A–088

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MSCPH–506

M.Sc. PHYSICS (MSCPH)

(Condensed Matter Physics)

2nd Semester Examination, 2024 (June)

Time : 2:00 Hrs. Max. Marks : 70

Note* :–** This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

(Long Answer Type Questions) 2×19=38

***Note* :–** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. Explain the structure of hexagonal closed pack (hep). Obtain the c/a ratio of hep crystal structure and packing fraction.

2. What are phonons ? Explain the normal modes of vibration.

3. Discuss Langevin's theory of diamagnetism. Derive an expression for the change of magnetic moment.

4. What is electrostatic screening ? Define polaritons.

5. Explain Josephson Effect in detail.

Section–B

(Short Answer Type Questions) 4×8=32

***Note* :–** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Give the name and example of 7 types of crystal structure.

2. What are Brillouin zones ?

3. Explain the origin of hydrogen bond. What is the difference between primary and secondary bonds ?

4. What are colour centers ? Explain the F centers in ionic bonds.

5. What is the meaning of anharmonicity in crystals ?

6. Define Fermi energy. How does Fermi energy depend upon temperature ?

7. A valance electron in a crystal absorbs a photon of wavelength $\lambda = 0.300$ nm and this is just enough energy to allow the electron to jump from the valance band to conduction band. What will be the size of energy gap ?

8. A Ge crystal is doped with 10^{14} donor atoms/cm^3. Assuming that all the donors are ionized determine the resistivity of the doped sample.

($\mu_e = 0.39$ m^2/Vs)

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