

B.E.T.C.E Examination 2017(Old)
(2nd year, 2nd Semester)

MATERIAL SCIENCE

The figures in margin indicate full marks. All the questions must be answered in one place. The answers should be precise.

Answer any five questions and all carry equal marks

Full Marks:100

Time: Three hours

- Q.1 (a) Give the variation of electronic charge distribution of Hydrogen atom predicted by the Cloud model and explain it. 10
- (b) Clearly differentiate among crystalline, polycrystalline and amorphous materials. What is Domain?. 5
- (c) Differentiate between primary and secondary chemical bonding. Give examples. 5
- Q.2 (a) Explain how the dielectric properties are linked with molecular structures, mechanical and optical properties. 10
- (b) What is the origin of permanent dipole moment in a material? How is it responsible for temperature dependence? Explain it. 6
- (c) How do you measure dielectric constant of a solid material? Briefly describe the technique. 4
- Q.3 (a) Describe the dielectric properties of elemental dielectric materials. Define static and optical dielectric constants. How do you determine them.? 8

- (b) What is interpretation of the following
- (i) Loss tangent,
 - (ii) Imaginary part of dielectric constant? 6
- (c) (i) Give two examples of Ferroelectric materials
- (ii) Sketch the structure of BaTiO₃,
 - (iii) Explain the electrostriction. 6
- Q.4 (a) Explain the dielectric losses in radiofrequency. Explain why the orientational polarisation vanishes at radiofrequency. 8
- (b) Derive the Clausius Masotti equation for AC field. 6
 - (c) Obtain energy loss in condenser with lossy dielectric. 6
- Q.5 (a) Give the classifications of magnetic materials and provide two examples of each type of Material. 6
- (b) Define magnetic dipole moment and obtain its expression for a current loop. Obtain a relation of magnetisation in terms of magnetic field intensity. What is its importance? 10
 - (c) Discuss paramagnetism. 4
- Q.6 (a) What is Neel Temperature? Discuss the behaviour of anti ferromagnetic material above and below transition temperature. 10
- (b) Show that the diamagnetic susceptibility is very low and is of the order of 10^{-5} . 10
- Q.7 (a) Define the following
- (i) Ferromagnetic Curie Temperature
 - (ii) Differential permeability
 - (iii) Internal field constant 9

(b) Explain B-H curve for magnetism ϵ 6

(c) What is a ferrite material? Give the typical curie temperature of Fe. 5

Q.8 Write short notes on any four 5x4

(i) Schrodinger Equation

(ii) Ferroelectricity

(iii) Ionic polarisation

(iv) Chemical bonding

(v) Electrical hysteresis for ferroelectric effect