



**B.E DEGREE EXAMINATIONS: APRIL / MAY 2023**

(Regulation 2018)

Sixth Semester

**MECHANICAL ENGINEERING**

U18MET6005: Applied Materials Engineering

**COURSE OUTCOMES**

- CO1:** Apply the knowledge on Metal Structure Crystallization and Plastic Deformation  
**CO2:** Apply the knowledge on the various phase diagrams and their applications  
**CO3:** Apply the knowledge of failure mechanisms in failure analysis of metallic materials.  
**CO4:** Apply the knowledge on Fe-Fe<sub>3</sub>C phase diagram, various micro-structures, and alloys  
**CO5:** Apply the knowledge on mechanical properties of materials and their measurement  
**CO6:** Explain properties, structure and applications of composites, ceramics and nanomaterials

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

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

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

- |   |     |                   |
|---|-----|-------------------|
| 1. What is the relationship between grain size and strength of a metal?             | CO1 | [K <sub>1</sub> ] |
| 2. How slip system influences the plastic deformation behavior?                     | CO1 | [K <sub>3</sub> ] |
| 3. List the differences between substitutional and interstitial solid solutions.    | CO2 | [K <sub>2</sub> ] |
| 4. What is the Eutectoid phase reaction? and what will be resulting microstructure? | CO2 | [K <sub>1</sub> ] |
| 5. List the differences between ductile and brittle fracture.                       | CO3 | [K <sub>2</sub> ] |
| 6. List the assumptions for the Griffith theory.                                    | CO3 | [K <sub>2</sub> ] |
| 7. What is the strengthening mechanism of dual phase steel?                         | CO4 | [K <sub>1</sub> ] |
| 8. List the applications of High carbon steel.                                      | CO5 | [K <sub>2</sub> ] |
| 9. List the differences between Commodity and Engineering polymers                  | CO6 | [K <sub>2</sub> ] |
| 10. Why diamond cutting tools are not used for machining steel?                     | CO6 | [K <sub>3</sub> ] |

**Answer any FIVE Questions:-**  
**PART B (5 x 16 = 80 Marks)**  
**(Answer not more than 400 words)**

- |     |    |  |    |     |                   |
|-----|----|--|----|-----|-------------------|
| 11. | a) | Discuss in detail the various stages of crystallization process.   | 8  | CO1 | [K <sub>2</sub> ] |
|     | b) | Explain with neat sketch any two-grain size measurement?   | 8  | CO1 | [K <sub>2</sub> ] |
| 12. |    | Explain the Isomorphous phase diagram with neat sketch in which discuss  | 16 | CO2 | [K <sub>2</sub> ] |
|     | a. | Conditions to be met to have unlimited solubility,   |    |     |                   |
|     | b. | Tie-line rule,   |    |     |                   |
|     | c. | Lever principle and  |    |     |                   |
|     | d. | Composition variation during solidification.   |    |     |                   |
| 13. | a) | Explain the mechanism and stages of Fatigue failure.   | 12 | CO3 | [K <sub>2</sub> ] |
|     | b) | Write short notes on failure analysis procedure.   | 4  | CO3 | [K <sub>2</sub> ] |
| 14. | a) | List the phases involved in the Iron – Iron Carbide (Fe – Fe <sub>3</sub> C) diagram and invariant phase reactions with neat sketch. | 10 | CO4 | [K <sub>2</sub> ] |
|     | b) | Explain the effect of various alloying elements in steel   | 6  | CO4 | [K <sub>2</sub> ] |
| 15. | a) | Discuss in detail about the composition and effect of heat treatment on the strength of Maraging steel.                              | 10 | CO5 | [K <sub>2</sub> ] |
|     | b) | Discuss in detail about the manipulation of phase content and mechanical properties in dual phase steel.                             | 6  | CO5 | [K <sub>2</sub> ] |
| 16. | a) | Explain the mechanism of shape memory alloys with a suitable example.  | 8  | CO6 | [K <sub>2</sub> ] |
|     | b) | Discuss in detail about the properties and applications of   | 8  | CO6 | [K <sub>2</sub> ] |
|     | a. | Poly methyl meth acrylate (PMMA)   |    |     |                   |
|     | b. | Poly Carbonate (PC)  |    |     |                   |

\*\*\*\*\*