

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. 6  
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 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 :  $\mu = 1700\ \text{cm}^2/\text{volt}\cdot\text{sec}$ . 4
- 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
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