SOMAIYA
VIDYAVIHAR UNIVERSITY
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Module 2 Unit 3

OPTICAL FIBRES – NUMERICAL PROBLEMS

1. The acceptance angle of an optical fibre is 25°. Calculate refractive index of cladding if refractive index of core is 1.52.
2. A fibre has acceptance angle of 25° and internal critical angle of 70°. Determine core and cladding refractive index and fractional refractive index.
3. The core and cladding refractive index for a step index optical fibre are 1.46 and 1.42 respectively and its core radius is 0.05 mm. Find the normalized frequency and number of allowed modes if it is operated at 1.3 μm.
4. What is the limiting radius for an optical fibre to serve as single mode at 850 nm having numerical aperture of 0.025?
5. The input power of a 2 mW laser decreases to 20 μW after traversing a 50 km long optical fibre. Determine attenuation coefficient of the fibre.
6. Calculate length of an optical fibre having loss factor of 0.2 dB/km if input power decreases by 90% on traversing this fibre.
7. Refractive index of core of a step index fibre is 1.46 and fractional refractive index is 0.015. How much is the intermodal dispersion if length of this fibre is 1500 m?
8. A 5 km long step index fibre with fractional refractive index of 0.01 offers intermodal dispersion of 250 μs/km. Calculate the acceptance angle and critical angle for total internal reflection for this fibre.
9. A 10 km long optical fibre link with a loss of 0.2 dB/km is fed with signal from a 5 mW laser source. Calculate the power received at the output. If this fibre has two connectors in its path each with a loss factor of 1 dB, calculate the percentage decrease in power output as compared to earlier case.
10. Consider a graded index multimode optical fibre having cladding refractive index of 1.42 and fractional refractive index of 0.025. Calculate the maximum bit rate for optical data transmission from this fibre of length 2 km. Assume material dispersion offered by fibre in be 1.7 ns/km.

Homework:

1. The internal critical angle for an optical fibre is 82°. Calculate its acceptance angle if core RI is 1.44.
2. A fibre has core RI 1.5. Find its cladding RI if it is immersed in water giving acceptance angle of 8°. RI of water is 1.33.
3. Light output from a 20 km long optical fibre having attenuation coefficient of 0.25 dB/km is 25 μW. What would be the input power?
4. A 5 km long step index fibre with fractional RI of 0.01 offers intermodal dispersion of 250 μs/km. Calculate the acceptance angle and critical angle for total internal reflection for this fibre.
5. The data speed measured over a 1 km long graded index fibre is 100 MBPS. Material dispersion due to the fibre is 1.5 ns/km. Determine the acceptance angle need to be maintained by a source if fractional RI of this fibre is 0.052.

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