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BIEL-017

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

Term-End Examination

00634

June, 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) With the help of a neat diagram, explain the block diagram of an optical fiber communication system. 5

(b) Draw the electromagnetic spectrum and show the region in the spectrum used for an optical fiber communication system. 5

2. (a) Define the relative refractive index difference for an optical fiber and show how it may be related to the numerical aperture. *5*

(b) A step index fiber with a large core diameter compared with the wavelength of the transmitted light has an acceptance angle in air of 22° and relative index difference of 3%. Estimate the numerical aperture and the critical angle at the core cladding interface. *5*

3. Define normalized frequency for an optical fiber and explain its use in determination of the number of guided modes propagating within a step index fiber. *10*

4. Compare stimulated Brillouin and stimulated Raman scattering in optical fiber and indicate the way in which they can be avoided in optical fiber communication. *10*

5. Describe the mechanism of intermodal dispersion in a multimode step index fiber. Show that total broadening of a light pulse δT_s due to intermodal dispersion in a multimode step index fiber is given by

$$\delta T_s \cong \frac{L\,(NA)^2}{2n_1 C}.$$ *10*

6. (a) Discuss the mechanism of optical feedback to provide oscillation and hence amplification within the laser. Indicate how this provides a distinctive spectral output from device. *6*

(b) The longitudinal modes of a GaAs injection laser emitting at a wavelength of 0·87 μm are separated in frequency by 278 GHz. Determine the length of optical cavity. The refractive index of GaAs = 3·6 . *4*

7. (a) Comment on the differences in the performance characteristics between the conventional LEDs used for optical communication and superluminescent LEDs. *5*

(b) Outline the common LED for optical communication and compare Edge emitter and Surface emitter LEDs. *5*

8. Define the Noise Equivalent Power (NEP) for a photodetector. Obtain an expression for the NEP of a photodiode in which the dark current dominates. *10*

9. An APD has a quantum efficiency of 45% at 0·85 μm. When illuminated with radiation of this wavelength it produces an output photocurrent of 10 μA after avalanche gain with a multiplication factor of 250. Calculate the received optical power to the device. *10*

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

(a) Regenerative Repeater

(b) Mie Scattering Loss

(c) PIN Photodiode