

Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH(EE-OLD)/SEM-3/MS(EE)-301/2012-13

2012

ELECTRICAL ENGINEERING MATERIALS

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :
 $10 \times 1 = 10$

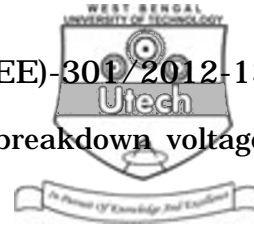
- i) Which of the following polarizability is depends on time ?
 - a) Electronic polarizability
 - b) Ionic polarizability
 - c) dipolar polarizability
 - d) Both (a) and (b).
- ii) The conductivity of conducting materials is
 - a) directly proportional to the mobility of free electron
 - b) inversely proportional to the mobility of free electron
 - c) directly proportional to the square of the mobility of free electron
 - d) inversely proportional to the square of the mobility of free electron.

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- iii) The energy loss in a dielectric is proportional to
 - a) complex dielectric constant
 - b) imaginary dielectric constant
 - c) real dielectric constant
 - d) none of these.
- iv) The internal field in solids is equal to
 - a) $E + P/\epsilon_0$
 - b) $E + P/2\epsilon_0$
 - c) $E + P$
 - d) $E + P/3\epsilon_0$
- v) Fusing current is the current to fuse the wire
 - a) exact
 - b) maximum
 - c) minimum
 - d) over.
- vi) Piezoelectric effect is the production of electricity by
 - a) chemical effect
 - b) varying field
 - c) temperature
 - d) pressure.
- vii) The critical magnetic field B_c of a superconductor
 - a) varies linearly with temperature
 - b) is independent with temperature
 - c) increases with increasing temperature
 - d) decreases with increasing temperature.
- viii) With the insertion of a dielectric, the capacity of a capacitor
 - a) increases
 - b) decreases
 - c) does not change
 - d) changes arbitrarily.
- ix) An ion is
 - a) a free electron
 - b) a free neutron
 - c) a free proton
 - d) an atom with unbalanced electric charge.
- x) Materials which store electric energy are classified as
 - a) magnetic materials
 - b) dielectric materials
 - c) insulating materials
 - d) conducting materials.



- xi) Which one has the lowest electrical breakdown voltage among the following materials ?
- | | |
|--------------|--------------|
| a) PVC | b) Mica |
| c) Porcelain | d) Bakelite. |
- xii) Hard ferrites are used for making
- | |
|---------------------------------|
| a) transformer core |
| b) electrical machinery |
| c) lightweight permanent magnet |
| d) high frequency equipments. |

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. a) What is Curie temperature ?
b) Derive the Curie-Weiss law of Ferromagnetism. 1 + 4
3. a) What is meant by mobility of electrons in a metal ?
b) Calculate the mobility of electrons in copper if the number of free electrons per unit volume of copper is $8.5 \times 10^{28} \text{ m}^{-3}$, & the resistivity of copper is $1.7 \times 10^{-8} \Omega\text{m}$. 2 + 3
4. Show that the imaginary part of dielectric constant of a dielectric material gives rise to absorption of energy by the material from an alternating field. 5
5. Compare the merits & demerits of the uses of Cu & Al as conductors for power transmission lines. 5
6. Briefly describe the principle of operation of solar cell. 5



GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Distinguish between ferromagnetic, ferrimagnetic & anti-ferromagnetic materials.
b) Define the term 'spontaneous magnetization'. Derive the relation between relative permeability (μ_r) & magnetic susceptibility (χ) of a magnetic material.
c) Discuss the various uses of ferrites. $6 + 6 + 3$
8. a) Explain free electron theory of metals.
b) Derive Widemann-Franz law in connection with thermal conductivity of metals.
c) What are the factors on which the fusing current depends ? $6 + 6 + 3$
9. a) Explain the term 'Superconductivity'. Name some of the important superconducting elements, compounds & alloys.
b) State the application of superconductors.
c) State the desirable properties of high resistivity materials. $6 + 3 + 6$
10. a) Explain the mechanism of polarisation in dielectric materials.
b) Derive the expression of orientational polarization in terms of electric field & temperature.
c) The dielectric constant of helium measured at 0°C & at 1 atmosphere is 1.0000684. Under these conditions, the gas contains 2.7×10^{25} atoms / m^3 . Calculate the radius of the electron cloud (atomic radius) & the displacement χ when a helium atom is subjected to a field of 10^6 V/m. $4 + 6 + 5$
11. Write notes on any *two* of the following : $2 \times 7 \frac{1}{2}$
 - a) Thermionic converters
 - b) MHD generators
 - c) Fuel cell.

