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BIEL-017

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

00559

December, 2017

BIEL-017 : OPTICAL FIBER COMMUNICATION

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Assume missing data, if any. Use of scientific calculator is permitted.*

1. (a) Explain the advantages of Optical Fiber Communication Systems. 5

(b) A step index fiber has a solid acceptance angle in air of 0·115 radians and relative refractive index difference of 0·9%. Estimate the speed of light in the fiber core. 5

2. Draw the block diagram and explain the detection principle of coherent optical fiber systems. *10*

3. (a) Describe the following with the help of simple ray diagrams : *5*

   (i) Multimode step index fiber

   (ii) Single mode step index fiber

   (b) Compare the advantages and disadvantages of multimode and single mode step index fibers. *5*

4. Briefly explain the reasons for pulse broadening due to material dispersion in optical fibers. The group delay T_g in an optical fiber is given by

$$T_g = \frac{1}{C}\left(n_1 - \frac{\lambda_a n_1}{\delta \lambda}\right).$$ *10*

5. (a) Explain what is meant by the Critical Bending Radius of an optical fiber. *3*

   (b) A multimode graded index fiber has a refractive index at the core axis of 1·46 with a cladding refractive index of 1·45. The critical radius of curvature which allows large bending loss to occur is 84 μm. Determine the wavelength of transmitted light. *7*

6. (a) Describe the techniques used to give both electrical and optical confinement in a multimode injection laser. *5*

(b) What do you mean by Photoconductors and Phototransistors ? *5*

7. Derive an expression for the coupling efficiency of surface emitting LEDs into a step index fiber. Determine the optical loss in dB when we are coupling optical output into fiber with acceptance angle of 14°. *10*

8. Discuss the operation of silicon APD, describing how it differs from the p-i-n photodiode. Outline the advantages and disadvantages with the use of APD as a detector in optical fiber communication. *10*

9. When 10^{11} photons per second, each with an energy of $1{\cdot}28 \times 10^{-19}$ J, are incident on an ideal photodiode, calculate

(a) the wavelength of incident radiation,

(b) output photocurrent,

(c) output photocurrent if APD has a multiplication factor of 18. *10*

10. Write short notes on any ***two*** of the following : *2×5=10*

(a) Edge Emitter LED

(b) Mode Hopping

(c) Frequency Chirp