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MSH 551

**IV Semester M.Sc. Degree Examination, September/October 2022
(CBCS)**

MATERIALS SCIENCE

Magnetic Materials and Magnetic Resonance

Time : 3 Hours

Max. Marks : 70

Instructions : 1) *Scientific calculator may be **allowed**.*
2) *Answer **all** questions.*

1. a) Give the Langevins theory of diamagnetic susceptibility. What type of materials are expected to be diamagnetic ?
b) Describe the principle of Gouy balance method used to determine magnetic susceptibility. **(14+6)**

OR

2. a) Discuss the various contributions to magnetic moment of an atom.
b) Explain with an example how P_{eff} can be calculated. **(14+6)**
3. a) Give an account of Heisenberg exchange interaction and connect the exchange integral to the ferromagnetic Curie temperature.
b) Give some prominent examples and their areas of application with justification, for
i) Hard and
ii) Soft magnetic materials. **(12+8)**

OR

4. a) On the basis of 'two-sub lattice model explain the behavior of an antiferromagnetic material and show that like interactions are also antiferromagnetic.
b) Write a note on the role of neutron diffraction in the analysis of structure of antiferromagnetic materials. **(14+6)**
5. a) Describe the basic principles involved in
i) NMR
ii) ESR
b) Discuss some important areas of application of NMR. **(12+8)**

OR

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6. a) Obtain an expression for the rate of energy absorption in nuclear magnetic resonance and explain the role of spin-lattice relaxation.
- b) Explain the principle involved in Mossbauer spectroscopy. **(14+6)**
7. Answer the following questions. **(2×5=10)**
- a) Give the symbolic spin structures in para, ferro, antiferro and ferri magnetic materials.
- b) Mention two Heusler alloys and give their significance.
- c) What are the two factors leading to energy loss in transformers ? Indicate how to minimize them.
- d) Can NMR be observed from a nuclei with $I = 0$? Why ?
- e) Explain how neutron has a magnetic moment, even though it does not possess electric charge.
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