Registration No. : | | | | | | | | | | |

Total number of printed pages – 2

B. Tech

PEEC 4302

Fifth Semester Regular Examination – 2014

FIBER OPTICS AND OPTOELECTRONICS DEVICES

BRANCH : MME

QUESTION CODE : H 222

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) What is material dispersion in an optical fiber ?

   (b) Write briefly the function of an isolator.

   (c) Draw the refractive index profile for a graded index optical fiber.

   (d) Discuss briefly propagation modes in single mode fibers.

   (e) Draw simple energy band diagram for a pin photodiode.

   (f) What is fiber splicing ?

   (g) How Fresnel reflection coefficient is related to the refractive index of the medium ?

   (h) Write briefly about a single mode fiber connector.

   (i) Define responsivity in a photodiode.

   (j) Briefly write the difference between a direct and indirect band gaps.

2. What are the advantages of optical fiber system over conventional copper system ? Mention the low loss windows in an optical fiber system. What is numerical aperture (NA) and derive NA for a step index fiber ? 10

3. Mention the difference between a step index and a graded index fiber. How modal dispersion is minimized in a graded index fiber ? Derive the wave equations for a step index fiber. 10

P.T.O.

4. (a) Define quantum efficiency. In a 100-ns pulse, 6×10^6 photons at a wavelength of 1300 nm fall on an InGaAs photodetector. On the average 3.9×10^6 electron-hole (e-h) pairs are generated. What is the quantum efficiency of the photodetector ? 5

(b) Explain with a neat sketch the double crucible method of fiber fabrication. 5

5. (a) The end faces of two optical fibers with core refractive indices of 1.50 are perfectly aligned and have a small gap between them. If this gap is filled with a gel having a refractive index of 1.30, find the optical loss in decibels at this joint. 5

(b) Discuss briefly about the refractive index profile for a dispersion shifted and dispersion flattened fiber. Discuss how dispersion can be minimized in both types of fiber. 5

6. (a) An LED with a circular emitting area of radius 20 μm has a lambertian emission pattern with a 100-W/(cm^2.sr) axial radiance at 100-mA drive current. How much optical power can be coupled into a step-index fiber having a 100-μm core diameter and NA = 0.22 ? 5

(b) Explain briefly the lensing schemes for coupling improvement. 5

7. (a) The numerical aperture of an optical fiber is 0.3. Calculate the acceptance angle for the meridional rays and also that for the skew rays which change direction by 90^0 at each reflection (assume the refractive index n_a of air is 1) 5

(b) What are the properties of materials required to be used as light sources ? 5

8. Answer any two of the following : 5×2

(a) Explain briefly about fiber beat length.

(b) Explain briefly different types of noise in a photodetector.

(c) Describe briefly population inversion for a three level system with energy level diagram.

(d) Describe briefly the function of a circulator.