Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[4857]-1032

S.E. (Electrical) (First Semester) EXAMINATION, 2015

MATERIAL SCIENCE

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***Physical Constants* :—**

(1) Angstrom Unit (AU) = 1×10^{-10} metres.

(2) Boltzmann's Constant (k) = 1.380×10^{-23} joule.degree^{-1}.

(3) Charge on Electron (e) = 1.601×10^{-19} coulomb.

(4) Mass of Electron (m) = 9.107×10^{-31} kg.

(5) Electron volt (eV) = 1.602×10^{-19} joules.

(6) Mass of Proton (m_p) = 1.627×10^{-27} kg.

(7) Velocity of light (c) = 2.998×10^{8} m/sec.

(8) Dielectric Constant of free space (ε_0) = 8.854×10^{-12} F/m.

(9) Permeability of free space (μ_0) = $4\pi \times 10^{-7}$ H/m.

(10) Debye Unit = 3.33×10^{-30} coulomb. metre.

1. (a) In case of dielectric materials, define electric dipole moment, polarization and polarizability along with their units. [6]

(b) Explain the various factors that affect the breakdown in liquid insulating material. [6]

P.T.O.

Or

2. (*a*) The relative permittivity of a parallel plate capacitor of 3 microfarad is 150. For an applied voltage of 1200 V, find the energy stored in the capacitor as well as energy stored in polarizing the dielectric. [6]

(*b*) State the properties and applications of : [6]

(*i*) Paper

(*ii*) Air.

3. (*a*) In a material an application of magnetic field of 3×10^6 A/m causes a magnetic flux density of 0.3 Wb/m^2. Calculate its permeability, susceptibility and magnetization. [6]

(*b*) Write notes on : [7]

(*i*) Thermocouple

(*ii*) Thermal Bimetal.

Or

4. (*a*) What do you mean by Curie temperature ? Explain the behaviour of ferromagnetic material under Curie temperature. Hence draw hysteresis loop for ferromagnetic material and define residual flux density and magnetic field strength. [7]

(*b*) The resistivity of copper at 300°K is 1.56×10^{-8} Ωm. With 4 atomic percent nickel, the resistivity of alloy of copper-nickel becomes 4.06×10^{-8} Ωm. With 3 atomic percent silver, the resistivity of alloy of copper-silver becomes 1.98×10^{-8} Ωm. What will be the resistivity of alloy of copper for 2 atomic percent of nickel and 2 atomic percent of silver at 300°K ? [6]

5. (*a*) What are carbon nano tubes ? Discuss their electrical and mechanical properties. [6]

(*b*) What do you mean by Single Electron Transistor (SET) ? [6]

Or

6. (*a*) Discuss briefly, the energy bands in conductors, semiconductors and insulators. [6]

(*b*) Write a short note on molecular machines. [6]

7. (*a*) Describe measurement of dielectric strength of solid insulating material with reference to IS 2584. [7]

(*b*) Describe different tests to be carried out on High Voltage (HV) cables. [6]

Or

8. (*a*) Describe in detail the procedure for measurement of dielectric strength of air as per relevant IS code practice. [7]

(*b*) How will you test transformer oil ? Explain it with a neat diagram of test setup. [6]