

1992

B.E. 2nd Semester Examination, May-2010

## PHYSICS-II

## Paper-Phy-102-E

Time allowed : 3 hours]

[Maximum marks : 100

**Note :** Attempt five questions in all, selecting at least two questions from each part.

## Part-A

1. (a) Draw sketches illustrating (101) and (111) planes in cubic unit cell. 4
- (b) What do you understand by quarks and gluons ? 6
- (c) Discuss briefly the method for determination of structure of finely powdered poly crystalline material. 10
2. (a) What were the difficulties with classical physics in explaining certain observed phenomenon and how could quantum mechanics provide clues ? 12

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- (b) Derive de-broglie wave length of a particle in motion. Show that phase velocity of associated waves for a particle is always greater than velocity of light in vacuum. 8
3. (a) Derive formula of time independent Schrödinger equation for a free particle. Also discuss the interpretation of position probability density and normalisation of wave function. 15
- (b) Calculate the energy difference between the ground state and 1st excited state for an electron in one dimensional rigid box of length  $10^{-10}$  m.
- Given mass of electron =  $9.1 \times 10^{-31}$  kg and Planck's constant ( $h$ ) =  $6.62 \times 10^{-34}$  J sec. 5
4. (a) What is free electron theory of metals ? Derive an expression for electrical conductivity of metal on the basis of Lorentz-Drude theory. 12
- (b) Explain Fermi-Dirac distribution function. Plot this function for various temperatures including  $0^\circ\text{K}$ . 8

## Part-B

5. (a) Discuss the essential features of the electron energy band structure of solids on the basis of Kroning and Penney model. 15
- (b) Discuss the significance of E-K diagram. 5
6. (a) What is Hall effect ? Derive an expression for Hall co-efficient. Discuss some important applications of this effect. 15
- (b) A sample of n type semi-conductor has a Hall co-efficient  $0.015 \text{ m}^3/\text{c}$  and mobility of electrons  $0.35 \text{ m}^2 \text{ v}^{-1} \text{ sec}^{-1}$ . Electric field of  $150 \text{ v/m}$  is applied across the sample. Calculate the electron concentration and the current density in the sample. 5
7. (a) Discuss Langevin's theory of paramagnetism and point out its limitations. 15
- (b) Discuss the significance of E-K diagram. 5

8. (a) Define photo conductivity. What are traps ?  
Discuss the effect of traps on photoconductivity  
of a photoconductor. 10
- (b) Describe Meissner effect. Distinguish between  
type-I and type-II super conductor. 10