

**B.TECH. IN ELECTRONICS AND  
COMMUNICATION ENGINEERING (BTECVI)**

**Term-End Examination**

**December, 2013**

**BIELE-008 : OPTO ELECTRONICS  
COMMUNICATION SYSTEMS**

*Time : 3 hours*

*Maximum Marks : 70*

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- Note : (i) Attempt any seven questions.  
(ii) All questions carry equal marks.  
(iii) Missing data may be suitably assumed.  
(iv) Use of scientific calculators permitted.*
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1. Explain the advantages of optical communication system over general communication system on the basis of following factors : 2x5=10
- (a) Bandwidth.
  - (b) Electrical Isolation.
  - (c) Immunity to interference and crosstalk.
  - (d) Transmission Loss.
  - (e) Signal Security.
2. (a) Briefly indicate with the aid of suitable diagram, the difference between meridional and skew ray path in step index fibers. 5
- (b) Derive an expression for the acceptance angle for a skew ray which changes direction by an angle  $2\gamma$  at each reflection in a step index fiber in terms of the fiber NA (Numerical Aperture) and  $\gamma$ . Assume that the ray theory holds for the fiber. 5

3. Explain in detail the limitations imposed on the bit rate by fiber dispersion. **10**
4. (a) What do you understand by Fiber Birefringence? Also define the beat length of the fiber? **3+2=5**
- (b) A single mode fiber is measured to have **5**
- $$\lambda^2 \left( \frac{d^2 n}{d\lambda^2} \right) = 0.02 \text{ at } 0.8 \text{ } \mu\text{m. Calculate the}$$
- dispersion parameters  $B_2$  and  $D$ .
5. (a) Discuss the mechanism of optical feedback to provide oscillation and hence amplification with in the Laser. **5**
- (b) The longitudinal modes of GaAs injection laser emitting at a wavelength of  $0.87 \text{ } \mu\text{m}$  are separated in frequency by  $278 \text{ GHz}$ . Determine the length of the optical cavity and the number of longitudinal modes emitted. The refractive index of GaAs is  $3.6$ . **5**
6. (a) Explain the working principle of DH-LED. **5**
- (b) Explain in brief the difference between internal quantum efficiency and external quantum efficiency. **5**
7. Explain the factors which limits the speed of response of a photodiode. **10**
8. Explain the following receiver terms. **3.5+3.5+3=10**
- (a) Power Penalty
- (b) Extinction Ratio
- (c) Timming Jitter

9. Explain the concept of Noise Figure for an optical amplifier. Why does the SNR (Signal to Noise Ratio) of the amplified signal degrade by 3dB even for an ideal amplifier ? **10**
10. Distinguish between the amplification processes in an Erbium-doped Amplifier and a fiber Raman Amplifier. **10**
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