SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

OPTICAL AND MICROWAVE ENGINEERING

III YEAR/ VI SEMESTER

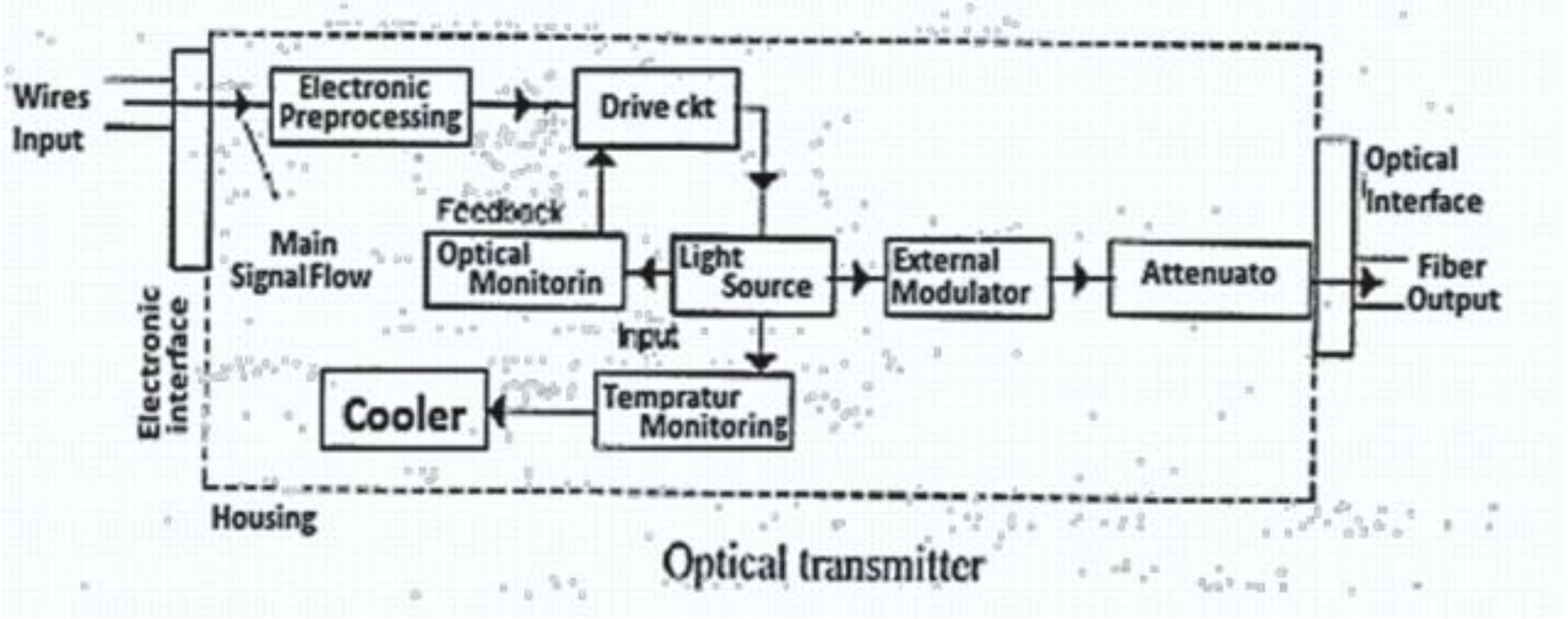
UNIT 5 – OPTICAL NETWORKS

TOPIC – OPTICAL TRANSMITTERS AND RECEIVERS

OPTICAL TRANSMISSION SYSTEMS

Optical transmitter is a device that generates the signal sent through optical fibers.

The basic elements of optical fiber transmitter are shown in Figure below :



The basic elements of optical fiber transmitter:

- *Electronic Interface:*

  There is wires standard electronic connection or pins energizing the transmitter. They provide power Electronic I/P and O/P Optical signals.

- *Electronic Processing*

  In some transmitters the I/P Electrical signals are electronically processed to put them into of suitable from to drive the light source.

- *Drive CKT*

  This depends on application, requirements, data format and the light source.

- *Optical Monitor*

  It Monitors the O/P of the LASER and provides feedback to the drive CKT so that the O/P power remains stable.

- *Temperature Monitor*

  The characteristic of semi-conductor LASER changes in temperature. The lifetime of LASER decreases with increase in operating temp and the O/P power also decrease which produce some change in O/P wavelength of the light, to keep the operating temp stable the Thermo-electric coolers are used in optical fiber transmitters these coolers control the temp of LASER.

Optical Modulator

The following modulators commonly are used in optical transmitters:

- The electroabsorption modulator (EAM), which is small and can be driven with a reasonably small voltage swing. Electrically, it is a reverse-biased p-n junction.

- The Mach-Zehnder modulator (MZM), which generates the highest-quality optical pulses with a controlled amount of chirp and a high extinction ratio. Electrically, it is a (terminated) transmission line.

- The maximum transmission distance that can be achieved in an optical communication system is determined by a combination of the chromatic dispersion limit, the polarization-mode dispersion (PMD) limit, and the attenuation limit.

System Architecture

From architecture point of view fiber optic communication can be classified into three major categories.

1. Point – to – point links
2. Distributed networks
3. Local area networks.

Point-to-Point Links

- A point-to-point link comprises of one transmitter and a receiver system. This is the simplest form of optical communication link and it sets the basis for examining complex optical communication links.
- For analyzing the performance of any link following important aspects are to be considered.
  a) Distance of transmission
  b) Channel data rate
  c) Bit-error rate
- All above parameters of transmission link are associated with the characteristics of various devices employed in the link.

- When the link length extends between 20 to 100 km, losses associated with fiber cable increases.
- In order to compensate the losses optical amplifier and regenerators are used over the span of fiber cable.
- A regenerator is a receiver and transmitter pair which detects incoming optical signal, recovers the bit stream electrically and again convert back into optical from by modulating an optical source.
- An optical amplifier amplify the optical bit stream without converting it into electrical form.
- The spacing between two repeater or optical amplifier is called as repeater spacing (L).
- The repeater spacing L depends on bit rate B. The bit rate-distance product (BL) is a measure of system performance for point-to-point links.

ASSESSMENT TIME

1. Coherent radiation is relatively _____
   a) Parabolic
   b) Elliptic
   c) Directional
   d) Rectangular

Answer: c

Explanation: Most of the light output is coupled into optical fibre. This is because of the isotropic distribution of narrow-line width, coherent radiation is directional.

2. The finite spectral width of the optical source causes _____
   a) Depletion
   b) Frequency burst
   c) Pulse broadening
   d) Efficient reflection

Answer: c

Explanation: The finite spectral width causes pulse broadening due to material dispersion on an optical fiber communication link. This results in a limitation on the bandwidth-length product.

THANK YOU