GIET UNIVERSITY, GUNUPUR – 765022

M. Sc. (Second Semester) Examinations, September – 2021

20PHPC203 - Basic Solid State Physics

(Physics)

Time: 2 hrs   Maximum: 50 Marks

(The figures in the right hand margin indicate marks.)
PART – A

Q.1. Answer *ALL* questions   **(2 x 10 = 20 Marks)**

a. What are the characteristics of covalent bond?

b. Give Fermi-Dirac distribution function. Plot it as function of energy.

c. What is dispersion relation?

d. Define density of state.

e. Write the failure of free electron model.

f. Give an account of the reduced zone in a periodic potential.

g. Describe spontaneous polarisation of a ferroelectric material.

h. Discuss frequency dependence of dipolar polarizability.

i. What are crystal defects?

j. Draw the energy level diagram indicating conduction band, valence band, fermi level, and acceptor level of a p-type semiconductor.

PART – B   (6 x 5 = 30 Marks)

Answer *ANY FIVE* the questions   Marks

2. Discuss lattice dynamics of a diatomic lattice and explain what are acoustic and optical phonons.   (6)

3. Assume that the inter atomic forces between two atoms is given by the following function of the distance r between the centres of the particles $F(r) = \frac{A}{r^m} + \frac{B}{r^n}$ with n>m   (6)

    (a)Discuss the significance of the two terms with suitable graph.

    (b)Obtain an expression for the interaction energy and explain with suitable graphs, the variation of this energy with atomic spacing.

4. Describe the Hall effect. Explain how the measurement of Hall coefficient's helps one to determine the mobility of electrons in metals.   (6)

5. What is extrinsic semiconductor? Discuss the variation of the Fermi level with temperature for an n-type semiconductor.   (6)

6. Discuss the Kronig – Penny model for the motion of an electron in a periodic potential.   (6)

7. Write a short note on Clausius – Mossotti relation.   (6)

8. Deduce expressions for the densities of free electrons and holes in an intrinsic semiconductor.   (6)

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