Total No. of Questions—8]

Seat No.

[5152]-544

S.E. (Electrical) (I Sem.) EXAMINATION, 2017
MATERIAL SCIENCE
(2015 PATTERN)

Time : Two Hours   Maximum Marks : 50

Physical Constants :—

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

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

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

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

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

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

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

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

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

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

SECTION I

1.   (*a*)   Write short note on Polar and Non-Polar dielectric materials with examples.   [6]

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

        (*i*)   Pressboard

        (*ii*)   Varnish.

2. (*a*) What are different mechanisms of polarization ? Explain any *two* with diagram. [6]

(*b*) Explain various factors which affect breakdown in solid insulating materials. [6]

3. (*a*) What do you mean by spontaneous magnetization ? Hence derive Curie-Weiss law for ferromagnetic materials. [6]

(*b*) Write materials used for Super-capacitors, Solders and Super Conductors. [6]

Or

4. (*a*) In a magnetic material, an application of a magnetic field of 3×10^5 A/m results into a flux density of 1.2 tesla. Calculate its permeability, susceptibility & magnetisation. [6]

(*b*) Describe properties and applications of Kanthal and Bronze. [6]

5. (*a*) Describe with neat diagrams : [8]

(*i*) Molecular Machines

(*ii*) Single Electron transistor

(*b*) What are different types of batteries used in electric hybrid vehicles ? Write their properties. [5]

<div align="center">*Or*</div>

6. (*a*) Explain with neat diagram – BN Nanotubes. [7]

(*b*) Explain with neat diagram, chemical reaction and applications of : [6]

   (*i*) Lithium-ion

   (*ii*) Sodium-Sulphur.

7. (*a*) With neat circuit diagram & phasor diagram, explain measurement of dielectric loss angle (tan δ) by Schering Bridge as per IS 13585-1994. [7]

(*b*) With neat sketch, explain how flux density is measured with the help of Gauss meter. [6]

<div align="center">*Or*</div>

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*) Explain the method of finding dielectric strength of air using sphere gap voltmeter with a neat diagram as per IS 2584. [7]