Nov - Dec - 2012

[4261] – 109

F.E. (Semester – II) Examination, 2012
APPLIED SCIENCE – II
(Physics) (2008 Pattern)

Time : 2 Hours | Max. Marks : 50

Instructions: *1) Answer **1** or **2**, **3** or **4**, **5** or **6**.*
*2) **Neat** diagrams must be drawn **wherever** necessary.*
*3) Black figures to the **right** indicate **full** marks.*
*4) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*
*5) Assume suitable data, **if necessary**.*

Constants :

1) Mass of electron - 9.1×10^{-31} Kg.
2) Charge on electron - 1.6×10^{-19} C
3) Velocity of light - 3×10^{8} m/sec.
4) Planks constant (h) - 6.625×10^{-34} J.Sec.

1. A) Show that the group velocity of a matter wave is equal to the particle velocity. 6

   B) Derive the Schrodinger's time dependent equation starting from the Schrodinger's time independent wave equation. 7

   C) Lowest energy of an electron trapped in an infinite potential well is 38 ev. Calculate the width of the well. 4

   OR

2. A) State and explain Heisenberg's uncertainty principle. Illustrate it by an experiment on electron diffraction at a single slit. 6

   B) Derive an expression for the energy levels and wave function of a particle enclosed in an infinite potential well. 7

   C) An electron has a speed of 600 m/s with an accuracy of 0.005%. Calculate the uncertainty with which we can locate the position of the electron. 4

P.T.O.

3. A) Explain the construction and operation of Ruby laser with neat labeled diagram. **6**

   B) Distinguish between type I and type II superconductors. **6**

   C) What are lasers ? State the properties of lasers. **4**

OR

4. A) With a neat labeled diagram, explain construction and working of He-Ne laser. **6**

   B) State and explain the Meissner effect. What important property of superconductors it explains. **6**

   C) Explain :

      i) Spontaneous emission

      ii) Stimulated emission. **4**

5. A) Classify the elements into conductors, insulators and semiconductors on the basis of band theory of solids. **6**

   B) Define nanotechnology. Discuss the mechanical and electrical properties of nano materials. **7**

   C) Calculate the conductivity of pure Si at room temperature when the concentration of carriers is 1.6×10^{10}/C.C.

   (μ_e = 1500 cm^2/volt-sec, μ_h = 500 cm^2/volt-sec). **4**

OR

6. A) What is Fermi function ? Show that the Fermi level lies at the centre of the energy gap in an intrinsic semiconductor. **7**

   B) Explain briefly the theory of colloids and hence explain how colloids are synthesized by the chemical route. **6**

   C) Calculate the mobility of charge carriers in a doped silicon whose conductivity is 100 per ohm-m and Hall coefficient is 3.6×10^{-4} m^3/Coulomb. **4**
