KUMARAGURU
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B.E DEGREE EXAMINATIONS: JUNE 2015

(Regulation 2013)

Second Semester

U13PHT202: MATERIALS SCIENCE

(Common to Mechanical, Mechatronics, Aeronautical And Automobile Engineering)

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Type 1 superconductors have

    a) Higher critical fields than type II   b) Two critical fields

    c) Lower critical field than type II   d) Same critical field as that of type II

2. The unit of Lorentz number is ……………..

3. When we add Arsenic with silicon, the

    a) Fermi level shifts towards conduction   b) Fermi level is stationary
        band

    c) Fermi level shifts towards the valence   d) Fermi level shifts towards the acceptor energy
        band   level of the same semiconductor

4. At 0K, semiconductor act as ……………..

5. The diamagnetic susceptibility is

    a) Positive   b) Negative

    c) Zero   d) Positive and very large

6. In a ferroelectric material, as the applied filed is gradually reduced to zero, the polarization still left is knows as:……………..

7. Nitinol is a

    a) Conducting polymer   b) Shape memory alloy

    c) Dielectric material   d) Thermoelectric material

8. Carbon nano tube Shape is ……………..

9. Among the following materials, which one has the highest hardness?

    a) Steel   b) Copper

    c) Cast iron   d) Silicon carbide

10. Creep curve is a plot of …… versus -------

11. Mention the drawbacks of classical free electron theory.

12. Explain Meissner effect.

13. The resistivity of intrinsic semiconductor germanium at 300k is 0.47 ohm- metre. If the electron and hole mobilities are 0.38 and 0.18 $m^2V^{-1}s^{-1}$ calculate the intrinsic carrier density at 300k.

14. What are the applications of Hall effect?

15. Magnetic field intensity of a paramagnetic material is 10^4A/m. At room temperature, its susceptibility is 3.7×10^{-3}. Calculate the magnetization in the material.

16. Define dielectric loss.

17. What are metallic glasses?

18. Mention different structures of carbon nanotubes.

19. Define fatigue.

20. What is meant by cold working metals?

PART C (5 x 14 = 70 Marks)
(Not more than 400 words)

Q.No. 21 is Compulsory

21. Based on the classical free electron theory, derive expression for electrical conductivity and thermal conductivity of conducting materials and hence arrive at widemann – Franz law.

22. a) Derive an expression for density of electrons in the conduction band and density of holes in the valence band of an intrinsic semiconductor.

(OR)

   b) (i) What is hall effect? Derive an expression for Hall voltage and Hall coefficient in a semiconducting material.   (10)

   (ii) The hall coefficient of a specimen of doped silicon is found to be $3.66 \times 10^{-4} m^3$/C. the resistivity of the specimen is 8.93×10^{-3} ohm-metre. Find the mobility and density of the charge carriers.   (4)

23. a) (i) Explain the properties of Dia, Para, Ferro and Anti - Ferro magnetic materials.   (10)

   (ii) Distinguish between soft and hard magnetic materials.   (4)

(OR)

   b) Explain different types of polarization mechanism in dielectrics.

24. a) (i) What is shape memory effect? Discuss their characteristics and properties.   (10)

   (ii) Mention any four applications of metallic glasses.   (4)

(OR)

b) (i) Describe electro deposition technique to synthesis nanoparticles. (7)

(ii) Explain the synthesis of carbon nano tubes by Pulsed laser deposition. (7)

25. a) (i) Explain Griffith's theory of brittle material and derive an expression for the applied stress at which fracture occur due to an existing crack. (10)

(ii) Distinguish between brittle and ductile fracture. (4)

(OR)

b) (i) Define creep. Discuss the different stages in creep curve. (7)

(ii) Write short notes on the tensile test on a metal. (7)

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