



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

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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 4
- 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 $1.6 \times 10^{10}/\text{C.C.}$
($\mu_e = 1500 \text{ cm}^2/\text{volt-sec}$, $\mu_h = 500 \text{ cm}^2/\text{volt-sec}$). 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 $3.6 \times 10^{-4} \text{ m}^3/\text{Coulomb}$. 4