OPTO ELECTRONICS AND FIBRE OPTICS
(AEIE 3233)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

    (i)   Which of the following is not suitable for making an LED?
           (a) GaAs   (b) Si
           (c) InGaAsP   (d) AlGaAs

    (ii)   Laser beam machining process can be used for
           (a) Conductors   (b) Insulators
           (c) Metals   (d) All of the mentioned

    (iii) Which type of optical fiber is preferred for long distance communication
           (a) step index single mode fiber   (b) graded index multimode fiber
           (c) step index multimode fiber   (d) graded index single mode fiber

    (iv)   Which of the following is an example of a wavelength modulated sensor
           (a) micro bend sensor   (b) fiber optic gyroscope
           (c) a fluorescence temperature sensor (d)   all of these

    (v)   A photo conducting detector can be constructed from
           (a) an intrinsic semiconductor   (b) an extrinsic semiconductor
           (c) polycrystalline material   (d) all of the above

    (vi)   The core of an optical fiber has a
           (a) Lower refracted index than air
           (b) Lower refractive index than the cladding
           (c) Higher refractive index than the cladding
           (d) Similar refractive index with the cladding

    (vii) The loss in signal power as light travels down a fiber is called
           (a) dispersion   (b) scattering
           (c) absorption   (d) attenuation

(viii)   What is the wavelength value of CO_2 laser used in Laser beam machining?
      (a) 0.16 μm   (b) 1.6 μm
      (c) 10.6 μm   (d) 106 μm

(ix)   Which of the following measurands can not measured by a micro bent sensor?
      (a) displacement   (b) temperature
      (c) pressure   (d) electric current

(x)   If two optical fibers with different diameter are to be spliced , which of the following mechanical spices will be most suitable
      (a) snug tube splice   (b) loose tube splice
      (c) spring groove splice   (d) V-groove splice

Group – B

2.   (a)   What is an intrinsic and extrinsic semiconductor? What is radiance or brightness? Why silicon is not used to fabricate LED or Laser diode?

    (b)   What are the requirements of a photo detector?

(2 + 2 + 3) + 5 = 12

3.   (a)   Mention few photo detector materials and their properties. What is electroluminescence?

    (b)   Write short note on any two:
       (i)   Optoisolator
       (ii)   LDR
       (iii) Photo-transistor.

(3 + 3) + (2 × 3) = 12

Group – C

4.   (a)   What is meant by heterojunction? Write the basic principle of confinement of carriers in heterojunction LED.

    (b)   Write short note on one any two:
       (i)   PIN photodiode
       (ii)   Dome LED
       (iii) Burrus type LED

(3 + 3) + (2 × 3) = 12

5.   (a)   Explain the detection process in a p-n photodiode. Compare the device with p-i-n photodiode.

    (b)   Describe with relevant diagram the operation of silicon Reach-Through Avalanche Photodiode. What are the drawbacks of Avalanche Photodiode?

7 + 5 = 12

Group – D

6. (a)   What do you mean by population inversion? How is population inversion accomplished in semiconductor and non-semiconductor laser?

   (b)   Write short note on any one:
         (i)   Laser range meter
         (ii) Laser welding

                                                            (4 + 4) + 4 = 12

7. (a)   Describe Laser Machining with proper diagram. What applications are best suited for Laser Machining? What are the advantages and disadvantages of Laser Machining Over Other Processes?

   (b)   Explain with necessary diagrams three process of absorption, spontaneous emission and stimulated emission in a two-level energy system.

                                                            (3 + 2 + 3) + 4 = 12

Group – E

8. (a)   Define Refraction. What is Snell's law? What is critical angle of incidence? What is total internal refection?

   (b)   Discuss with the aid of suitable diagrams, the design of the following connectors: (i) ferrule connector and (ii) expanded-beam connector

                                                      (1 + 1 + 1 + 1) + (4 + 4) = 12

9. (a)   Explain the bending losses. What is micro bending? How it can be reduced?

   (b)   Write short note on any one:
         (i) Optical fiber displacement sensor
         (ii) Optical liquid level sensor

                                                            (3 + 2 + 2) + 5 = 12

Department & Section	Submission Link
AEIE	https://classroom.google.com/c/MzY0NTU2NzQzMjM0/a/MzY0NTU2NzQzMjQz/details