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[5057]-2033

S.E. (Electrical) (I Sem.) EXAMINATION, 2016

MATERIAL SCIENCE

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Figures to the right indicate full marks.

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) Derive Clausius-Mossotti relation as applied to dielectric materials in static field. State clearly the assumptions made. [6]

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- (b) State the properties and applications of : [6]
- (i) Ceramics
 - (ii) Transformer oil.

Or

2. (a) Write short note on fibre optics with its principle of working. State clearly materials used for fibre optics. [6]
- (b) Explain various factors which affect breakdown in liquid insulating materials. [6]
3. (a) Define with units : [6]
- (i) Magnetic dipole moment
 - (ii) Magnetization
 - (iii) Magnetic susceptibility.
- (b) A filament of a 230 V lamp is to be drawn from a wire of having a diameter of 0.025 mm and resistivity at 25°C is $5.65 \times 10^{-6} \Omega\text{-cm}$. If the resistance temperature coefficient at 25°C is $5 \times 10^{-3}/^\circ\text{C}$. Calculate the length of the filament to dissipate 40 W at filament temperature of at 3000°C. [6]

Or

4. (a) Differentiate between hard and soft magnetic materials. [6]

- (b) Describe properties and applications of Nichrome and Brass. [6]
5. (a) Describe with neat diagrams : [8]
- (i) Nano wires
 - (ii) Carbon clusters.
- (b) What are different types of batteries used in electric vehicles ? Write their properties. [5]

Or

6. (a) Explain with neat diagram — Single Electron Transistor (SET). [7]
- (b) Explain with neat diagram, chemical reaction and applications of : [6]
- (i) Lead acid battery
 - (ii) Nickel Cadmium Battery.
7. (a) Explain the method of finding dielectric strength of air using sphere gap voltmeter with a neat diagram as per IS 2584. [7]
- (b) With neat sketch, explain how flux density is measured with the help of Gauss-meter. [6]

Or

8. (a) Explain the step by step method of finding dielectric strength of transformer oil with a neat diagram as per IS 6798. [6]
- (b) With neat circuit diagram and phasor diagram, explain measurement of dielectric loss angle ($\tan \delta$) by Schering Bridge as per IS 13585-1994. [7]