

Total No. of printed pages = 3

ECE 181404

Roll No. of candidate

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2023

B.Tech. 4th Semester End-Term Examination
Electronics and Communication Engineering
ELECTRICAL ENGINEERING MATERIALS

New Regulation (w.e.f. 2017-18) & New Syllabus (w.e.f. 2018-19)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *four* from the rest.

1. Answer the following: (10 × 1 = 10)
- (i) In order to obtain a high value for capacitance, the permittivity of the dielectric medium should be _____
- (a) High (b) Low
(c) Zero (d) Unity
- (ii) Which of the following has the negative temperature co-efficient?
- (a) Copper (b) Tungsten
(c) Germanium (d) Aluminium
- (iii) What is the magnetic susceptibility of superconductor?
- (a) +1 (b) -1
(c) 0 (d) Infinite
- (iv) If a diamagnetic substance is brought near the north or south pole of a bar magnet, it is:
- (a) Repelled by both the poles
(b) Repelled by the north pole and attracted by the south pole
(c) Attracted by the north pole and repelled by the north pole
(d) Attracted by both the poles

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- (v) Thermal conductivity is the rate of heat transfer
- (a) Per unit area per unit thickness
 - (b) Per unit area per unit temperature difference and per unit wall thickness
 - (c) Per unit area per unit temperature difference
 - (d) None of the above
- (vi) Drift current is due to
- (a) Applied electric field over a given distance
 - (b) Random motion of electrons
 - (c) Random motion of holes
 - (d) Recombination of holes and electrons
- (vii) In an indirect bandgap semiconductor, a transition between conduction band and valance band results in
- (a) heat
 - (b) light
 - (c) both
 - (d) none of the above
- (viii) The proton and the neutron are about _____ times heavier than the electron
- (a) 1480
 - (b) 1840
 - (c) 1.480
 - (d) 1.840
- (ix) _____ is referred for a superconductor
- (a) Paramagnetism
 - (b) Ferromagnetism
 - (c) Ferrimagnetism
 - (d) Diamagnetism
- (x) The type of impurity of Antimony for a semiconductor is _____
- (a) Monovalen
 - (b) Bivalent
 - (c) Trivalent
 - (d) Pentavalent

2. (a) Discuss the energy bands of metals, semiconductors and insulators. (5)
- (b) Differentiate the different types of crystal defects of semiconductors. (5)
- (c) Explain how collision between electrons affect the conductivity of a conductor. Draw its relation with temperature. (5)
3. (a) Enumerate the types of Dielectric Polarization. Explain anyone of it. (7)
- (b) Briefly explain the complex dielectric constant. (3)
- (c) List causes for degradation of insulators due to its ageing. (5)

4. (a) Briefly explain the three main types of magnetic materials. (6)
(b) "Superconductors may be considered perfect diamagnets." Explain. (4)
(c) State and derive the Curie-Weiss Law. (5)
5. (a) Explain the four major assumptions within the Drude model for electrical conductivity. (8)
(b) Estimate the mean free path and the relaxation time of electrons in copper. The number of copper ions per unit volume is 8.47×10^{22} ions/cm³, the radius of a copper ion is 10^{-10} m and the average speed is 1.1×10^5 m/s. (7)
6. (a) List the differences between the intrinsic and extrinsic semiconductors. (5)
(b) Derive the continuity equation. Give its significance. (7)
(c) Why effective mass of hole is greater than electron? (3)
7. Write short notes on (any three) : (3×5=15)
(a) Resistivity of semiconductors
(b) Polarizability
(c) Dielectric loss
(d) Diamagnetism.

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