

**Q1. A) Select correct answer****(12)**

- 1) A laser of wavelength  $7200 \text{ \AA}$  and aperture  $0.045 \text{ m}$  is targeted on the moon. If the moon is at a distance of about  $4 \times 10^5 \text{ km}$  from the earth then the angular spread of the beam will be \_\_\_\_\_  
 a)  $16.0 \times 10^{-5}$  b)  $1.60 \times 10^{-5}$  c)  $0.16 \times 10^{-5}$  d) None of these. **Ans: b**
- 2) If the core and the cladding of an optical fiber has refractive indices  $1.5$  and  $1.47$  respectively then the angle of acceptance in air will be \_\_\_\_\_  
 a)  $17^{\circ}27'$  b)  $16^{\circ}27'$  c)  $15^{\circ}27'$  d) None of these. **Ans: a**
- 3) When a stronger solution is separated from a weaker one by a semi permeable membrane, the weaker solution diffuses through the membrane into the stronger solution in an effort to equalize the strength of the two solutions. This phenomenon is called \_\_\_\_\_  
 a) diffusion b) surface tension c) viscosity d) osmosis **Ans: d**
- 4) The plasma membrane is a \_\_\_\_\_ with embedded proteins that separates the internal contents of the cell from its surrounding environment.  
 a) Golgi apparatus b) ER c) protein d) phospholipid bilayer **Ans: d**
- 5) \_\_\_\_\_ have high ductility and wires can be drawn from them.  
 a) Metals b) Semiconductor c) Polymers d) Ceramics **Ans: a**
- 6) Snell's law relates to \_\_\_\_\_ of light.  
 a) Reflection b) Refraction c) Transmission d) Absorption **Ans: b**

**Q1. B) Answer in one sentence****(3)**

- 1) What is an optical fiber?
- 2) State Fick's first law.
- 3) What is viscosity?

**Q1. C) Fill in the Blanks****(5)**

- 1) The acronym for "light amplification by stimulated emission of radiation" is \_\_\_\_\_ **Ans: LASER**
- 2) For requirement of good auditorium the quality of sound must remain.....  
**Ans: Unaltered**
- 3) Golgi apparatus participates in cell wall formation and secretion. This statement is ..... (True/False) **Ans: True**
- 4) Alnico is a \_\_\_\_\_ magnet. **Ans: Hard**
- 5) \_\_\_\_\_ materials create electricity when they are subjected to mechanical stress. **Ans: Piezoelectric**

**Q2. A) Attempt any one**

**(8)**

- 1) Explain any three applications of optical fiber.

**Ans: Atleast 3 applications – 8 marks**

- 2) Discuss the factors reverberation, echo, resonance, echelon effect and focusing of sound that affect the acoustic in the hall. **Ans: Each factor- 2 marks**

**Q2. B) Attempt any one**

**(8)**

- 1) Explain with the neat diagram, the process of absorption, spontaneous emission and stimulated emission of light.

**Ans: absorption 2 marks, spontaneous and stimulated emission each 3 marks.**

- 2) Explain any three properties of laser.

**Ans: Atleast 3 properties explained – 8 marks**

**Q2. C) Attempt any one**

**(4)**

- 1) The room has wall area  $180 \text{ m}^2$ , the floor area is  $200 \text{ m}^2$  and ceiling area is  $200 \text{ m}^2$ . The volume of the auditorium is  $1200 \text{ m}^3$ . The average sound absorption coefficient for the walls is  $0.032$ , for ceiling is  $0.78$  and for the floor is  $0.058$ . Calculate the average sound absorption coefficient and reverberation time.

