Registration No. :

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B. Tech
PEEC 4302

Fifth Semester Examination – 2013
FIBER OPTICS AND OPTOELECTRONICS DEVICES
BRANCH : MM, MME
QUESTION CODE : C-364
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) Define mode field diameter.
   (b) Give an expression for a linearly polarized wave.
   (c) What is the necessity of cladding for an optical fiber ?
   (d) Define cutoff wavelength of the fiber.
   (e) What are scattering losses ?
   (f) Define direct band gap materials and indirect band gap materials.
   (g) Define population inversion.
   (h) Differentiate LEDs and Laser diodes.
   (i) Differentiate intermodal dispersion and intramodal dispersion.
   (j) Differentiate isolators and circulators.

2. (a) Briefly explain a step index fiber and a graded index fiber. Explain how in graded index fiber modal dispersion can be minimized. 5
   (b) A silica optical fiber has a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine the critical angle at the core-cladding interface, the Numerical Aperture of the fiber, the acceptance angle in air for the fiber. 5

3. (a) Explain briefly about link power budget analysis. 5
   (b) What is pulse broadening ? Derive the expression for the same in graded index waveguide. 5

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4. Briefly explain with suitable diagrams the following concepts in optical fiber transmission :
   (a) The evanescent field
   (b) Goos-Haenchen shift
   (c) Mode coupling

   Describe the effects of these phenomena on the propagation of light in optical fibers. 10

5. (a) Explain at what wavelength a dispersion shifted fiber usually operates. What is the difference between a dispersion shifted fiber and dispersion flattened fiber ? 5

   (b) Two polarization maintaining fibers operating at wavelength of 1.3 micrometer have beat lengths of 0.7 mm and 80 m. Determine the fiber birefringence in each case and comment on the results. 5

6. (a) Explain the function of a fiber connector. With a neat sketch explain a cylindrical ferrule connector. 5

   (b) Explain briefly a spontaneous emission and stimulated emission in an Erbium doped fiber amplifier. 5

7. (a) A graded index fiber has a parabolic refractive index profile ($\alpha = 2$) and a core diameter of 50 micrometer. Estimate the insertion loss due to a 3 micro meter lateral misalignment at a fiber joint when there is index matching and assuming there is uniform illumination of all guided and leaky modes. 5

   (b) An Avalanche photodiode has a quantum efficiency of 65% at a wavelength of 900 nanometer. If 0.5 microwatt of optical power produces a multiplied photo current of 10 micro ampere, find the multiplication M. 5

8. Answer any **two** of the following : 5×2
   (a) Explain vapor phase deposition techniques.
   (b) Write a brief note on Fiber bending losses.
   (c) What is meant by chirping ?
   (d) Different methods of fiber splicing.

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PEEC 4302   2   – C