College of Engineering, Shivajinagar, Pune

F.Y. B.Tech.

(AS-106) Physics-II

Date	: 12/05/2010	Timing	:	3 h
Academic Year	: 2009- 10	Max. marks	:	50

Spring Semester

Instructions:

1.All questions are compulsory

2.Figures to the right indicate full marks

3. Cell phones are prohibited, the handset will be retained permanently by exam cell.

Q.1. a) Discuss the effect of temperature on position Fermi level in extrinsic semiconductor. [4]

b) A rocket ship is 100 metre long on the ground. When it is in flight, its length is 99 metres to an observer on the ground. What is its speed? [3]

c) Explain the working and principle of scintillation counter. [3]

OR

c) A G.M counter wire collects 10^8 electrons per discharge when the counting rate is 500 counts per min. What will be the average current in the circuit? [3]

Q.2. a) State the fundamental postulates of the special theory of relativity and deduce the Galilean transformation for space, velocity and time coordinates. [4]

b) Explain origin of contineous and characteristic X-rays [3]

OR

b) Explain how interplaner spacing can be determined using powder photograph method. [3]

c) The susceptibility of paramagnetic $FeCl_3$ is 3.7×10^{-3} at 27^0C. What will be the value of its relative permeability μ_r at 200^0 K and 500^0 K? [3]

Q.3 a) Consider a two particle system. Assume that three states a, b, and c, e.g., the first three energy levels of a particle in a one–dimensional box, are available to each particle. What are the possible states of the system when the particles are (a) Bosons (b) Fermions and (c) Classical. [3]

b)Derive four factor formula. [4]

c) Consider a single particle enclosed in a square of side L. Calculate the number

of microstates available to this system if the total energy of the system is between U and (U+ΔU). [3]

OR

c) In a betatron, the maximum magnetic field traversing in an electron orbit is 0.8 Wb/m^2. The operating frequency of it is 50 Hz and the stable orbit diameter is 0.8 m. Calculate the number of revolutions and the final energy of the electron assuming maximum possible time for acceleration. [3]

Q.4. a) Discuss any four properties of superconductor. [4]

b) Explain the concept of phase space in one dimension and extend this idea to three dimensions. [3]

c) Describe in brief about nanoparticles and their properties. [3]

OR

c) With neat labelled diagram explain the working of Scanning Electron Microscope [3]

Q. 5. a) Deduce an expression for length contraction and time dilation [4]

b) In a Hall effect experimental set up, a sample of n-type Ge has the donor density of 10^{21} $/m^3$. Find the Hall voltage developed if the magnetic field used is 0.6 Tesla, given that current density is 500 Amp/m^2 and width of the sample is 5mm. [3]

OR

b) Derive expression for Q-value of a nuclear reaction. [3]

c) Derive an expression for energy loss under a B-H curve. [3]