

May - June - 2012

[4161] - 109



Seat
No.

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

Time : 2 Hours

Max. Marks : 50

- Constants:** a) Planck's constant, $h = 6.63 \times 10^{-34}$ J.S.
b) Charge on electron, $e = 1.6 \times 10^{-19}$ C.
c) Mass of electron, $m_e = 9.1 \times 10^{-31}$ Kg.
d) Velocity of light, $C = 3 \times 10^8$ m/s.

1. a) Show that :
- 1) Phase velocity of matter wave is c^2/v , where C is the speed of light and v is the velocity of the particle. 7
 - 2) Group velocity of a wave packet is equal to particle velocity. 6
- b) Derive Schroedinger's time independent wave equation. 4
- c) An electron is trapped in a rigid box of width $2A^\circ$. Find its lowest energy level and momentum. 4
- OR
2. a) Derive an equation of energy and wave function when a free particle is trapped in an infinite potential well. 7
- b) State de Broglie's hypothesis and derive the equation for de Broglie's wavelength in terms of
- 1) Energy 6
 - 2) For an electron. 6
- c) If uncertainty in the position of a particle is equal to de Broglie's wavelength, then show that uncertainty in velocity is equal to the velocity of the particle. 4
3. a) Explain the construction and working of semiconductor laser with the help of Energy band diagram. 6
- b) What is superconductivity ? Explain BCS theory of superconductors. 6
- c) Explain the terms :
- 1) Meissner effect 4
 - 2) Population Inversion 4

OR

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4. a) Explain the construction and working of He-Ne Laser with neat, labelled diagram. 6
- b) Distinguish between Type I and Type II superconductors. 6
- c) What are the advantages of Fibre Optic Communication ? 4
5. a) Explain Hall Effect in semiconductors. Derive equation for Hall voltage and Hall coefficient. 7
- b) Explain any two properties of nanoparticles. 6
- c) Calculate the number of acceptors to be added to a Germanium sample to obtain the resistivity of $10\ \Omega\text{-cm}$. 4
- Given : $\mu = 1700\ \text{cm}^2/\text{volt}\cdot\text{sec}$.
- OR
6. a) Define Fermi level in conductors and semiconductors. Show that the Fermi level lies at the centre of Energy gap in an intrinsic semiconductor. 7
- b) Explain synthesis of metal nanoparticles by colloidal route. 6
- c) The resistivity of copper wire of diameter 1.03 mm is 6.51 ohm per 300m. The concentration of free electrons in copper is $8.4 \times 10^{28}/\text{m}^3$. If current is 2A, find the mobility of free electrons. 4