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Question Paper Code: 52003

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2020

Second Semester

Mechanical Engineering

15UPH203–MATERIAL SCIENCE

(Common to Chemical Engineering)

(Regulation 2015)

Duration: One hour

Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

(Answer any six of the following questions)

- At $T = 0$ K, the energy levels located above Fermi energy E_F are CO1- R
(a) partially filled (b) vacant (c) filled (d) none of these
- In dielectric, the polarization is CO1- R
(a) linear function of the applied electric field
(b) square function of the applied electric field
(c) exponential function of the applied electric field
(d) independent of electric field
- Conductivity of a semiconductor increases with CO2- R
(a) increase in temperature (b) decrease in temperature
(c) constant temperature (d) increase in band gap
- Acceptor type impurities are the CO2- R
(a) trivalent atoms (b) tetravalent atoms (c) pentavalent atoms (d) divalent atoms
- Water is a _____ substance. CO3- R
(a) paramagnetic (b) ferromagnetic (c) antiferromagnetic (d) diamagnetic

6. The Cooper pair is CO3- R
 (a) two electrons moving in the same direction (b) two electrons with resultant spin zero
 (c) two electrons connected through a phonon (d) two electrons connected like a boson
7. Metallic glasses are CO4- R
 (a) crystalline (b) soft (c) amorphous (d) biomaterials
8. When particle size is reduced from micro to nano, porosity is CO4- R
 (a) increased (b) decreased (c) same (d) exponentially increased
9. Cracks are CO5- R
 (a) volume defects (b) point defects (c) surface defects (d) line defects
10. The entropy S for a reversible process is CO5- R
 (a) constant (b) zero (c) positive (d) negative

PART – B (3 x 8= 24 Marks)

(Answer any three of the following questions)

11. Calculate electrical conductivity of a metal with relaxation time 10^{-14} second and density of electrons $6 \times 10^{28} \text{ m}^{-3}$ by obtaining an expression for electrical conductivity for metals on the basis of classical free electron theory. CO1- App ((8)
12. Why does the conductivity of a semiconductor change with impurity content? Specify two elements that you would add to pure silicon to make it an extrinsic semiconductor of the n-type and the p type. CO2- Ana (8)
13. Classify magnetic materials based on their spin and explain them. CO3- Ana (8)
14. What are metallic glasses? How are they prepared? CO4- U (8)
15. What is creep? Discuss the factors affecting creep. CO5- U (8)