

## Assignment-2

### Material Science & Metallurgy (3131904)

Last date for submission : 30/9/2019

#### Unit : - 4 Phase and Phase equilibrium:

1. Explain Unary equilibrium Phase diagram.
2. Explain Binary equilibrium Phase Diagram.
3. Briefly explain Gibb's Phase rule.
4. What is the solid solution? Explain types of solid solution with sketch.
5. State Hume -Rothery rules for solid solution.
6. What is a substitutional solid solution? Explain the Hume Rothery rule for the formation of a substitutional solid solution.
7. State the Gibbs Phase Rule & justify that degree of freedom at eutectic point in binary phase diagram is zero.
8. Explain lever rule and different reaction like eutectic, eutectoid.
9. Explain the 'Lever rule' based on the phase diagram of binary alloy.
10. Draw cooling curve of pure metal and An alloy of two metals which are completely soluble in liquid and solid phase.
11. Draw the phase diagram of binary system showing 100% solubility in liquid and solid phases and explain lever rule.
12. Justify the statement "iron shows limited solubility for carbon in solid phase"
13. What information may be obtained from an equilibrium diagram?

#### Unit : - 5 : Allotropy of Iron, Iron-Iron-Carbide equilibrium system:

14. Explain allotropy of iron.
15. State critical reactions of Iron-carbon phase Diagram.[3]
16. Explain iron carbon diagram with critical reactions.
17. Draw the Iron-Iron Carbide equilibrium diagram and explain the eutectic, eutectoid and peritectic transformation.
18. Draw & Explain Iron-Iron Carbide Diagram with all regions.
19. Explain iron – iron carbon diagram for hypo eutectoid steel and hyper eutectoid steel.
20. Draw iron – iron carbide equilibrium diagram. Explain important phases in it. Discuss the phase transformation takes place for the eutectoid steel from liquid to room temperature.
21. Draw only steel portion of iron-iron carbide diagram & indicate on it the temperature ranges up to which steels are heated for (i) annealing (ii) normalizing (iii) hardening
22. Justify the statement "iron shows limited solubility for carbon in solid phase".

#### Unit : - 6 : Heat Treatment of Steel:

23. State Any 4 name of Case hardening Processes.
24. Explain Austempering and Martempering
25. Difference between annealing and tempering.
26. What are the advantages of Austempering & Martempering?
27. Explain Induction hardening
28. Justify the need of Heat treatment processes for metals.
29. Why normalizing produces structure having superior strength and hardness compared to annealing?
30. Write purpose of the case hardening heat treatment and explain any one in detail.
31. Explain full annealing and stress relieve annealing

32. Explain difference between annealing and normalizing
33. What is heat treatment? List the purpose of heat treatment.
34. What is hardening? Why tempering is done after hardening?
35. What is surface hardening process? Explain:
  - Gas carburizing
  - Flame hardening
  - Induction hardening
  - Nitriding
  - Carbonitriding
  - cyaniding
36. What is austempering and martempering?

### **Unit : - 7 : Theory of Alloys:**

Write in detail about the following topics :

37. Systems
38. Phase and phase rules
39. Structural constituents
40. Cooling curves
41. Phase diagram (rules: lever arm principle)
42. Eutectic, eutectoid and peritectic reactions
43. I-C equilibrium diagram, constituents , microstructures
44. Properties of plain carbon steels

### **Unit : - 8 : Corrosion of Metal and Alloys:**

45. Explain mechanism of corrosion
46. Types of corrosion
47. Prevention techniques of corrosion

### **Unit : - 9 : Metallic materials:**

48. What is metallography?
49. What useful information can be obtained from metallography?
50. Explain Macro examination and Micro examination, in brief.
51. Explain Optical Metallurgical Microscope with neat sketch.
52. Differentiate between micro and macro examination of engineering metallic materials?