MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : PEROB802C Fiber Optic Communication
UPID : 008396

Time Allotted : 3 Hours   *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer *any ten* of the following :   [1 x 10 = 10]

   (I)   An optical fiber is made up of _____ material.

   (II)   A technique used for determining the total fiber attenuation per unit length is known as _____ method.

   (III)   Multimode step index fiber has _____
           (a) large core diameter & large numerical aperture
           (b) large core diameter & small numerical aperture
           (c) small core diameter & large numerical aperture
           (d) small core diameter & small numerical aperture

   (IV)   The threshold for indirect absorption occurs at wavelength of _____.

   (V)   Light incident on fibers of angles _____ the acceptance angle does not propagate into the fiber.

   (VI)   In fiber optic communication, _____ acts as a transmission medium.

   (VII)   An optical fiber behaves as a birefringence medium due to differences in _____.

   (VIII) The bandwidth in fiber optical communication is represented in terms of _____.

   (IX)   _____ takes a snapshot of the fiber in a fiber optic cable plant.

   (X)   What is the limitation of Brillouin fiber amplifier?

   (XI)   What is difference between cross-phase modulation and self-phase modulation?

   (XII)   Multimode graded-index glass fiber optic cables are tested with sources at _____ and _____ wavelengths.

Group-B (Short Answer Type Question)

Answer *any three* of the following :   [5 x 3 = 15]

2. Briefly explain the block diagram of fiber optic communication system.   [5]

3. State Snell's law. What do you understand by total internal reflection?   [5]

4. Give any two applications of optical fibers in the industry.   [5]

5. Deduce Einstein's relation.   [5]

6. Explain the concept of Raman amplifier.   [5]

Group-C (Long Answer Type Question)

Answer *any three* of the following :   [15 x 3 = 45]

7. (a) With the aid of a suitable diagram, explain the acceptance angle for an optical fiber.   [4]

    (b) Define numerical aperture of a step index fiber. Obtain an expression for it.   [5]

    (c) A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has   [6]
         a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine
         (i) the critical angle at the core–cladding interface
         (ii) the numerical aperture for the fiber
         (iii) the acceptance angle in air for the fiber.

8. (a) List out the factors which cause losses in optical fibers.   [5]

    (b) Why is LASER much preferred than LED as an optical source?   [5]

    (c) What is meant by splicing? Mention two types of splicing.   [5]

9. (a) Using appropriate diagram, discuss one melting method for the preparation of multicomponent   [5]
         glass.

    (b) Briefly describe the major reasons for the cabling of optical fibers which are to be placed in a field   [5]
         environment.

    (c) Explain the working principle of optical time domain reflectometer.   [5]

10. (a) Mention the criteria for choosing the photo detectors in optical communication. [5]

   (b) Define responsivity and quantum efficiency of a photo detector. Derive an expression for the [8]
responsivity of an intrinsic photodiode in terms of quantum efficiency and the wavelength of the
incident radiation.

   (c) What do you understand by power budget? [2]

11. (a) A planar LED is fabricated from GaAs which has a refractive index of 3.6. [7]
(i) Calculate the optical power emitted into air as a percentage of the internal optical power for the
device when the transmission factor at the crystal-air interface is 0.68.
(ii) When the optical power generated internally is 50% of the electric power supplied, determine
the external power efficiency.

   (b) What do you mean by external quantum efficiency of LASER? [5]

   (c) Demonstrate on direct and indirect bandgap materials in detail. [3]

*** END OF PAPER ***