**Reg. No.**

# B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2023
## Second Semester
# PH22253 – Engineering Materials
*(Common to AE, ME, MN)*
**(Regulation 2022)**

**TIME: 3 HOURS**                                                                     **MAX. MARKS: 100**

| COURSE OUTCOMES | STATEMENT | RBT LEVEL |
|---|---|---|
| CO 1 | Gain knowledge about various ferrous and non ferrous alloys and their phase diagrams and analyze the qualities of non ferrous alloys | 4 |
| CO 2 | To understand various heat treatment techniques and analyze qualities of alloy steels. | 4 |
| CO 3 | Evaluate the concepts of semiconductors and understand the behavior of electrons in the semiconductors | 3 |
| CO 4 | Summarize basics of superconducting, magnetic and dielectric properties and few of the technologies and applications | 3 |
| CO 5 | Enhance knowledge about various new engineering materials | 3 |

## PART- A (20 x 2 = 40 Marks)
### (Answer all Questions)

|  |  | CO | RBT LEVEL |
|---|---|---|---|
| 1. | What is a solid solution? Give Examples. | 1 | 2 |
| 2. | Define Hume Rothery's Empirical rule for the substitutional solid solution. | 1 | 3 |
| 3. | Define Isomorphous system. | 1 | 2 |
| 4. | What is the maximum number of Phases that can coexist in equilibrium in a three component system? | 1 | 3 |
| 5. | Calculate atomic percent of carbon in mild steel containing 0.2 wt% of carbon. | 2 | 3 |
| 6. | Why is nitriding important? | 2 | 2 |
| 7. | State Fick's law of Diffusion. | 2 | 2 |
| 8. | Give the composition of low, medium and high carbon steel. | 2 | 3 |
| 9. | Graphically show the variation of conductivity of semiconductor with temperature. | 3 | 3 |
| 10. | Compare Direct and Indirect Band Gap Semiconductors. | 3 | 3 |
| 11. | In a solid, consider the energy level lying 0.05eV above Fermi level. What is the probability of this level being occupied by an electron at 300K? | 3 | 3 |
| 12. | What are the applications of Hall Effect? | 3 | 2 |
| 13. | Evaluate electronic Polarisability of Neon atom of radius 0.158nm. | 4 | 3 |
| 14. | Define Dielectric constant. Give its importance. | 4 | 3 |
| 15. | Mention the energies involved in origin of domains in ferromagnetic material. | 4 | 2 |
| 16. | Prove that superconductors are diamagnetic. | 4 | 3 |
| 17. | Give various types of ceramics. | 5 | 2 |
| 18. | What are the advantages of using metallic glasses as transformer core material? | 5 | 3 |
| 19. | Mention different forms of nano materials. | 5 | 2 |
| 20. | What are the types of Shape Memory Alloys? | 5 | 2 |

## PART- B (5 x 10 = 50 Marks)

| | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|
| **21. (a)** | Describe in detail the applications of Phase rule in study of Phase Diagram. | **(10)** | 1 | 4 |
| | **(OR)** | | | |
| **(b)** | What is Binary Phase diagram? Explain in detail about binary Isomorphous system and region present in it. | **(10)** | 1 | 4 |
| **22. (a)** | Draw the Fe-C equilibrium diagram and label all the phases and their microstructures at Various temperatures for 0.8% C. | **(10)** | 2 | 4 |
| | **(OR)** | | | |
| **(b)** | Discuss about the various alloying elements in steel. | **(10)** | 2 | 4 |
| **23. (a)** | Derive an expression for density of electrons in the conduction band of an intrinsic semiconductor. | **(10)** | 3 | 3 |
| | **(OR)** | | | |
| **(b)** | What is Hall effect? Discuss the theory of Hall effect for a N-type semiconductor and derive an Expression for Hall coefficient.How will you determine Hall Coefficient Experimentally? | **(10)** | 3 | 3 |
| **24. (a)** | What is meant by Internal field and how it is calculated for a cubic Structure? | **(10)** | 4 | 3 |
| | **(OR)** | | | |
| **(b)** | Explain the Phenomenon of super conductivity and the properties exhibited by the super conductors. | **(10)** | 4 | 3 |
| **25. (a)** | With a neat diagram describe the production, properties and applications of Metallic Glass. | **(10)** | 5 | 2 |
| | **(OR)** | | | |
| **(b)** | What are Nano materials? Explain Production, properties and applications of nanomaterials. | **(10)** | 5 | 2 |

## PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

| | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|
| **26.** | Deduce an expression for electronic polarisability and ionic polarisability in a dielectric material. | **(10)** | 4 | 3 |