Module 2 Unit 3

OPTICAL FIBRES – NUMERICAL PROBLEMS

1. Find critical angle and acceptance angle for an optical fibre having core RI 1.5 and cladding 1.48.
2. The acceptance angle of an optical fibre is 25°. Calculate RI of cladding if RI of core is 1.52.
3. For an optical fibre, fractional RI is 0.0025 and core RI is 1.45. Determine its NA and acceptance angle.
4. A fibre has acceptance angle of 25° and internal critical angle of 70°. Determine core and cladding RI.
5. The core and cladding RI for a SI optical fire are 1.46 and 1.42 respectively. Find the normalized frequency and number of allowed modes if it is operated at 1.3 μm. The core radius is 0.05 mm.
6. Determine number of allowed modes for a GRIN optical fibre having core radius 0.15 mm, which is operated at 1550 nm and 850 nm. Its internal critical angle is 80° and RI of core is 1.48.
7. What is the limiting radius for an optical fibre to serve as single mode at 8500 Å with numerical aperture of 0.025?
8. An optical fibre has core radius of 5 μm Will it act as a single mode fibre at 850 nm? Its core and cladding RI are 1.4 and 1.399 respectively.
9. 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.
10. Calculate length of an optical fibre having loss factor of 0.2 dB/km if input power decreases by 90% on traversing this fibre.
11. RI of core of a step index fibre is 1.46 and fractional RI is 0.015. How much is the intermodal dispersion if length of this fibre is 1500 m? Express it in ns/km.
12. For a multimode graded-index fibre, RI of core is 1.5 and fractional RI is 0.01. What would be the intermodal dispersion in ns/km?
13. 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.
14. Consider a step index multimode optical fibre having core and cladding RI of 1.46 and 1.42 respectively. Calculate the maximum bit rate for optical data transmission from this fibre of length 2 km. What would be the bit rate if this fibre were graded index? Assume material dispersion offered by fibre in both cases be 1.7 ns/km.

Homework:

15. The internal critical angle for an optical fibre is 82°. Calculate its acceptance angle if core RI is 1.44.
16. 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.
17. A graded index optical fibre supports 1325 modes at an operating wavelength of 1.3 μm. Determine its core radius if the numerical aperture is 0.3.
18. 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.
19. 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?
20. 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.
