Reg. No. : | | | | | | | | | | |

Question Paper Code: 42003

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022.

Second Semester

Civil Engineering

14UPH203 - MATERIALS SCIENCE

(Common to Mechanical Engineering)

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 1 = 10 Marks)

1. In the case of _____, the valence band and the conduction band overlap each other

   (a) conductors (b) dielectrics (c) insulators (d) semiconductors

2. The valence electrons are _____ the nucleus and they are _____ bound.

   (a) ionic (b) covalent (c) hydrogen (d) metallic

3. The pure Si and Ge Semiconducting materials have _____ bonds.

   (a) intrinsic semiconductor (b) compound semiconductor
   (c) n-type semiconductor (d) p-type semiconductor

4. Semiconductors have _____ temperature coefficient

   (a) positive (b) negative (c) neutral (d) infinite

5. In the case of paramagnetic materials the spin magnetic moments of the adjutant atoms are aligned

   (a) parallel to each other (b) antiparallel to each other
   (c) randomly (d) antiparallel but of unequal magnitude

6. The superconducting state is perfectly _____ in nature.

(a) Diamagnetic (b) heat capacity (c) isotopic effect (d) entropy

7. _____ occurs when a dielectric contains occluded gas bubbles.

(a) thermal breakdown (b) defect breakdown
(c) intrinsic breakdown (d) discharge breakdown

8. _____ Polarization occur in Ferrites and semiconductors.

(a) Electronic (b) Ionic (c) Orientation (d) Space charge

9. Which of the following technique is used to form metallic glasses?

(a) Slow cooling (b) Quenching (c) Melt spinning (d) Hardening

10. Milling, Lithographic method and machining are examples of

(a) bottom-up approach (b) sputtering technique
(c) plasma assisted technique (d) top-down approach

PART - B (5 x 2 = 10 Marks)

11. List the postulates of free electron theory.

12. Compare intrinsic and extrinsic semiconductor.

13. List the properties of a Ferromagnetic material.

14. Define dielectric constant.

15. Give any four applications of nanomaterial.

PART - C (5 x 16 = 80 Marks)

16. (a) Derive an expression for the electrical and thermal conductivity and hence deduce Wiedemann- Franz law. (16)

Or

(b) Define density of states and derive an expression for carrier concentration in metals. (16)

17. (a) Derive an expression for carrier concentration in an n-type semiconductors and discuss the variation of fermi level and carrier concentration with temperature (16)

Or

(b) (i) What is Hall effect? Derive an expression for Hall coefficient? Describe arrangement for the measurement of Hall coefficient. (12)

(ii) Write the applications of Hall effect. (4)

18. (a) What are Ferrites? Classify Ferrites based on their structures. (16)

Or

(b) (i) Classify the types of superconductors based on magnetization. (8)

(ii) Discuss in detail the phenomena of superconductivity based on BCS theory. (8)

19. (a) Interpret the different types of Polarization mechanism in dielectrics. (16)

Or

(b) What is internal field? Derive an expression for internal field and hence deduce the Clasius-Mosotti equation. (16)

20. (a) Discuss how to improve the mechanical proportion of engineering materials. Differentiate Creep and Fatigue (16)

Or

(b) Illustrate in detail the Sol-gel method to prepare nano material. (16)