Register Number:……..

KUMARAGURU
college of technology
character is life

## GENERAL INSTRUCTIONS TO THE CANDIDATES

1. Candidates are instructed to answer the questions as per Bloom's Taxonomy knowledge level ($K_1$ to $K_6$)
2. Candidates are strictly instructed not to write anything in the question paper other than their roll number.
3. Candidates should search their pockets, desks and benches and handover to the Hall Superintendent/ Invigilator if any paper, book or note which they may find therein as soon as they enter the examination hall.
4. Candidates are not permitted to bring electronic watches with memory, laptop computers, personal systems, walkie-talkie sets, paging devices, mobile phones, cameras, recording systems or any other gadget / device /object that would be of unfair assistance to him / her.
5. Corrective measures as per KCT examination policies will be imposed for malpractice in the hall like copying from any papers, books or notes and attempting to elicit the answer from neighbours.

**B.E DEGREE EXAMINATIONS: JUNE 2016**

(Regulation 2015)

Second Semester

**CIVIL ENGINEERING**

U15PHT201**:** Materials Science

**COURSE OUTCOMES**

**CO1:** Apply core concepts in Materials Science to solve engineering problems.
**CO2:** Describe the impact of acoustic engineering solutions in a constructional environmental and societal. context
**CO3:** Determine the position of the acceptor or donor levels and the band gap of an extrinsic semiconductor.
**CO4:** Classify & differentiate the structure and physical properties of conducting materials.
**CO5:** Apply the techniques to manufacturing of modern materials for engineering practice.

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

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. Match the list I with list II CO2 [$K_2$]

| List I | List II |
|---|---|
| A. Thermal conductivity | i. $K^{-2}W\Omega$ |
| B. Lorentz number | ii. $Vm^{-1}$ |
| C. Electrical conductivity | iii. W/m/K |
| D. Electric field | iv. $\Omega^{-1}m^{-1}$ |

| | A | B | C | D |
|---|---|---|---|---|
| a) | iii | i | iv | ii |
| b) | i | iii | iv | ii |
| c) | iv | ii | iii | i |
| d) | ii | iv | i | iii |

2. Which of the following is based on the principle of flux quantization? CO2 [$K_1$]

   a) Magnetic Levitation  b) SQUID

   c) Cryotron  d) Magnetic Resonance Imaging

3. When the sound intensity is doubled, the increase in the acoustic intensity level are CO1 [$K_2$]

   a) 3.01dB  b) 3.56dB

   c) 4.01dB  d) 5.01dB

4. Accorders to Weber – Fechner law, the sensitiveness of the ear CO1 [$K_1$]

   a) Increases with the intensity of sound  b) Decrease with the intensity of sound

   c) Decreases with the increase of the intensity of the sound  d) Independent of the sound

5. Consider the following statements in properties of semiconductors CO3 [$K_2$]

   1. Semiconductors have negative temperature coefficient of resistance
   2. The electrical conductivity of semiconductors is increased by the addition of impurities
   3. The electrical conductivity of semiconductor decreases with increase in temperature.
   4. They are formed by covalent bond.

   The correct statements are

   a) 1,2,4  b) 1,2,3

   c) 1,4  d) 2,4

6. In an intrinsic semiconductor the concentration of charge carriers increases exponentially with temperature CO3 [$K_1$]

   a) False  b) True

   c) Partially true  d) Remains same

7. The following items consists of two statements, one labeled as the “Assertion(A)” and other as “Reason(R)”.Examine these two statements and select the answers from the following codes. CO4 [$K_2$]

   Assertion(A): All the dielectric materials are not insulator

   Reason(R): All the insulator are dielectric materials

a) A is true but R is false
b) Both A and R false
c) Both A and R individually true and R is not correct explanation of A
d) Both A and R individually true and R is correct explanation of A

8. Sequence the following sentences in the formation hysteresis loop CO4 [$K_2$]

1. The applied magnetic field H is reversed and increased gradually, the magnetic induction becomes zero at the point is known as coercivity.
2. Further increase of magnetic field H, the magnetic induction increase in the reverse direction. If the magnetic field is varied backwards, this will complete hysteresis loop.
3. The value of magnetic field is decreased to zero but magnetic induction has a definite value is known as rententivity.
4. The magnetic induction B increases with the magnetic field H.

