62134

Reg. No.

IV Semester M.Sc. Degree Examination, September/October - 2022

PHYSICS

Condensed Matter Physics I (Elective)

(CBCS 2020-21 Scheme)

Paper : 403b

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

Answer **all** questions.

PART-A

1. a) What is Bloch function? Discuss the Kroning-Penney model for energy bands in solids.

    b) Discuss de Hass-van Alphen effect. **(10+5)**

(OR)

2. a) An insulator has an optical absorption which occurs for all wavelengths shorter than $1800 \, A°$. Find the width of the forbidden energy band for this insulator.

    b) Describe the Anomalous skin effect for determining the Fermi surface of a copper. **(5)**

3. a) Discuss the concept of Brillouin zones as applicable to one-dimensional monatomic lattice. **(10)**

    b) Derive Debye's formula for the specific heat of solids. Comment on the result at low temperature. **(5+10)**

(OR)

4. a) Derive vibrational modes of a diatomic linear lattice. Name the different branches of the dispersion relation curve.

    b) Discuss the limitations of Einstein theory of lattice specific heat. **(10+5)**

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5. a) Explain photovoltaic effect.

b) Describe the analysis of elastic compliance and stiffness constants in a cubic crystal.

(5+10)

(OR)

6. a) What is photoconductivity? Explain two of its applications.

b) Explain with neat diagram, the experimental determination of elastic constants using ultrasonic interferometer for solids. **(5+10)**

PART-B

7. **Answer any Five of the following.** **(5×5=25)**

a) Explain the concept of effective mass of electron.

b) The Fermi energy of copper is 7eV. Calculate i) The Fermi momentum of electrons in copper and ii) the de-Broglie wavelength of electron.

c) Discuss group velocity of harmonic wave train.

d) What are the short comings of Einstein's theory?

e) Calculate the number of photons from green light of mercury $\left(\lambda=4961A^\circ\right)$ to do one joule of work.

f) Discuss the behavior of elastic waves in [110] direction.