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| **Q.**  **No.** | **Question Description** |
|  | Define the relative refractive index difference for an optical fiber and show how it may be related to the numerical aperture. A step index fiber with a large core diameter compared with the wavelength of the transmitted light has an acceptance angle in air of 22° and a relative refractive index difference of 3%. Estimate the numerical aperture and the critical angle at the core–cladding interface for the fiber. |
|  | The velocity of light in the core of a step index fiber is 2.01 × 108 m s−1, and the critical angle at the core–cladding interface is 80°. Determine the numerical aperture and the acceptance angle for the fiber in air, assuming it has a core diameter suitable for consideration by ray analysis. The velocity of light in a vacuum is 2.998 × 108m s−1 |
|  | Using simple ray theory, describe the mechanism for the transmission of light within an optical fiber. Briefly discuss with the aid of a suitable diagram what is meant by the acceptance angle for an optical fiber. Show how this is related to the fiber numerical aperture and the refractive indices for the fiber core and cladding. An optical fiber has a numerical aperture of 0.20 and a cladding refractive index of 1.59. Determine: (a) the acceptance angle for the fiber in water which has a refractive index of 1.33; (b) the critical angle at the core–cladding interface. Comment on any assumptions made about the fiber. |
|  | A 15 km optical fiber link uses fiber with a loss of 1.5 dB km−1. The fiber is spliced every kilometer with connectors which give an attenuation of 0.8 dB each. Determine the minimum mean optical power which must be launched into the fiber in order to maintain a mean optical power level of 0.3 μW at the detector. |
|  | A multimode step index fiber has a relative refractive index difference of 1% and a core refractive index of 1.46. The maximum optical bandwidth that may be obtained with a particular source on a 4.5 km link is 3.1 MHz. (a) Determine the rms pulse broadening per kilometer resulting from chromatic dispersion mechanisms. (b) Assuming waveguide dispersion may be ignored, estimate the rms spectral width of the source used, if the material dispersion parameter for the fiber at the operating wavelength is 90 ps nm−1 km−1. |

**Practice Questions**