a) 2-4-1-3
b) 2-1-4-3
c) 3-1-4-2
d) 4-3-1-2

9. Metallic glasses have CO5 [$K_1$]

a) High conductivity
b) High temperature coefficient of resistance
c) High electrical resistance
d) Low mechanical strength

10. Carbon nano tube shape is CO5 [$K_1$]

a) Spherical
b) Oval
c) Cylindrical
d) Square

**PART B (10 x 2 = 20 Marks)**

**(Answer not more than 40 words)**

11. Distinguish between loudness and intensity of sound CO1 [$K_1$]

12. Prove that 26% change in intensity alters the sound intensity level by 1dB CO1 [$K_2$]

13. Find the relaxation time of conduction electrons in a metal of resistivity $1.54 \times 10^{-8}$ ohm-m if the metal has $5.8 \times 10^{28}$ conduction electrons/$m^3$. CO2 [$K_2$]

14. Distinguish between type I and type II superconductors. CO2 [$K_1$]

15. The intrinsic carrier density is $1.5 \times 10^{16}$ /$m^3$. If the mobility of electron and hole are 0.13 and 0.05 $m^2 V^{-1} s^{-1}$ respectively, calculate its electrical conductivity. CO3 [$K_2$]

16. Mention any four applications of Hall effect. CO3 [$K_1$]

| | | | | |
|---|---|---|---|---|
| 17. | Mention any four properties of diamagnetic materials. | | CO4 | [$K_1$] |
| 18. | What is an Ionic polarization? | | CO4 | [$K_1$] |
| 19. | Give the principle of preparation of metallic glasses. | | CO5 | [$K_1$] |
| 20. | List out various structure of carbon nanotubes. | | CO5 | [$K_1$] |

**Answer any FIVE Questions:-**
**PART C (5 x 14 = 70 Marks)**
**(Answer not more than 300 words)**

**Q.No. 21 is Compulsory**

| | | | | |
|---|---|---|---|---|
| 21. | (i) Explain the factors affecting the acoustics of a building and their remedy. | (10) | CO1 | [$K_1$] |
| | (ii) Describe with necessary theory a method of measuring the absorption coefficient of a material by using Sabine's reverberation formula. | (4) | CO1 | [$K_1$] |
| 22. | (i) Develop an expression for density of energy states and obtain an expression for Fermi energy of a metal at 0K. | (10) | CO2 | [$K_2$] |
| | (ii) The critical temperature for a metal with isotopic mass 199.5 is 4.185 K. Calculate the isotopic mass if the critical temperature falls to 4.133 K | (4) | CO2 | [$K_2$] |
| 23. | (i) Relate the charge carrier concentration in an n – type semiconducting material in terms of square root of the donor concentration at low temperature. | (10) | CO3 | [$K_2$] |
| | (ii) A magnetic flux density of 0.5 $Wb/m^2$ is applied from front to back, perpendicular to largest faces of a specimen. A current of 20 mA flows lengthwise and the voltage measured across its width is 37 μV. The dimension of the specimen is 12 mm long, 1mm wide and 1mm thick. Find the Hall coefficient. | (4) | CO3 | [$K_2$] |
| 24. | (i) Briefly explain domain theory of ferromagnetism. | (10) | CO4 | [$K_1$] |
| | (ii) Distinguish between Hard and Soft magnetic materials. | (4) | CO4 | [$K_1$] |
| 25. | (i) Discuss in detail the various dielectric breakdown mechanisms. | (10) | CO4 | [$K_1$] |
| | (ii) Explain the frequency and temperature dependence on polarization mechanisms. | (4) | CO4 | [$K_1$] |
| 26. | (i) What is shape memory effect? Discuss their characteristics and properties. | (10) | CO5 | [$K_1$] |
| | (ii) Explain the preparation of nanoparticles by ball milling method. | (4) | CO5 | [$K_1$] |
| 27. | (i) Distinguish: Dia, Para, Ferro and antiferromagnetic materials. | (10) | CO3 | [$K_2$] |
| | (ii) Sketch the ferromagnetic hysteresis loop and explain the Coercivity and retentivity | (4) | CO3 | [$K_2$] |

**********