



Reg. No. : .....

Name : .....

**Seventh Semester B.Tech. Degree Examination, October 2011**  
**(2008 Scheme)**  
**08.735 : OPTOELECTRONIC DEVICES (TA)**

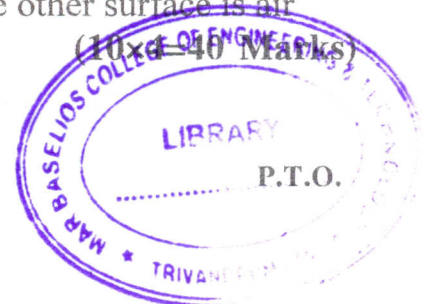
Time : 3 Hours

Max. Marks : 100

**PART – I**

Answer **all** questions.

1. Briefly explain radiative and non radiative recombination in semiconductors.
2. Explain responsivity and quantum efficiency.
3. Calculate momentum change due to phonon absorption in InP having band gap energy of 1.35eV.
4. What are the unique features of laser beam ?
5. Discuss the detection process in APD.
6. Differentiate electrical bandwidth, optical bandwidth and modulation bandwidth of an LED.
7. For a planar LED device fabricated from GaAs which has a refractive index of 3.6, Calculate the conversion efficiency if electrical power is 5W and optical output is  $50 \mu W$  where as the device current is  $10 \mu A$ .
8. Compare the performance characteristics of a p-i-n photodiode and a p-n photodiode.
9. Briefly explain the Electro-optic measurement technique.
10. Calculate the value of reflectance if the refractive index of silicon is 3.5 for an uncoated silicon photodiode at a wavelength of 800nm, the other surface is air interface.





## PART – II

Answer **any 2** from **each** Module.

**Module – I**

11. Describe the Absorption in Quantum wells and the Quantum confined stark effect.
12. What is Auger Recombination ? Derive the equation for absorption coefficient of a semiconductor.
13. Draw the layer diagram and operation of a p-i-n diode. Calculate the responsivity of the device if the number of incident photons are 800 and the corresponding electron generation in photodiode is 500 at a wavelength of 1300nm.  
(2×10=20 Marks)

**Module – II**

14. What is quantum efficiency ? Discuss the techniques and parameters need to be optimized to maximize quantum efficiency of an LED.
15. What is meant by acousto-optic effect ? Explain Raman-Nath modulator.
16. Discuss the characteristics of solar cell. A  $5\text{cm}^2$  Ge solar cell with a dark reverse saturation current of  $2\text{nA}$  has AM1 radiation incident up on it producing  $4 \times 10^{17}$  electron-hole pairs per second. The electron and hole diffusion lengths may be assumed to be 5 micro m. Calculate the short circuit current and open circuit voltage of the cell.  
(2×10=20 Marks)

**Module – III**

17. With the aid of suitable diagrams, discuss the principles of operation of the injection laser. Compare its ideal light output against current characteristics.
18. A gallium Arsenide injection laser with a cavity of length 500 micro meters has a loss coefficient of  $20\text{cm}^{-1}$ . The measured differential external quantum efficiency of the device is 45%. Calculate the internal quantum efficiency of the laser. The refractive index of GaAs is 3.6.
19. Write short notes :
  - a) Relaxation oscillations
  - b) Frequency chirp
  - c) Partition noise
  - d) Mode hopping.  
(2×10=20 Marks)