MANIPAL
ACADEMY of HIGHER EDUCATION
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Reg. No. | | | | | | | | | | |

DEPARTMENT OF SCIENCES, IV SEMESTER M.Sc(Physics)

END SEMESTER EXAMINATIONS, MAY 2022

CONDENSED MATTER PHYSICS - II [PHY 6011]

(CHOICE-BASED CREDIT SYSTEM-2020)

Time: 3 Hours Date:06-05-2022 MAX. MARKS: 50

Note: (i) Answer ALL questions.

(ii) Missing data may be suitably assumed.

1A. Derive an expression for dipolar polarizability. 5

1B. Derive classical Langevin equation for diamagnetic susceptibility. 5

2A. The polarizability of NH_3 molecule is found experimentally by the measurement of dielectric constant as 2.42×10^{-39} Fm^2 at 309K and 1.74×10^{-39} Fm^2 at 448K respectively. Calculate for each temperature the polarizability due to permanent dipole moment and due to deformation of molecules. 4

2B. Explain the entropy of superconducting state. Show that the superconducting state is more ordered than the normal state. 4

2C. A paramagnetic material has 10^{28} atoms/m^3. The magnetic moment of each atom is 1.8×10^{-23} Am^2. Calculate the paramagnetic susceptibility at room temperature (300K). If a bar magnet of 0.1m long and 1cm^2 cross sectional area constructed from this material is placed in a magnetic field of 8×10^4 A/m, determine its dipole moment. 2

3A. What are soft and hard superconductors? Calculate the critical current for a superconducting wire of Lead having a diameter of 1 mm at 4.2 K. The critical temperature for Lead is 7.18 K and the critical field at 0 K is 6.5×10^4 A/m. 4

3B. Explain the kinetic theories of glass formation. 6

4A.	What are ceramics and composites? Explain	5
4B.	Explain the 'number average' and 'weight average' molecular weight of polymers. Compute the number-average degree of polymerization for polypropylene $(C_3H_6)_n$, given that the number average molecular weight is 1,000,000 g/mol. Molecular weight of C is 12.01 g/mol and H is 1.008 g/mol.	5
5A.	Describe thermotropic liquid crystals.	5
5B.	Using X-ray diffraction set up how the energy of the characteristic X-ray lines is determined through the glancing angle position of their various orders of diffraction? Explain.	5

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