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BIEL-017

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

00896

Term-End Examination

June, 2015

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) An optical fiber in air has a Numerical Aperture (NA) of 0·4. Compare the acceptance angle for meridional rays with that for skew rays which changes direction by 100° at each reflection. *6*

(b) Describe the advantages of optical fiber communication. *4*

2. (a) What do you understand by the terms intramodal and intermodal dispersion for step and graded index fibers ? *4*

(b) A graded index fiber has a core with parabolic refractive index profile which has a diameter of 50 μm. The fiber has a numerical aperture of 0·2. Estimate the total number of guided modes propagating in the fiber when it is operating at a wavelength of 1 μm. *6*

3. (a) What are the various material absorption losses in optical fibers ? *5*

(b) Derive an expression for the elliptical and circular polarization. *5*

4. (a) Discuss linear and non-linear scattering losses in optical fiber. *6*

(b) Explain intermodal dispersion in multimode step index fiber. *4*

5. A typical single mode fiber has a zero-dispersion wavelength of 1·31 μm with a dispersion slope of 0·09 ps/nm^1-km. Compare the total first order dispersion for the fiber at the wavelengths of 1·28 μm and 1·55 μm. When the material dispersion and profile dispersion at the latter wavelength are 13·5 ps nm^{-1} km^{-1} and 0·4 ps nm^{-1} km^{-1} respectively, determine the waveguide dispersion at this wavelength. *10*

6. (a) Explain the non-linear effects in optical fibers. *5*

(b) What is Automatic Gain Control (AGC) equalization ? Why is it required ? *5*

7. (a) Briefly explain the reasons for pulse broadening due to material dispersion in optical fibers. 5

(b) With the aid of suitable diagrams, discuss the operating principle of the injection laser. 5

8. (a) Outline the common LED structures for optical fiber communications, discussing their relative merits and demerits. 6

(b) Explain the detection process in a p-n photodiode. 4

9. (a) Describe the basic detection process in a photoconductive detector. 5

(b) Describe the benefits of a waveguide phototransistor over the conventional p-i-n phototransistor. 5

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

(a) Modal noise in optical fibers

(b) Raman scattering in optical fibers

(c) Fiber birefringence