

Time : 3 Hours

[Marks :100]

- N.B : (1) All questions are compulsory.  
 (2) Figures to the right indicate maximum marks.  
 (3) Use of non-programmable calculators is permitted.  
 (4) Symbols used have their usual meaning

Q1. A) Select correct answer (12)

- 1 The reverberation time for music is about \_\_\_\_\_ seconds  
 a) 1 to 2 b) 2 to 2.5 c) 3 to 4 d) 4 to 5
- 2 The relations between probabilities of stimulated absorption and emission were given by \_\_\_\_\_  
 a) Bohr b) Einstein c) Planck d) Fermi
- 3 Smaller distances result in \_\_\_\_\_ diffusion rates and larger distances result in \_\_\_\_\_ diffusion rates  
 a) faster, slower b) slower, faster c) zero, finite d) finite, zero
- 4 \_\_\_\_\_ is the spontaneous net movement of solvent molecules through a selectively permeable membrane into a region of higher solute concentration, in the direction that tends to equalize the solute concentrations on the two sides.  
 a) Facilitated diffusion b) Simple diffusion  
 c) Osmosis d) Translational diffusion
- 5 The resistivity of metals increases with  
 a) Rise in temp b) Fall in temp c) Remains unchanged d) None
- 6 Smallest unit of energy  
 a) joule b) ergs c) eV d) None

B) Answer in one sentence (03)

- 1 State Sabine's formula.
- 2 Define pH.
- 3 Define polar dielectrics.

C) Fill in the Blanks (5)

- 1 In graded index fibre the refractive index varies in the \_\_\_\_\_ direction
- 2 \_\_\_\_\_ is the difference in electric potential between the interior and the exterior of a biological cell.
- 3 All organisms are constructed of and by \_\_\_\_\_
- 4 Property of developing voltage when pressure is applied \_\_\_\_\_
- 5 Property of inducing magnetic field opposite to the applied magnetic fields \_\_\_\_\_

Q2. A) Attempt **any one** (8)

- 1 State any eight applications of optical fibers
- 2 Explain fiber geometry and discuss the mechanism of transmission of light using total internal reflection.

- B) Attempt **any one** (8)
- 1 Explain the following properties of laser:
    - (a) Coherence
    - (b) Directionality
  - 2 Describe the construction and working of He-Ne laser.
- C) Attempt **any one** (4)
- 1 The volume of a room is  $600 \text{ m}^3$ . The wall area of the room is  $220 \text{ m}^2$ , the floor area is  $120 \text{ m}^2$  and the ceiling area is  $120 \text{ m}^2$ . The average sound absorption coefficient, (i) for the walls is 0.03; (ii) for the floor is 0.06 and (iii) for the ceiling is 0.80. Calculate the average sound absorption coefficient and the reverberation time.
  - 2 A hall has a volume of  $2250 \text{ m}^3$ . Its total absorption is equivalent to  $100 \text{ m}^2$  of open window. What will be the effect on the reverberation time if audience fills the hall and thereby increase the absorption by another  $100 \text{ m}^2$ ?
- Q3. A) Attempt **any one** (8)
- 1 What are biological fluids? Enlist them and give their properties.
  - 2 Explain patch-clamp technique, its principles and state its applications.
- B) Attempt **any one** (8)
- 1 Explain facilitated diffusion.
  - 2 What is action potential? Discuss types of action potential and explain characteristic of action potential.
- C) Attempt **any one** (4)
- 1 Determine the resting potential across the cell membrane given that concentrations of  $\text{K}^+$  (inside  $400 \text{ mM}$ , outside  $10 \text{ mM}$ ) of  $\text{Na}^+$  (inside  $50 \text{ mM}$ , outside  $460 \text{ mM}$ ) and of  $\text{Cl}^-$  (inside  $40 \text{ mM}$ , outside  $540 \text{ mM}$ ) and the respective permeabilities of  $\text{K}^+$ ,  $\text{Na}^+$  and  $\text{Cl}^-$  are 1, 0.03 and 0.1.
  - 2 Explain the process of osmosis at a cell membrane. State its physical importance.
- Q4. A) Attempt **any one** (8)
- 1 Mention any four important characteristics of alloys & any two applications.
  - 2 Mention any four important characteristics of polymers & any two applications.
- B) Attempt **any one** (8)
- 1 Mention any four important characteristics of semiconducting materials & any two applications.
  - 2 Mention any four important characteristics of insulating materials & any two applications.

- C) Attempt **any one** (4)
- 1 Compare Paramagnetic & Ferromagnetic substances.
  - 2 Compare hard & soft magnets.

- Q5. Attempt **any Four** (20)
- 1 Explain how reverberation affects the acoustics of a hall.
  - 2 Write a short note on : Sound distribution in an auditorium
  - 3 Explain Hodgkin-Huxley model of action potential.
  - 4 Explain Goldman equation.
  - 5 Compare ferroelectric & dielectric materials and mention any one application of each.
  - 6 Define piezoelectric effect and mention any one application.
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