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PG CBCS
M.Sc. Semester-III Examination 2020
PHYSICS
PAPER: PHS 303A

Full Marks: 40

Time: 2 Hours

Write the answer for each unit in separate sheet

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.

303A: Solid State Physics-I

Marks: 40

Answer any four questions of the following:

$$10 \times 4 = 40$$

1. Explain the origin of energy gap in solid on the basis of nearly free electron model. Estimate and plot the first four bands in a simple cubic alloy along [100] and [110] direction according to empty lattice approximation. 6+4
 2. Assuming a simple cubic lattice find the energy dispersion relation of electron according to tight binding approximation in [111] direction. Find also the band-width. 10
 3. What is the significance of LST relation? Write short notes on
 - i. Polaron
 - ii. Polariton6+2+2
 4. Show on the basis of Kramer's Kronig relation how the real part and imaginary part of a complex function can be correlated. What do you mean by reduced zone scheme and periodic zone scheme? 6+4
 5. Explain De Hass Van Alphen effect. Find an expression of luminescence intensity corresponding to thermo luminescence in a solid. 4+6
 6. What do you mean by ferroelectric transition? Show in detail the characteristics of ferroelectric transition in BaTiO_3 crystal. 2+8
 7. Derive the expression of diffusion coefficient in an ionic crystal. Find an expression of elastic energy of the crystal per unit length of screw dislocation. 5+5
 8. Describe in detail Raman effect in solids. Derive the energy dispersion relation for Frenkel exciton in solids. 5+5
 9. Explain how you will determine experimentally the area of Fermi surface using the principle of De Hass Van Alphen effect. What do you mean by polarization catastrophe? Discuss about Tight Binding Model. 3+2+5

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10. Distinguish luminescent and non-luminescent solids. Clearly explain ionic polarization and hence find an expression of dielectric constant when an ac field is applied. Find an expression of plasma oscillation frequency assuming electromagnetic wave falling in a metal. 3+4+3
