OPTO ELECTRONICS AND FIBER OPTICS
(AEIE 3232)

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 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

    (ii)   At which wavelength the silica fiber has minimum loss and dispersion
            (a) $0.85\mu m$ (b) $1.7\mu m$
            (c) $1.1\mu m$ (d) $1.3\mu m$

    (iii)   Snell's law relates _____.
            (a) light reflection   (b) light refraction
            (c) light transmission   (d) light absorption

    (iv)   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

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

    (vi)   What is the abbreviation of Laser?
            (a) Light allowed simple emission of radiation
            (b) Light amplification by stimulated emission of radiation
            (c) Light amplified simultaneous emission of rays
            (d) Light amplified stimulated emanation of rays

    (vii)   What is the full form of LBM in advanced machining processes?
         (a) Laser Beam Manufacturing   (b) Laser Beam Machining
         (c) Light Blast Manufacturing   (d) Light Beam Machining

    (viii)   Which of the following are the properties of a laser?
         (a) Highly collimated   (b) Monochromatic
         (c) Coherent light beam   (d) All of the mentioned

    (ix)   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

    (x)   Which of the following pairs are suitable for making a heterojunction?
         (a) Si and Ge   (b) Si and GaAs
         (c) Ge and GaAs   (d) GaAs and AlGaAs

Group – B

2.   (a)   Explain direct band gap and indirect band gap type of semiconductors. Give at least two examples of each. Which of these are suitable for fabricating LEDs?

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

                     (3 + 2 + 1) + (2 × 3) = 12

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

    (b)   Write short note on any one:
        (i) Photo conducting effect
        (ii) Photo voltaic effect.

                     (3 + 4) + 5 = 12

Group – C

4.   (a)   What are the advantages of LED? Name the factors to determine frequency response of an LED.

    (b)   Write short note on any one:
        (i) Edge emitting LED
        (ii) Surface emitting LED

                     (4 + 2) + 6 = 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?

(3 + 3) + (3 + 3) = 12

Group – D

6. (a) What is stimulated emission? Explain optical feedback and laser oscillation.

   (b) Compare LASER and LED as source in optical fiber communication system

   (2 + 5) + 5 = 12

7. (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

Group – E

8. (a) Describe the structures of different types of optical fibers with ray paths. What is the approximate diameter of an optical fiber in each case?

   (b) The average optical power launched into a 10 km length of fiber is 100 μW and the average output power is 2.5 μW. Calculate (i) the signal attenuation in decibels through the fiber. It is assumed that there are no connectors or splices (ii) the signal attenuation per km of the fiber, (iii) overall signal attenuation for the 11 km optical link using the same fiber with 3 splices each having an attenuation of 0.8 Db and (iv) numerical value of the ratio between input and output power.

   (4 + 2) + (2 + 2 + 1 + 1) = 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/Mjk5MzU0NTM1MDU0/a/MzY0NTUzMjA0NTM4/details