D) Wall area  $S_1 = 180 \text{ m}^2$  with sound absorption coefficient  $a_1 = 0.032$   
Floor area  $S_2 = 200 \text{ m}^2$  with sound absorption coefficient  $a_2 = 0.058$   
Ceiling area  $S_3 = 200 \text{ m}^2$  with sound absorption coefficient  $a_3 = 0.78$   
Vol<sup>m</sup> of auditorium  $V = 1200 \text{ m}^3$   
Calculate avg. sound absorption coefficient  $a = ?$   
& reverberation time  $t = ?$

$$a = \frac{\sum a_s}{\sum S} = \frac{a_1 S_1 + a_2 S_2 + a_3 S_3}{S_1 + S_2 + S_3} = \frac{0.032 \times 180 + 0.058 \times 200 + 0.78 \times 200}{180 + 200 + 200}$$
$$= \frac{173.36}{580} = 0.2989$$

— 2 marks

$$= \frac{0.158 V}{\sum a_s} = \frac{0.158 \times 1200}{0.032 \times 180 + 0.058 \times 200 + 0.78 \times 200} = \frac{189.6}{173.36}$$
$$= 1.0537$$

— 2 marks

- 2) Calculate numerical aperture of a step index fiber for an optical fiber that have a core of refractive index 1.5 and cladding of refractive index 1.48. Also determine the maximum angle for entrance of light if the fiber put in air.

Handwritten solution for the numerical aperture and maximum angle of light entrance:

2)  $n_1 = 1.5$ ,  $n_2 = 1.48$  — 2 marks

c. Numerical aperture  $N.A = \sqrt{(n_1^2 - n_2^2)^{1/2}}$

$$= \sqrt{(1.5^2 - 1.48^2)^{1/2}}$$

$$= 0.2441$$
 — 2 marks

maximum angle of entrance of light  $i_m = \sin^{-1} \sqrt{(n_1^2 - n_2^2)^{1/2}}$

$$i_m = 14.13^\circ$$
 — 2 marks

**Q.3 A) Attempt any one (8)**

- 1) Explain **Osmosis** and show how it is different from Diffusion. What is Osmotic pressure?

**Ans: Osmosis – 2 marks + difference – 4 marks + Osmotic pressure – 2 marks**

- 2) **What is action potential?** Describe the generation propagation of action potential in neuron cells. **Ans: action potential -2mks+ generation -3+ propagation-3mks**

**3. B) Attempt any one (8)**

- 1) Explain **surface tension** based on molecular theory. Discuss any one method to measure surface tension. **Ans: Explanation-5 marks +method-3mks**

- 2) Define, Explain and give any one method to measure **viscosity**.

**Ans: definition-2mks+Explanation-3+method-3mks**

**3.C) Attempt any one (4)**

- 1) Write short note on cell capacitance. **Ans: Atleast 4 points – 4 marks**

- 2) Write note on body fluids. **Ans: Atleast 4 points – 4 marks**

**Q4 A) Attempt any one (8)**

- 1) Describe the different chemical methods to synthesize nanomaterials.

**Ans: Chemical vapour deposition (4), Solgel method (4)**

- 2) Classify materials on the basis of magnetic properties.

**Ans: Metals and Alloys, Ceramics, Polymers and Composites, Thin film nonmaterial, (Any four with explanation) (8)**

Q4 B) Attempt any one (8)

1) Explain how electrical properties differ in metals, semiconductors and insulators.

**Ans: Explanation of electrical properties in metals (3)**

**Explanation of electrical properties in semiconductors (3)**

**Explanation of electrical properties in insulators (2)**

2) a) Explain magnetic hysteresis.

**Ans: magnetic hysteresis diagram (2), Explanation (2)**

b) Explain magnetic recording and storage.

**Ans: Explanation of magnetic recording and storage (4)**

Q4 C) Attempt any one (4)

1) Explain soft magnets and hard Magnets. **Ans: Explanation of Soft Magnets (2), Explanation of Hard Magnets (2)**

2) Write short note on Metals and Alloys.

**Ans: Explanation of Metals and Alloys (4)**

**Q5. Attempt any Four (20)**

1) Explain step index optical fiber. **Ans: Explanation – 5 marks**

2) Write short note on holography. **Ans: Explanation of Holography – 5 marks**

3) Describe types of action potential. **Ans: Different types – 5 marks**

4) Explain osmosis and factors effecting osmosis.

**Ans: Osmosis – 2 marks, Factors – 3 marks**

5) Explain the effect of temperature on the Conductivity of Solids.

**Ans: Effect of temperature on conductivity of metals (2)**

**Effect of temperature on conductivity of semiconductors (2)**

**Effect of temperature on conductivity of insulators (1)**

6) Write a short note on Ceramics. **Ans: Explanation of Ceramics (5)**

