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 m^3. The wall area of the room is 220 m^2, the floor area is 120 m^2 and the ceiling area is 120 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 m^3. Its total absorption is equivalent to 100 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 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 K^+ (inside 400 mM, outside 10 mM) of Na^+ (inside 50mM, outside 460 mM) and of Cl^- (inside 40 mM, outside 540mM) and the respective permiabilities of K^+, Na^+ and 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.
