



P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. – Mechanical Engineering

Semester End Examination; Dec - 2017/Jan - 2018

Material Science and Metallurgy

Time: 3 hrs

Max. Marks: 100

Note: Answer FIVE full questions, selecting ONE full question from each unit.

UNIT - I

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| 1 a. | Define atomic packing factor. Obtain an expression for Delta Iron and Gamma Iron. | 10 |
| | b. Discuss the various types of crystal system with the help of sketches. | 10 |
| 2 a. | With neat sketches, explain correct statements, steady state and unsteady state diffusion. | 10 |
| | b. With neat sketches, explain various types of zero dimensional defects. | 10 |

UNIT - II

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| 3 a. | Explain the following properties of a material under static uni-axial tension with the help of stress strain graph : | |
| | i) Elastic strength ii) Resilience iii) Stiffness | 10 |
| | iv) Modulus of resilience v) Tangent. | |
| | b. With the help of neat sketches, clearly explain the plastic deformation of single crystals. | 10 |
| 4 a. | Explain Griffith's theory of brittle fracture and derive an expression for the same. | 10 |
| | b. With the help of neat sketches, explain time dependent plastic deformation at constant stress found in materials. | 10 |

UNIT - III

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| 5 a. | What are equilibrium diagram? Why they are called So? Explain the construction of such diagram. | 10 |
| | b. What is Lever Rule? Explain how it is useful? | 8 |
| | c. Draw the cooling curve for a pure metal and alloy. | 2 |
| 6 a. | Draw a neat sketch of Iron-Iron carbide diagram show all phase fields, temperature, composition and various invariant reactions on it. | 10 |
| | b. Explain the steps to construct TTT diagram. Draw a neat sketch of Time-Temperature-Transformation diagram for eutectoid steel. | 10 |

UNIT - IV

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| 7 a. | What is meant by hardenability in steels? With sketch, explain one important technique to determine the same. | 10 |
| | b. Explain the annealing, normalizing, tempering heat treatment cycles using Iron-Iron carbide diagram. | 10 |

- 8 a. Explain Austempering and Martempering with figures. 10
b. Discuss precipitation hardening of aluminum copper alloys. 10

UNIT - V

- 9 a. With neat sketch, explain Galvanic cell. 10
b. Explain the following :
i) Passivity of stainless steels 10
ii) Stress corrosion cracking in aluminum alloy 7075.
- 10 a. Compare gray cast iron with spheroidal graphite iron with respect to their structure, composition properties and applications. 10
b. i) Define Brass. Explain season cracking of brass and how to eliminate it? 10
ii) Define Bronze. Explain Tin Bronzes antifriction properties.

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