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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.

   A plate of Iron exposed to carburizing atmosphere on one side and a decarburizing atmosphere on the other side at temperature 700ºC. 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^3 respectively. Assume coefficient of diffusion as 3×10^{-11} m/*s* at this temperature. | 8

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

    ii) Cathode protection   20

    iii) Stress corrosion cracking.

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