Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (ICE)/SEM-8/IC-801A/2010

2010

OPTO-ELECTRONICS & LASER BASED 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 × 1 = 10

   i) Which of the following mterials is not suitable for making an LED ?

      a) GaAs

      b) Silicon

      c) In GaAsP

      d) GA A1As.

ii) The material for making an efficient LED should be a/an

a) metal

b) indirect band gap semiconductor

c) direct band gap semiconductor

d) insulator.

iii) Once a population inversion has been attained, atoms can return to the lower energy states ..... or ..... .

a) randomly, not at all

b) by controlled triggering by applying heat

c) by absorbing photons, by controlled triggering

d) randomly, by controlled triggering.

iv) The basic concept in laser-maser action is to trigger the excited atoms that are in a population inversion before they have chance to randomly

a) combine with other atoms

b) disintegrate

c) return to lower energy levels

d) absorb energy.

v) The Gallium-Arsenide Laser uses ..... as its excitation or pump energy.

a) electrical current

b) flash lamp

c) chemical action

d) magnetic field.

vi) The core diameter of single mode optical fibre is

a) 5 μm b) 10 μm

c) 15 μm d) 20 μm.

vii) Bandwidth of optical fibre is in the order of

a) kHz b) MHz

c) MHz/GHz d) THz.

viii) Luminous flux is measured in units of

a) Lumen b) Footcandle

c) Lux d) Nit.

ix) P-I-N photodiode has

a) 3 junctions b) 4 junctions

c) 2 junctions d) 5 junctions.

x) Power delivery by optical fibre has

a) high loss

b) low loss

c) no loss

d) loss depends on core diameter.

xi) Which is *not* true for fibre optic communication ?

a) Greater bandwidth

b) Lower attenuation

c) Electromagnetic isolation

d) Heavy weight.

xii) Gain on LED is ..... LASER.

a) greater than

b) less than

c) equal to

d) 2 times that of.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. How does OTDR work ? Describe.

3. Describe Polarization of light.

4. State the Hygienic principle of wave front.

5. State Kerr electro-optic effect.

6. Describe the principle of operation of CCD.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) State the principle of opeation of LED.

   b) What is understood by direct and indirect bandgap semiconductor ?

   c) State with diagram the principle of operation of Surface Emitting LED. 4 + 5 + 6

8. a) Define LASER. State the types of LASER and elaborate.

   b) With schematic diagram, explain the working principle of Gas LASER (He-Ne LASER).

   c) Differentiate between active and passive mode locking.

5 + 5 + 5

9. a) How does P-I-N diode work ?

   b) State the working principle of Avalanche photodiode. Explain with diagram.

   c) What is the principle of operation of a *p-n* photodiode ?

   d) A photodiode has the quantum efficiency of 75% when photons of energy 1·6 ✳ 10^ – 19 J are incident upon it. Find out :

      i) At what wavelength the photodiode operating ?

      ii) Calculate the incident optical power required to obtain a photocurrent of 3 μA.

4 + 4 + 4 + 3

10. a) What is Quantum Efficiency ?

b) What do you mean by absorption coefficient ?

c) Define responsivity.

d) How is displacement measured with optical sensor ?

3 + 3 + 3 + 6

11. Write short notes on any *three* of the following : 3 × 5

a) Photometery

b) Light power meter

c) Wave-particle duality

d) CO_2 LASER

e) Optical fibre flow meter.