22-23/12453

M.Sc. 1st Semester Examination-2022-23

PHYSICS

Course ID : 12453 **Course Code : PHYS/103C**

Course Title : Solid State Physics–I & Electronics–I

Time : 2 Hours *Full Marks : 40*

The figures in the right hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Unit–I

1. Answer any three of the following : 2×3=6

   (a) What is 'zero-dimentional' defect ?

   (b) Evaluate nearest neighbour distance of FCC structure in terms of atomic radius.

   (c) What is exchange interaction in ferromagnetism ?

   (d) Define the reciprocal lattice vectors specifying all the symbols.

   (e) Define Brillouin Zone and write its importance.

2. Answer any *two* of the following : 4×2=8

(a) Explain and represent the crystal structure of HCP lattice.

(b) Establish the Bragg's diffraction law from the Laue's law of diffraction.

(c) State Lennard-Jones potential for a Van-der walls gas explaining the terms. Find the condition for minimum potential energy from Lennard-Jones potential.

(d) Write down the dispersion relation for a monoatomic lattice and draw the dispersion relation.

3. Answer any *one* of the following : 6×1=6

(a) State and explain the Schottky defect and Frenkel defect. How does the Schottky defect concentration changes with temperature ?

(b) Give a comparative discussion between X-ray diffraction, electron diffraction and neutron diffraction.

Unit–II

4. Answer any *three* of the following : 2×3=6

(a) What do you mean by CMRR of an opamp ? Explain.

(b) Write down the expression of width of the depletion region of a pn-junction semiconductor.

(c) Explain the term 'depletion capacitance' of a pn-junction semiconductor.

(d) What do you mean by junction breakdown ?

(e) Draw the graph of charge density across the junction of a pn-junction semiconductor and explain.

5. Answer any *two* of the following : 4×2=8

(a) Derive the expression of electric field in the depletion region of an unbiased pn-junction semiconductor.

(b) Draw the h-parameter equivalent circuit of a transistor. Explain it.

(c) Derive the following for a two port transistor network circuit using hybrid parameters :

(i) Current Gain,

(ii) Voltage gain,

(iii) Input Resistance.

(d) What is filter ? Why active filters are necessary ? Explain. 1+1+2

6. Answer any *one* of the following : 6×1=6

(a) Discuss the following :

(i) Tunnel Diode,

(ii) Feedback in Oscillators. 3+3

(b) Design and analyze the following using Op-Amps with proper diagram :

(i) Differentiator amplifier,

(ii) Subtractor amplifier. 3+3

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