Unit-1

Lecture -2

Bit Rates, Design Consideration, Power Penalties, Power Budget

Typical bit rates at different wavelengths

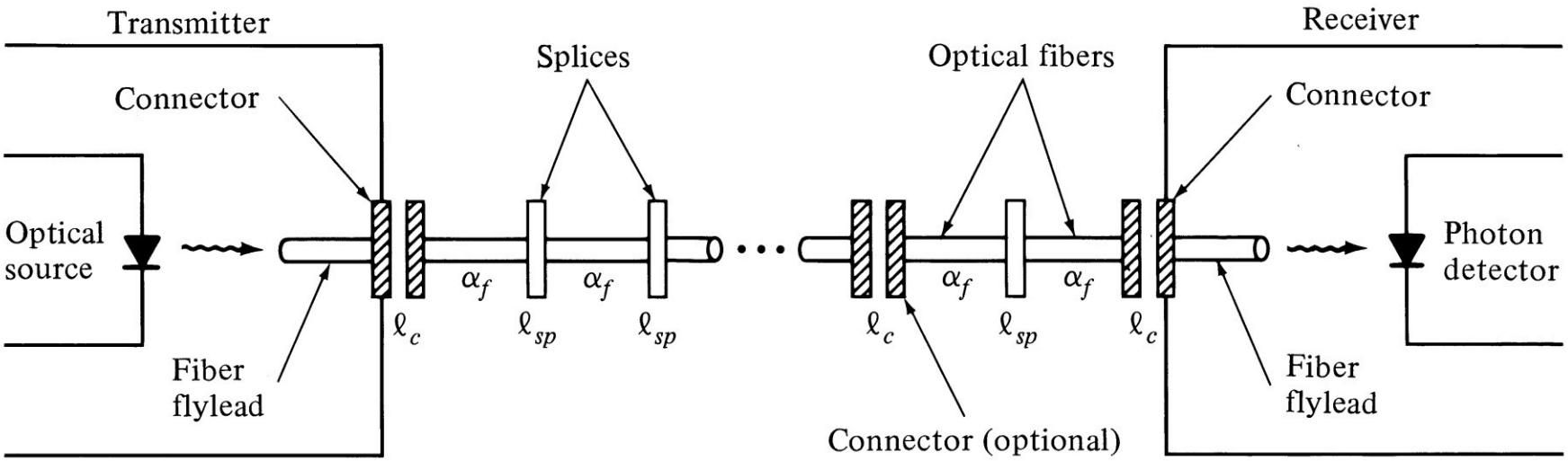
Wavelength	**LED** Systems	**LASER** Systems.
800-900 nm (Typically Multimode Fiber)	150 Mb/s.km	2500 Mb/s.km
1300 nm (Lowest dispersion)	1500 Mb/s.km	25 Gb/s.km (InGaAsP Laser)
1550 nm (Lowest Attenuation)	1200 Mb/s.km	Up to 500 Gb/s.km (Best demo)

Design Considerations

- Link Power Budget
  - There is enough power margin in the system to meet the given BER
- Rise Time Budget
  - Each element of the link is fast enough to meet the given bit rate

These two budgets give necessary conditions for satisfactory operation

Optical power-loss model



$$P_T = P_s - P_R = ml_c + nl_{sp} + \alpha_f L + \text{System Margin}$$

P_T: Total loss; P_s : Source power; P_R: Rx sensitivity

m connectors; n splices

Try Ex: 8.1

Power Budget Example

- Specify a 20-Mb/s data rate and a BER = 10^{-9}.
- With a Si *pin* photodiode at 850 nm, the required receiver input signal is –42 dBm.
- Select a GaAlAs LED that couples 50 mW into a 50-µm core diameter fiber flylead.
- Assume a 1-dB loss occurs at each cable interface and a 6-dB system margin.
- The possible transmission distance L = 6 km can be found from

$$P_T = P_S - P_R = 29\ dB = 2l_c + \alpha L + \text{system margin} = 2(1\ \text{dB}) + \alpha\text{L} + 6\ \text{dB}$$

- The link power budget can be represented graphically (see the right-hand figure).