

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2053

Roll No.

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B. Tech.

(SEM. IV) THEORY EXAMINATION 2010-11
ELECTRICAL AND ELECTRONICS ENGG.
MATERIALS

Time : 3 Hours

Total Marks : 100

Note : Attempt **all** questions.

1. Attempt any **four** parts of the following : (4×5=20)
- (a) What is forbidden energy gap ? Classify insulators, semiconductors and conductors on the basis of energy band diagram.
 - (b) Describe briefly the basic seven crystal systems.
 - (c) Explain Bragg's Law. How it can be used to determine the lattice parameters ?
 - (d) Discuss briefly :
 - (i) Schottky defects and
 - (ii) Frenkel defects.
 - (e) Explain, space lattice and Atomic packing factor.
 - (f) Explain briefly :
 - (i) Body centred cubic structure (BCC)
 - (ii) Face centred cubic structure (FCC).

2. Attempt any **four** parts of the following : (4×5=20)
- (a) Explain the different factors which affect the resistivity of conducting materials ?
 - (b) What is superconductivity ? Discuss the effect of magnetic field on the superconductors.
 - (c) Derive an expression for heat developed in a current carrying conductor.
 - (d) Explain Seebeck, Peltier and Thomson effects.
 - (e) Explain briefly Sommerfeld theory and Zone theory of solids.
 - (f) A coil of copper wire has a resistance of 50 ohm at 20°C. Calculate its resistance at 60°C. Given the temperature coefficient of resistance at 0°C as 0.00427.
3. Attempt any **two** parts of the following : (2×10=20)
- (a) What is Hall Effect ? Derive the relation between Hall coefficient and carrier density.
 - (b) Describe the construction and working principle of FET. How does it differ from IGFET ?
 - (c) (i) Differentiate between intrinsic and extrinsic semiconductors.
(ii) Discuss in brief the effect of temperature on the conductivity of N-type or P-type materials.
4. Attempt any **two** parts of the following: (2×10=20)
- (a) Describe hysteresis loop of a magnetic material and explain residual magnetism and coercive force.

- (b) (i) Differentiate between soft and hard magnetic materials.
- (ii) Distinguish between diamagnetism, paramagnetisms and ferromagnetism.
- (c) Explain the following :
 - (i) Relative permeability
 - (ii) Magnetic susceptibility
 - (iii) Magnetostriction and
 - (iv) Magnetic anisotropy.

5. Attempt any **two** parts of the following : (2×10=20)

- (a) What is dielectric loss and loss angle ? How do the loss factor and dielectric constant vary with temperature and frequency of an alternating field ? Explain.
- (b) Describe various mechanisms of dielectric polarisation and derive an expression for electronic polarizability.
- (c) (i) A simple parallel plate condenser is to be made to store 10 μc at a potential of 10 kv. The separation between the plates is to be 5×10^{-9} m. Calculate the area that the plates must have if the dielectric material between the plates is of alumina of dielectric constant 10.
- (ii) Prove that the internal field due to polarization inside the dielectric is given by :

$$t^1 = E + \frac{P}{3\xi_0}$$