical fibre cable at an incidence angle less than that ofacceptance cone half angle of the fibre.

Next the light pulses inside the fibre undergo total internal reflection and reach the other end of the cable. Good quality optical fibres with less attenuation to be chosen to receive good signals at the receiver end.

The final step in the communication system is to receive the optical signals at the end of the optical fibre and convert them into equivalent electrical signals. Semiconductor photodiodes are used as opticalreceivers.Atypicalopticalreceiver is madeofareverse biased junction, in whichthe received light pulses create electron-hole charge carriers. These carriers, in turn, create an electric field and induce a photocurrent in the external circuit in the form of electrical digital pulses. These digital pulses are amplified and re-gain their original form using suitable amplifier and shaper. The electrical digital pulses are further decoded into an analogues electrical signal and converted into the usable form like audio or video etc.,

As the signal propagates through the fibre it is subjected to two types of degradation. Namely attenuation and delay distortion. Attenuationisthereductioninthe strengthofthe signalbecausepower loss due to absorption and scattering of photons.Delay distortion is the reduction in the quality of the signal because of the spreading of pulses with time. These effects cause continuous degradation of the signalasthelightpropagatesandmayreachalimitingstagebeyond

which it may not be retrieve information fromthe light signal.At this stage repeater is needed in the transmission path.

Reciever	Amplifier	Transmitter

An optical repeater consists of a receiver and a transmitter arranged adjacently.The receiver section converts the optical signal into corresponding electrical signal. Further the electrical signal is amplified and recast in the original form and it is sent into an optical transmitter section where the electrical signal is again converted back to optical signal and then fed into an optical fibre.

Finally at the receiving endthe optical signal from thefibre is fed into a photo detector where the signal is converted to pulses of electric current which is then fed to decoder which converts the sequence of binary data stream into an analog signal which will be the same information which was there at the transmitting end.

Advantagesoverconventionalcommunication:

1) Large Bandwidth: Optical fibres have a wider bandwidth (when compared to conventional copper cables). This helps in transmitting voice, video and data on a single line and at very fast rates (10^{14} bps as compared to about 10^4 bps in ordinary communication line)
2) Electromagnetic Interference (EMI): EMI and disturbance in the transmission is a very common phenomenon in ordinary copper cables. However, the optical fibre cables are free fromEMI, since Electromagnetic radiation has no effect on the optical wave. Hence, there is no need to provide specially shielded conditionsfor the optical fibre.
3) Low attenuation: Compared to metallic cables, optical fibres have a low attenuation level (as they are relatively independent of frequency).Thelossinopticalfibresisverylow,of theorderof 0.1to0.5dB/kmoftransmission.

4) Electrical Hazards: Since, optical fibres carry only the light signals, there are no problems of short-circuiting and shock hazards.
5) Security:Unlike electrical transmission lines, there is no signal radiationaroundtheoptical fibre,hencethetransmissionissecure. The tapping of the light waves, if done, leads to a loss of signal and can be easily detected.
6) Optical fibre cablesare small in size, light weight and have a long life.

Disadvantages:

- Fibrelossismoreatthejointsifthejointsdonotmatch(the joining of the two ends of the separate fibres are called splicing)

Attenuationlossis largeasthelengthofthefibreincreases

- Repeatersare required at regular intervaloflengthsto amplifythe weak signal in long distance communication.
- Severbendswillincreasethelossof thefibre.Hence,thefibre should be laid straight as far as possible and avoid severe bends.

Note:

- Point to Point haul communication system is employed in telephone trunk lines. This system of communication covers the distances 10 km and more. Long-haul communication has been employed in telephone connection in the large cities of New York andLosAngeles.Theuseofsingle modeoptical fibreshasreduced the cost of installation of telephone lines and maintenance, and increased the data rate.
- Local Area Network (LAN) Communication system uses optical fibres to link the computer-oriented communication within a range of 1 or 2 km.
- Community Antenna Television (CATV) makes use of optical fibres for distribution of signal to the local users by receiving a multichannel signal from a common antenna.