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

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Automobile 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

- 1 a. Define the term atomic packing factor. Calculate the value of atomic packing factor for,
 i) Simple cube ii) Body center cubic iii) Face centered cubic cell. 10
- b. State and explain Fick's laws of diffusion. Explain the factors affecting diffusivity. 10
- 2 a. Classify the crystals defects. Explain the point defects in crystal with neat sketches. 10
- b. Explain plastic deformation of metals and the mechanisms that contribute to it. 10

UNIT - II

- 3 a. Explain the mechanism of fatigue crack growth in ductile materials. 10
- b. Derive Griffith's criterion for brittle fracture with a neat sketch. 10
- 4 a. What is fatigue failure? Discuss the factors affecting fatigue strength in metals. Mention fatigue protection methods used to improve the fatigue life. 10
- b. Explain creep using three-stage creep curve mentioning the mechanism contributing to creep in each of the stages. Mention the factors affecting the creep. 10

UNIT - III

- 5 a. What is the solid solution? List and explain governing rules for the formation of substitutional solid solution. 8
- b. State and explain Gibb's phase rule and lever rule in analyzing phase diagrams. 6
- c. Describe the construction of phase diagrams by thermal analysis. 6
- 6 a. Draw a neat sketch of Fe-C equilibrium diagram and label all the phase fields, also explain all the invariant reactions in the system. 10
- b. What are TTT diagrams? Explain the steps to construct TTT diagram. Draw a labeled sketch of a TTT diagram for eutectoid steel. 10

UNIT - IV

- 7 a. What are the objectives of heat treatment? Classify the various heat treatment processes. Explain any one heat treatment process. 10
- b. Define harden ability of a material and explain with a neat sketch the Jominy end quench test and mention its practical applications. 10

8. Explain the following processes :

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|----------------------|--------------------------|----|
| i) Pack carburizing | ii) Nitriding | 20 |
| iii) Flame hardening | iv) Induction hardening. | |

UNIT - V

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| 9 a. | Classify the different types of steels and explain the effect of alloying elements on steel. | 10 |
| b. | Give the typical composition, properties and uses of any four non-ferrous alloys. | 10 |
| 10 a. | What is a composite material? How it is classified? What are the essential ingredients of a composite material? What is the role of each of them? | 10 |
| b. | List the different methods of manufacturing FRP. Explain any two of them. | 10 |

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