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[5459]-152

**S.E. (Electrical) (I Semester) EXAMINATION, 2018**

**MATERIAL SCIENCE**

**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

**Physical Constants :**

1. Angstrom Unit(AU) =  $1 \times 10^{-10}$  metres
2. Boltzmann's Constant (k) =  $1.380 \times 10^{-23}$  joule.degree<sup>-1</sup>
3. Charge on Electron (e) =  $1.601 \times 10^{-19}$  coulomb
4. Mass of Electron (m) =  $9.107 \times 10^{-31}$  kg
5. Electron volt (eV) =  $1.602 \times 10^{-19}$  joules
6. Mass of Proton (m<sub>p</sub>) =  $1.627 \times 10^{-27}$  kg
7. Velocity of light (c) =  $2.998 \times 10^8$  m/sec
8. Dielectric Constant of free space ( $\epsilon_0$ ) =  $8.854 \times 10^{-12}$  F/m
9. Permeability of free space ( $\mu_0$ ) =  $4\pi \times 10^{-7}$  H/m
10. Debye Unit =  $3.33 \times 10^{-30}$  coulomb.metre

1. (a) Write short note on fibre optics along with materials used and its applications. [6]

P.T.O.

- (b) What is the difference between dielectric material and insulating material ? Hence write the properties and applications of – Air and Pressboard. [6]

Or

2. (a) Derive Clausius - Mossotti relation as applied to dielectric materials in static field. State clearly the assumptions made. [6]
- (b) Classify the solid insulating materials as per their ability to withstand temperatures. Explain properties and applications of any *two* solid insulating materials. [6]
3. (a) Differentiate between : [6]
- (i) Ferromagnetism and Antiferromagnetism
  - (ii) Soft Magnetic Materials and Hard Magnetic Materials.
- (b) Describe properties and applications of any *two* materials of the following : [6]
- (i) Copper
  - (ii) Constantan
  - (iii) Brass

Or

4. (a) Write short note on laser and magnetic strip technology. [6]
- (b) The resistivity of copper at 300°K is  $1.56 \times 10^{-8} \Omega\text{m}$ . With 2 atomic percent nickel, the resistivity of alloy of copper - nickel becomes  $4.06 \times 10^{-8} \Omega\text{m}$ . With 3 atomic percent

silver, the resistivity of alloy of copper-silver becomes  $1.98 \times 10^{-8} \Omega\text{m}$ . What will be the resistivity of alloy of copper for 4 atomic percent of nickel and 3 atomic percent of silver at  $300^\circ\text{K}$  ? [6]

5. (a) Explain State Of Charge (SOC), Depth Of Discharge (DOD), energy density, power density in case of batteries. [8]
- (b) Explain with neat diagram Single Electron Transistor. [5]

Or

6. (a) Explain with neat diagram, chemical reaction and applications of : [6]
- (i) ZEBRA Battery
- (ii) Nickel Cadmium Battery.
- (b) Describe with neat diagrams : [7]
- (i) Molecular Machines
- (ii) Nano wires

7. (a) With neat sketch, explain how flux density is measured with the help of Gauss meter. [6]
- (b) Enlist the apparatus along with the specifications to find the dielectric strength of transformer oil with a neat diagram. As per IS, what should be the gap spacing between the two electrodes ? [7]

Or

8. (a) With neat circuit diagram and phasor diagram, explain measurement of dielectric loss angle ( $\tan \delta$ ) by Schering Bridge as per IS 13585-1994. [6]
- (b) Enlist the apparatus along with the specifications to find the dielectric strength of solid insulating material with a neat diagram. Which materials have you tested in your High Voltage laboratory ? What was the material used for the electrodes ? [7]