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 – POINT TO POINT LINK

POINT TO POINT LINK

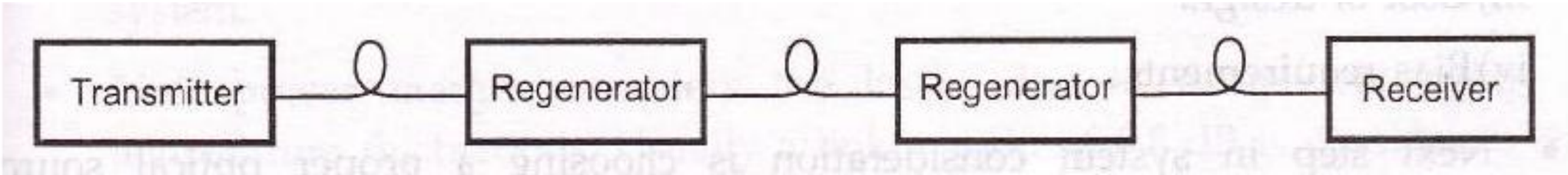
A point-to-point link comprises of one transmitter and a receiver system. This is the simplest form of optical communication link and it sets the basis for examining complex optical communication links.

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

POINT TO POINT LINK

All above parameters of transmission link are associated with the characteristics of various devices employed in the link. Important components and their characteristics are listed below.



POINT TO POINT 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.

PERFORMANCE

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Two important analysis for deciding performance of any fiber link are –
i) Link power budget / Power budget
ii) Rise time budget / Bandwidth budget

LINK POWER BUDGET

- The Link power budget analysis is used to determine whether the receiver has sufficient power to achieve the desired signal quality.
- The power at receiver is the transmitted power minus link losses.
- The components in the link must be switched fast enough and the fiber dispersion must be low enough to meet the bandwidth requirements of the application. Adequate bandwidth for a system can be assured by developing a rise time budget.

SYSTEM CONSIDERATONS

- Before selecting suitable components, the operating wavelength for the system is decided. The operating wavelength selection depends on the distance and attenuation. For shorter distance, the 800-900 nm region is preferred but for longer distance 100 or 1550 nm region is preferred due to lower attenuations and dispersion.
- The next step is selection of photodetector. While selecting a photodetector following factors are considered

i) Minimum optical power that must fall on photodetector to satisfy BER at specified data rate.
ii) Complexity of circuit.
iii) Cost of design.
iv) Bias requirements.

SYSTEM CONSIDERATONS

Next step in system consideration is choosing a proper optical source, important factors to consider are –

i) Signal dispersion.
ii) Data rate.
iii) Transmission distance.
iv) Cost.
v) Optical power coupling.
vi) Circuit complexity.

SYSTEM CONSIDERATONS

The last factor in system consideration is to selection of optical fiber between single mode and multimode fiber with step or graded index fiber. Fiber selection depends on type of optical source and tolerable dispersion. Some important factors for selection of fiber are :

i) Numerical Aperture (NA), as NA increases, the fiber coupled power increases also the dispersion.

ii) Attenuation characteristics.

iii) Environmental induced losses e.g. due to temperature variation, moisture and dust etc.

ASSESSMENT TIME

1. For linear as well as in nonlinear mode _____ are most important network elements.
   a) Optical amplifier
   b) Optical detector
   c) A/D converter
   d) D/A converters

Answer: a

Explanation: In single-mode fiber system, signal dispersion is very small, hence there is attenuation. These systems don’t require signal regeneration as optical amplification is sufficient so optical amplifier are most important.

THANK YOU