

**M.Sc. (Physics) Semester - 2 (CBCS) Examination**  
**August/September -2020 [NEW COURSE]**  
**Solid State Physics (CORE)**

Time: 2:00 Hours

Marks: 56

**Instructions:**

1. Figure to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any four of the following questions.

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|-----------|-----------------------------------------------------------------------------------------------|-----------|
| <b>1.</b> | Answer in brief any <b>seven</b> :                                                            | <b>14</b> |
|           | (a) Define single crystalline and polycrystalline states of materials.                        | 02        |
|           | (b) Draw $(100)$ and $(101)$ planes in simple cubic crystal.                                  | 02        |
|           | (c) What are the point defects in solids?                                                     | 02        |
|           | (d) Draw the resistance vs. temperature plots for metals and insulators.                      | 02        |
|           | (e) Define penetration depth ( $\lambda$ ) and coherence length ( $\xi$ ) in superconductors. | 02        |
|           | (f) Give any three applications of superconductors.                                           | 02        |
|           | (g) Draw the spin arrangements for paramagnetic and ferromagnetic materials.                  | 02        |
|           | (h) What is quenching effect for orbital moments?                                             | 02        |
|           | (i) Explain in brief the Slater's criteria.                                                   | 02        |
|           | (j) What are ferromagnetic domains?                                                           | 02        |
| <b>2.</b> | Answer any <b>two</b> of following questions:                                                 | <b>14</b> |
|           | (a) Describe in detail the X-ray, neutron and electron diffraction techniques.                | 07        |
|           | (b) Write a note on reciprocal lattice. Comment on its significance?                          | 07        |
|           | (c) Describe in detail the vacancy defects in solids.                                         | 07        |
| <b>3.</b> | Answer of the following questions:                                                            | <b>14</b> |
|           | (a) Write a note on Langevin's classical theory of paramagnetism.                             | 07        |
|           | (b) Discuss in detail the paramagnetism of rare earth ions and iron group ions.               | 07        |

**OR**

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|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|           | (a) Discuss Heisenberg exchange integral and magnon for ferromagnetic materials.                                                                                | 07        |
|           | (b) Write notes on antiferromagnetic and ferrimagnetic materials.                                                                                               | 07        |
| <b>4.</b> | Answer any <b>two</b> of following questions:                                                                                                                   | <b>14</b> |
|           | (a) Prove mathematically, the Bloch theorem for periodic Potentials. Using Kronig-Penney model, explain the formation of allowed and forbidden bands in solids. | 07        |
|           | (b) Explain in detail the tight binding approximation.                                                                                                          | 07        |
|           | (c) Discuss in detail the self interstitial in elemental solids. Write short notes on edge and screw dislocations.                                              | 07        |
| <b>5.</b> | Answer any <b>two</b> of following questions:                                                                                                                   | <b>14</b> |
|           | (a) Discuss in detail different five remarkable properties in the superconducting state.                                                                        | 07        |
|           | (b) Write a note on London equations for superconductivity. Provide the differences between type I and type II superconductors.                                 | 07        |
|           | (c) Write a note on BCS theory of superconductivity with its possible outcomes.                                                                                 | 07        |
|           | (d) Describe (i) single particle tunneling, (ii) Giaever tunneling and (iii) Josephson tunneling.                                                               | 07        |

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