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

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, B.E. - Mechanical Engineering

Semester End Examination; Dec - 2016/Jan - 2017

Material Science and Metallurgy

Time: 3 hrs

Max. Marks: 100

- Note:** i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.  
 ii) Draw neat sketch wherever necessary and answer should be specific.  
 iii) Assume suitably missing data, if any.

### UNIT - I

- 1 a. Define: 4  
 i) Unit cell      ii) Space lattice.
- b. With the help of neat sketch, explain: 8  
 i) BCC      ii) FCC      iii) HCP.
- c. Define Co-ordinate Number (CN) and Atomic Packing Factor (APF). And also give values of CN and APF for SC, BCC, FCC and HCP. 8
- 2 a. Give the classification of crystal imperfections. 4  
 b. With the help of neat sketch, explain screw dislocation. 8  
 c. State and explain Fick's law of Diffusion for steady state Diffusion. 8  
 A plate of Iron exposed to carburizing atmosphere on one side and a decarburizing atmosphere on the other side at temperature 700°C. If a condition of steady state is achieved, calculate the diffusion flux of carbon through the plate. If the concentration of carbon at positions of 5 and 10 mm beneath the carburizing surface are 1.2 and 0.8 kg/m<sup>3</sup> respectively. Assume coefficient of diffusion as  $3 \times 10^{-11}$  m/s at this temperature.

### UNIT - II

- 3 a. With help of neat sketch explain engineering stress and strain and true stress and strain. 8  
 b. What is plastic deformation? With help of sketch, explain any one of plastic deformation mechanism. 8  
 c. List various properties under elastic and plastic deformations zones. 4
- 4 a. Explain various stages of ductile fracture with help of neat sketch. 8  
 b. With help of creep curve, explain creep failure. 8  
 c. Sketch and explain briefly various fatigue loads. 4

### UNIT - III

- 5 a. Explain terms: 4  
 i) Component      ii) System      iii) Phase and solubility.

- b. Give rules governing formation of solid solution. 8
- c. Draw a phase diagram for Eutectic system and label all its parts. 8
- 6 a. Draw a neat sketch of iron-carbon equilibrium diagram and label various phases reactions on it. 10
- b. Explain the various steps involved in construction of TTT diagram for eutectoid steel (0.8%C). 10

**UNIT - IV**

- 7 a. List various types of annealing and explain spheroidising annealing. 10
- b. Give the objectives of hardening and explain hardening process. 10
- 8 a. Explain joining end-quench test with suitable sketch. 10
- b. Explain participation hardening with help of Al-Cu phase diagram. 10

**UNIT - V**

- 9 a. Explain Galvanic cell corrosion and also mention few methods to control the same. 10
- b. Write a short note on:
  - i) Polarization 10
  - ii) Passivation.
- 10. Write short notes on any two :
  - i) Corrosion prevention methods 20
  - ii) Cathode protection
  - iii) Stress corrosion cracking.

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