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PHS 553

Fourth Semester M.Sc. Degree Examination, Sept./Oct. 2022

(CBCS)

PHYSICS

Condensed Matter Physics – III

Time : 3 Hours

Max. Marks : 70

Instruction : Answer any four full questions, choosing one from each

Part (I – IV) and any two questions from Part – V.

PART – I

1. a) Describe the classical field theory of ferromagnetism and compare the results with experiment. **10**
b) Qualitatively describe the use of neutron diffraction for magnetic structure analysis. **5**
2. a) Explain the domain structure in ferromagnetic materials. **7**
b) Describe Ising model of ferromagnetism. **8**

PART – II

3. a) Describe the application of molecular field theory for antiferromagnetic arrangement of atomic moments. **10**
b) Write a note on spinels and garnets. **5**
4. a) Describe the molecular field theory of ferrimagnetism. **10**
b) Explain the formation of magnetic bubbles and give their important properties. **5**

PART – III

5. a) Describe the paramagnetic susceptibility in an alternating magnetic field. **8**
b) Explain the construction and working of ESR spectrometer. **7**
6. a) Obtain Bloch equations and introduce the concept of relaxation times. **7**
b) Give the basic principle of NMR and explain NMR spectrometer. **8**

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PART – IV

7. a) Describe mechanical attrition, lithography and methods of synthesis of nanomaterials. **9**
- b) Explain the Metal-Organic Chemical Vapor Deposition (MOCVD) method. **6**
8. a) What are surfactants ? Explain the size-controlled synthesis of nanoparticles using surfactants. **8**
- b) Explain the synthesis of nanomaterials by nanolithography and soft lithography using scanning probe methods. **7**

PART – V

9. Answer **any two** questions from the following :
- a) State and explain Bloch $T^{3/2}$ law. **5**
- b) Explain the meaning of indirect exchange interaction in anti-ferromagnetic material. **5**
- c) Explain spin-lattice relaxation in a two-level system. **5**
- d) Give the general applications of nanomaterials. **5**
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