



Name : .....  
Roll No. : .....  
Invigilator's Signature : .....

**CS/B.TECH (EIE-N)/SEM-6/EI-602/2011**

**2011**

**OPTO-ELECTRONICS & OPTICAL  
INSTRUMENTATION**

*Time Allotted : 3 Hours*

*Full Marks : 70*

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP - A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :  
 $10 \times 1 = 10$
- i) Which of the following materials is not suitable for making an LED ?
    - a) GaAs
    - b) Silicon
    - c) InGaAsP
    - d) GaAlAs.
  - ii) Attenuation in optical fibre is represented in
    - a) dB/km
    - b) dB/hr
    - c) kdB/fr
    - d) dB/m.
  - iii) Laser is not used in
    - a) Optical communications
    - b) Entertainment electronics
    - c) Illumination purposes
    - d) Bloodless surgery.



- iv) The Dark current in the photodiode is actually the
- a) Forward current through the junction
  - b) Reverse saturation current
  - c) Basically a output radiation
  - d) None of these.
- v) Which one is the coherent source ?
- a) LED
  - b) LASER
  - c) Photodiode
  - d) Both ( a ) & ( b ).
- vi) For a single spherical surface, Newton's formula is
- a)  $(x_1 x_2)^2 = (f_1 f_2)^2$
  - b)  $x_1 + x_2 = f_1 + f_2$
  - c)  $x_1^2 + x_2^2 = (f_1 + f_2)^2$
  - d)  $x_1^2 + x_2^2 = f_1^2 + f_2^2$ .
- vii) Which of the following photodetectors exhibits internal gain ?
- a)  $p - n$  photodiode
  - b) APD
  - c)  $p - i - n$  photodiode
  - d) none of these.
- viii) The measurement of optical radiation by the principle of radiometry is possible over the frequency range of
- a) visible range
  - b) only entire the IR range
  - c) UV, visible & IR range
  - d) none of these.
- ix) Hologram is the
- a) 2-D view on 2-D photo plate
  - b) 3-D view on 2-D photo plate
  - c) 2-D view on 3-D photo plate
  - d) 3-D view on 3-D photo plate.
- x) Carbon dioxide laser is a
- a) Molecular laser
  - b) Ionic laser
  - c) Atomic laser
  - d) None of these.





8. a) Discuss the principle of operation of PIN photodiode. Draw equivalent circuit of it.
- b) Define Responsivity and overall efficiency of PIN photodiode.
- c) A Si p-i-n photodiode with  $8 \mu\text{m}$  receives light of wavelength  $0.87 \mu\text{m}$  and power of  $0.5 \text{ W/cm}^2$ . Calculate the photocurrent density. Assume that the top illuminated surface is coated with antireflection coating such that there is no reflection. Absorption coefficient  $\alpha = 600 \text{ cm}^{-1}$ . 6 + 4 + 5
9. a) Differentiate between CW Laser output, Pulsed Laser output and Q-switched Laser output.
- b) What is Q-factor of a Laser Cavity ?
- c) What is cavity oscillation and how does it influence laser operation ?
- d) Write a short note on He-Ne Laser.
- e) What are the vibrational modes in a  $\text{CO}_2$  Laser ? 2 + 2 + 4 + 5 + 2
10. Explain the Principle of holography. Discuss the holographic technique invented by Gabor. Find out the Gaussian formula for single surface. 5 + 5 + 5
11. Write short notes on any *three* of the following : 3 × 5
- a) Quantum Well Laser
  - b) LDR
  - c) Camera mechanism
  - d) Refractometer
  - e) Optoisolator
  - f) Spectrometro.
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