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

Term-End Examination

December, 2015

BIEL-017 : OPTICAL FIBER COMMUNICATION

Time : 3 hours   *Maximum Marks : 70*

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

1. (a) Establish the relationship between the acceptance angle, numerical aperture and the refractive index for the fiber core and cladding. 4

   (b) Compare the advantages and disadvantages of multimode step index fiber with respect to single mode step index fiber, when used as an optical channel. 6

2. (a) What is meant by a graded index optical fiber ? Derive an expression for the possible refractive index profile of a graded index fiber. *6*

(b) Explain what is meant by critical bending radius for an optical fiber. *4*

3. (a) Discuss absorption losses in optical fibers. *5*

(b) Describe various linear scattering losses in optical fibers. *5*

4. (a) What is meant by modal noise in optical fibers ? Suggest how it may be avoided. *6*

(b) Explain fiber birefringence in single mode fibers. *4*

5. (a) Discuss degradation mechanism in injection lasers. *5*

(b) Compare LEDs with injection laser as a source used in optical fiber communication. *5*

6. (a) The carrier velocity in a silicon p-i-n photodiode with 25 μm depletion layer width is 3×10^4 m/sec. Determine the maximum response time for the device. *4*

(b) Compare the detection process of p-n diode with p-i-n diode. *6*

7. (a) Define quantum efficiency and responsivity of a photodetector. *4*

    (b) Discuss briefly noise in Avalanche Photo Diode (APD) receiver. *6*

8. An analog optical fiber system operating at a wavelength of 1 μm has a post-detection bandwidth of 5 MHz. Assuming an ideal detector and considering only quantum noise on the signal, calculate the incident optical power necessary to achieve a signal-to-noise ratio (SNR) of 50 dB at the receiver. *10*

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

    (b) What is Automatic Gain Control (AGC) equalisation ? Why is it required ? *6*

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

    (a) Raman Scattering

    (b) Mie Scattering

    (c) Mode Hopping in Injection Lasers