

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 He-Ne laser is a \_\_\_\_\_ laser  
 a) gas b) solid c) liquid d) plasma
- 2 Optical fibres are made of \_\_\_\_\_ glass.  
 a) silica b) crown c) flint d) ordinary
- 3 Diffusion rate is inversely proportional to \_\_\_\_\_.  
 a) solubility. b) surface area. c) size and shape of solute.  
 d) molecular velocity.
- 4 As membrane potential \_\_\_\_\_  
 a) approaches +30 mV, potassium channels open and it begins to flow out of the cell.  
 b) depolarizes at about 50 mV potassium channel gets closed.  
 c) reaches +50 mV the cell interior becomes more and more negative.  
 d) reaches +50mV, potassium channel opens and potassium ions flow out of the cell.
- 5 Communication by phonons is in \_\_\_\_\_.  
 a) Optical fiber b) AC cable c) DC cable d) None
- 6 One electron volt energy is equal to \_\_\_\_\_.  
 a)  $1.6 \times 10^{19}$  Joule b)  $1.6 \times 10^{12}$  ergs c)  $9.1 \times 10^{-16}$  Joules d)  $1.6 \times 10^{-12}$  ergs

B) Answer in one sentence (03)

- 1 State the two types of classification of extraneous noise in a hall?
- 2 Define pH.
- 3 What type of magnet is a superconductor ?

C) Fill in the Blanks (5)

- 1 Graded index fibres have a core with \_\_\_\_\_ decreasing as a function of r.
- 2 Repolarization state of action potential is from \_\_\_\_\_ back to -70mV
- 3 The function of mitochondria in cell is \_\_\_\_\_
- 4 Property of developing voltage when pressure is applied: \_\_\_\_\_
- 5 Property of inducing magnetic field in the direction of applied magnetic fields: \_\_\_\_\_

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

- 1 State Sabine's formula and explain the terms involved in it. Explain the term: absorption coefficient. Describe the method used to determine absorption coefficient.
- 2 State any eight requirements of a good auditorium.

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

- 1 Derive the Einstein's relations describing the probabilities of stimulated absorption and stimulated emission in lasers.

- 2 Explain the following properties of laser:  
 (a) Coherence  
 (b) Directionality
- C) Attempt **any one** (4)  
 1 An optical glass fibre of R.I. 1.50 is to be clad with another glass to ensure internal reflection that will contain light travelling within  $5^\circ$  of the fibre axis. What minimum index of refraction is allowed for the cladding?  
 2 A fibre cable has an acceptance angle of  $30^\circ$  and core index of R.I. 1.4. Calculate R.I. of cladding.
- Q3. A) Attempt **any one**. (8)  
 1 Explain the process of osmosis at a cell membrane. State its physical importance.  
 2 Explain Nernst equation.
- B) Attempt **any one**. (8)  
 1 What are different types of diffusion in cell membrane? Explain the diffusion across biological cell membrane.  
 2 Explain voltage clamp technique to measure ion currents through the membranes of excitable cells.
- C) Attempt **any one**. (4)  
 1 Calculate ion membrane potential for calcium ion at standard conditions at  $25^\circ\text{C}$ . Given that the external and internal concentration of calcium are 2.5 mM and 0.0001 mM respectively.  
 2 Explain Goldman equation.
- Q4. A) Attempt **any one** (8)  
 1 How alloys are different from pure metals. Mention any four applications of Alloys with enhance characteristics.  
 2 Mention any four important characteristics of soft magnetic material & any one applications.
- B) Attempt **any one** (8)  
 1 Mention any four important characteristics of nano materials & any one application.  
 2 Mention any four important characteristics of insulating material & any one application.
- C) Attempt **any one** (4)  
 1 Compare Ferroelectric & Ferromagnetic substances.  
 2 Compare Pyroelectric & Piezoelectric substances.

- Q5. Attempt **any Four** (20)
- 1 Explain the transmission of light through an optical fiber using total internal reflection.
  - 2 Write a short note on ‘Numerical aperture of a fiber?’
  - 3 State and explain Fick’s laws of diffusion.
  - 4 What are eukaryotic cells? Explain the important components of such cell
  - 5 Define ferromagnetism & mention any one application.
  - 6 Explain dielectric property of a material & any one application.

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