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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
MID SEMESTER EXAMINATION-MARCH 2015
B.Tech VI Semester (CSE,ECE,IT)

COURSE CODE: 10B11PH611 MAX. MARKS: 30
COURSE NAME: MATERIALS SCIENCE
COURSE CREDITS: 04 MAX. TIME: 2 HRS

Note: Read the instructions for every section. Attempt all questions in order.

Section A **(Marks: 6×1=6)**

I ***Attempt any six questions in this section***

1. What is meant by local field in a solid dielectric?
2. How you can control the dielectric loss?
3. How does the dielectric constant at optical frequencies vary *w.r.t.* the static dielectric constant?
4. Where can you use the spontaneous polarization in context to dielectrics?
5. Analyze the variation of Maxwell field in comparison to the local field in a dielectric?
6. Calculate the degree of polymerization if polyethylene $(C_2H_4)_n$ has molecular weight 56000 g/mol.
7. How thermosetting polymers are different from thermoplastic polymers?

Section B **(Marks: 3×3=9)**

Attempt any three questions in this section

II Calculate the total polarizability and relative permittivity of carbon dioxide if its electric susceptibility is 0.985×10^{-3}. Given the density of carbon dioxide = 1.977 kg/m^3. Also calculate the dipole moment for an applied electric field of 10^6 V/m.

III On being polarized, an oxygen atom produces a dipole moment of 0.5×10^{-22} C-m. If the distance of the centre of the negative charge cloud from the nucleus is 4×10^{-17}m, calculate the polarizability of the oxygen atom.

IV Ammonium chloride gas has dielectric constant ε_r=1.0083 at 0°C & ε_r=1.0049 at 100 °C. The number of molecules per unit volume = 2.7×10^{25}/m^3. Calculate the permanent dipole moment of ammonium chloride.

V Polyethylene sample containing 4000 chains with molecular weights between 1000 and 4000 g/mol, 8000 chains with molecular weights between 6000 and 9000 g/mol, 7000 chains with molecular weights between 10000 and 15000 g/mol, 2000 chains with molecular weights between 15000 and 20000 g/mol. Determine both number and weight average molecular weights and hence the polydispersity index.

Section C **(Marks: 5×3=15)**

All questions are compulsory in this section

VI Show that the dielectric constant of a polar molecule varies inversely as the first power of temperature.

VII Derive a relation between electric susceptibility and atomic polarizability on the basis of microscopic description of dielectric at atomic level.

VIII Using local field correlate the dielectric constant and polarizability.

IX Derive a relation between induced dipole moment and applied electric field taking into account the alternating field for electronic polarization.

X Write short notes on (a) Number average molecular weight;(b)Weight average molecular weight; (c)Refractory behavior of materials.