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06EE754

Seventh Semester B.E. Degree Examination, December 2010

Electrical Engineering Materials

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Explain the factors affecting the electrical conductivity of metals. (06 Marks)

b. List the postulates of classical free electron theory for metallic conduction. (06 Marks)

c. Calculate the current produced in a small germanium plate of area 1 cm^2 and of thickness 0.3 mm when a potential difference of 2 volt is applied across the faces. Concentration of free electrons in germanium is 2×10^{19} per m^3 and mobility of electrons and holes are 0.36 m^2/v-s and 0.17 m^2/v-s respectively. Take $e = 1.6 \times 10^{-19}$ coulomb. (04 Marks)

d. The resistivity of pure copper is 1.56 micro-ohm-cm. An alloy of copper containing 1 atomic percent nickel has a resistivity of 2.81 micro-ohm-cm. An alloy of copper containing 3 atomic percent silver has a resistivity of 1.98 micro-ohm-cm. What is the resistivity of an alloy containing 2 atomic percent nickel and 2atomic percent silver? (04 Marks)

2 a. Obtain the expression for the conductivity of an intrinsic semiconductor. (06 Marks)

b. A rectangular n-type germanium bar has a thickness of 2 mm. A current of 10 mA passes along the bar and a field of 0.1 Tesla is applied perpendicular to the current flow. The Hall voltage developed is 1 mV. Calculate the hall constant and electron density in the semiconductor. Find the Hall angle, assuming a mobility of 0.36 m^2/v-s for the carriers. (06 Marks)

c. Explain the classification of magnetic materials and give examples for each. (08 Marks)

3 a. Write the differences between hard and soft magnetic materials. (06 Marks)

b. Briefly explain the compound semiconductors. (06 Marks)

c. A parallel plate capacitor has an area of 8 cm^2, with a separation of 0.08 mm. The space is filled with polystyrene. The real part of the relative dielectric constant is 2.56 and the loss tangent is 0.7×10^{-4}, at a frequency of 1 MHz. Calculate the capacitance and the equivalent parallel loss resistance. (08 Marks)

4 a. Briefly explain gaseous insulators. (06 Marks)

b. Deduce the expression for loss tangent and brief its significance. (08 Marks)

c. The radius of the helium atom is about 0.55 $\mathring{A}$. Calculate the polarisability of helium and its relative permittivity. The number of helium atoms in a volume of one $metre^3$ is 2.7×10^{25} atoms. (06 Marks)

PART – B

5 a. Explain the following :
i) Cold mirror coatings ii) Heat mirror coatings. (10 Marks)

b. Explain the electron spine resonance and ferromagnetic resonance. (10 Marks)

6	a.	Brief the materials for solar cells.	(06 Marks)
	b.	List and explain the materials for batteries.	(06 Marks)
	c.	List the materials for solar thermal energy collection and explain.	(08 Marks)
7	a.	Discuss the electrical properties of ceramics.	(08 Marks)
	b.	Brief about thermoplastics.	(06 Marks)
	c.	Brief the properties of ferromagnetic materials.	(06 Marks)
8	a.	Write the applications of piezoelectric materials.	(06 Marks)
	b.	Brief the purpose of optical microscopy.	(06 Marks)
	c.	Brief the materials for electric resistors.	(08 Marks)

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