

M.SC. INSTRUMENTATION SCIENCE FIRST YEAR SECOND SEMESTER EXAM- 2022

SUBJECT: MATERIAL SCIENCE-I

Time: 2 Hours

Full Marks: 40

Answer any four questions

1. Name various dielectric polarisation mechanisms. Show that $P = \epsilon_0 E(E_r - 1)$, where P is the polarization. What is meant by complex dielectric constant? Explain dielectric relaxation and loss angle. 10
2. Explain 'internal field' in a solid dielectric. Obtain Clausius-Mosotti formula of dielectric constant with microscopic polarisabilities. 10
3. What is orientational polarization? Derive an expression for the mean dipole moment when a polar material is subjected to an external electric field. What happens if the electric field is an alternating field with varying frequency? 10
4. Explain physical basis of different types of magnetism of a material. Derive an expression for the paramagnetic susceptibility of a substance according to free electron theory. How does paramagnetic susceptibility of a substance vary with temperature? 10
5. What is the value of magnetic dipole moment associated with a loop carrying current? What is Bohr magnetron? What is meant by hysteresis in magnetic material? What are hard and soft magnetic materials? 10
6. What is Curie point? What are ferromagnetic domains? Explain the reasons for strong ferromagnetic property found in iron, cobalt and nickel. 10