SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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Grade Approved by AICTE, New Delhi & Affiliated to Anna University,
Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

OPTICAL AND MICROWAVE ENGINEERING

III YEAR/ VI SEMESTER

1

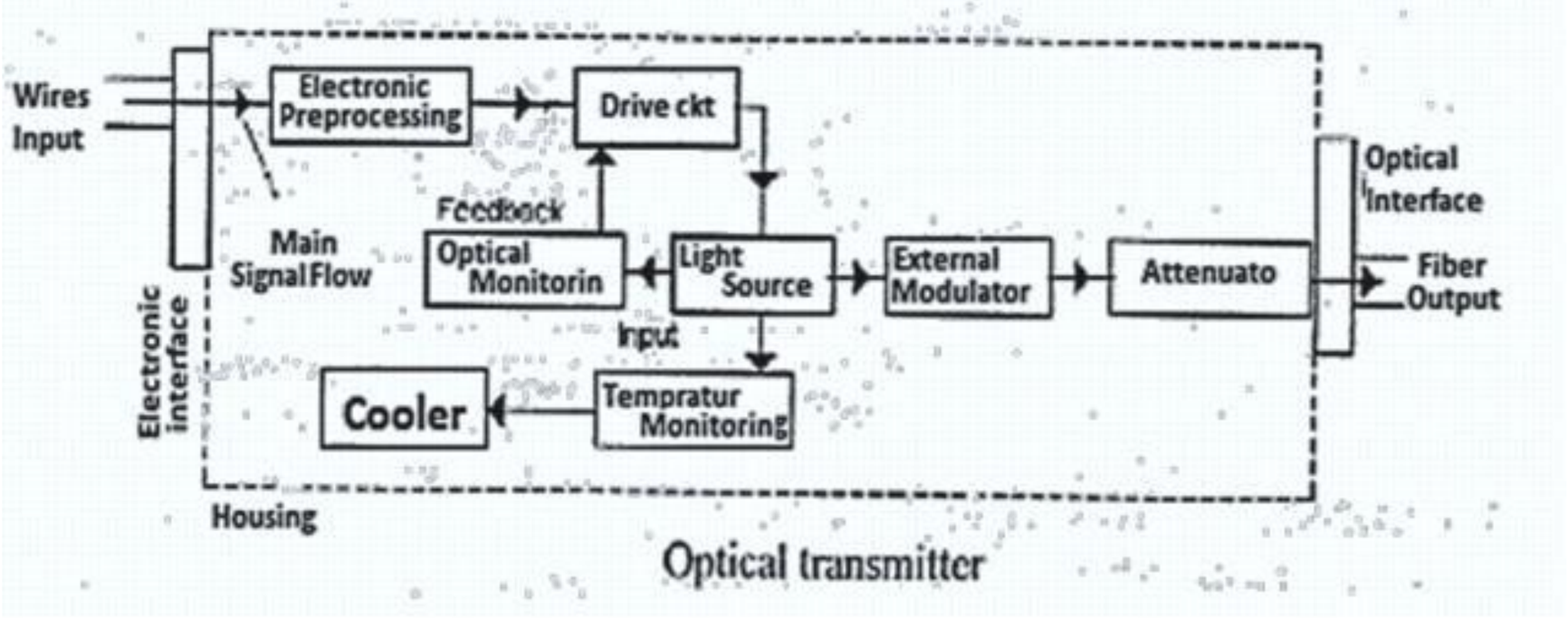
UNIT 5 – OPTICAL NETWORKS

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 :



Optical transmitter

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