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S.E. (Electrical) (I Sem.) EXAMINATION, 2018

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

Q.1 a) Write note on Dielectric loss and loss tangent ($\tan \delta$). (6)

b) Explain the various factors that affect the breakdown in solid insulating material. (6)

OR

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

b) Explain properties of insulating materials used for capacitor. (6)

Q.3 a) In a material an application of magnetic field of 275×10^4 A/m causes a magnetic flux density of 0.22 Wb/m². Calculate its permeability, susceptibility & magnetization. (6)

b) Write note on Materials used for lamp filament and fuses. (7)

P.T.O.

OR

Q.4 a) Derive Curie –Weiss law for magnetic materials. (7)

b) A filament of a 230V, 60W lamp is to be manufactured. The temperature of the filament is to be 2700° at 60W dissipation. Resistivity of the filament material at 20°C is 4.3×10^{-6} ohm-cm and $\alpha_{20} = 0.005/^{\circ}C$. Calculate the length of the filament at 20°C if its diameter at 20°C is 0.028 mm. (6)

Q.5 a) What do you mean by Single Electron Transistor (SET)? (6)

b) Write a short note on C₆₀. (6)

OR

Q.6 a) Discuss briefly, the energy bands in conductors and insulators. (5)

b) What are carbon nanostructures and carbon clusters? (7)

Q.7 a) Describe a method to determine the flux density by using Gauss meter. (7)

b) Describe measurement of dielectric strength of solid insulating material with reference to IS 2584. (6)

OR

Q.8 a) How will you test transformer oil? Explain it, with a neat diagram of test setup. (7)

b) Describe the different tests to be carried out on high voltage cables as per relevant IS code practice. (6)