

**THE KAVERY ENGINEERING COLLEGE***(An Autonomous Institution)***B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025***Third Semester**Mechanical Engineering***ME3392-Engineering Materials and Metallurgy***Regulations - 2021**Duration : 3 Hrs**Maximum : 100 Marks***PART - A (ANSWER ALL QUESTIONS) (Marks 10\*2=20)**

| <i>Q.No</i> | <i>Questions</i>                                                                                   | <i>BTL</i> | <i>CO</i> | <i>Marks</i> |
|-------------|----------------------------------------------------------------------------------------------------|------------|-----------|--------------|
| 1.          | Differentiate between substitutional solid solution and interstitial solid solution with examples. | L2         | 1         | 2            |
| 2.          | Give two applications of gray cast iron.                                                           | L1         | 1         | 2            |
| 3.          | Differentiate between normalizing and annealing.                                                   | L2         | 2         | 2            |
| 4.          | How does vacuum hardening improve the properties of steel?                                         | L1         | 2         | 2            |
| 5.          | How does Silicon (Si) influence the properties of steel?                                           | L1         | 3         | 2            |
| 6.          | What are nickel-based superalloys?                                                                 | L2         | 3         | 2            |
| 7.          | Differentiate between commodity polymers and engineering polymers.                                 | L2         | 4         | 2            |
| 8.          | What are intermetallic compounds? Give one example and use.                                        | L2         | 4         | 2            |
| 9.          | Differentiate between slip and twinning.                                                           | L2         | 5         | 2            |
| 10.         | Compare Izod and Charpy impact tests.                                                              | L2         | 5         | 2            |

**PART - B (ANSWER ALL QUESTIONS) (Marks 5\*16 = 80)**

| <i>Q.No</i> | <i>Questions</i>                                                                                                      | <i>BLT</i> | <i>CO</i> | <i>Marks</i> |
|-------------|-----------------------------------------------------------------------------------------------------------------------|------------|-----------|--------------|
| 11.         | a Draw and explain the Iron-Iron Carbide (Fe-Fe <sub>3</sub> C) equilibrium diagram.                                  | L2         | 1         | 16           |
|             | Or                                                                                                                    |            |           |              |
|             | b i Explain the eutectoid transformation in plain carbon steel with a neat sketch.                                    | L2         | 1         | 8            |
|             | ii Explain the effect of carbon content on the properties of steel.                                                   | L2         | 1         | 8            |
| 12.         | a i Articulate the process of full annealing with a neat diagram.                                                     | L3         | 2         | 8            |
|             | ii Discuss the necessity of tempering after hardening. How does the tempering temperature influence steel properties? | L3         | 2         | 8            |
|             | Or                                                                                                                    |            |           |              |
|             | b i Illustrate the Jominy end-quench test for measuring hardenability.                                                | L3         | 2         | 8            |
|             | ii Discuss the working principle of induction hardening with neat sketch.                                             | L3         | 2         | 8            |

|     |    |    |                                                                                                         |    |   |    |
|-----|----|----|---------------------------------------------------------------------------------------------------------|----|---|----|
| 13. | a  | i  | Explain the role of chromium and nickel in the development of stainless steels.                         | L3 | 3 | 8  |
|     |    | ii | Discuss in detail about HSLA steels – composition, properties, and applications.                        | L3 | 3 | 8  |
|     | Or |    |                                                                                                         |    |   |    |
|     | b  | i  | Discuss the role of copper in aluminium alloys (Al–Cu system).                                          | L3 | 3 | 8  |
|     |    | ii | Articulate the working principle, properties, and applications of shape memory alloys (SMA).            | L3 | 3 | 8  |
| 14. | a  | i  | Discuss the properties and applications of Polyethylene (PE), Polypropylene (PP), and Polystyrene (PS). | L3 | 4 | 8  |
|     |    | ii | Discuss the properties and applications of PTFE (Teflon) in engineering.                                | L3 | 4 | 8  |
|     | Or |    |                                                                                                         |    |   |    |
|     | b  | i  | Compare engineering ceramics with metals in terms of mechanical and thermal properties.                 | L3 | 4 | 8  |
|     |    | ii | Discuss the roles of matrix and reinforcement in composites.                                            | L3 | 4 | 8  |
| 15. | a  |    | Articulate the mechanisms of fatigue and creep failures with examples.                                  | L3 | 5 | 16 |
|     | Or |    |                                                                                                         |    |   |    |
|     | b  |    | Discuss the creep test of metals. Explain primary, secondary, and tertiary creep.                       | L3 | 5 | 16 |