Questions for self assessment

1. With help of schematic diagram explain the mechanism of epitaxial solidification.
2. Describe the modes of solidification in fusion welds?
3. Write the fundamental mechanisms of grain refinement of weld metal.
4. How do welding speed and heat input affect the grain structure of the weld metal?
5. Describe common methods of grain refinement of weld metal.
6. What is heterogeneous nucleation? Explain the principle of inoculation for refinement of weld metal.
7. How does arc pulsation help in grain refinement of weld metal?
8. How does application of mechanical vibrations and electromagnetic forces in weld metal during solidification refine the grain structure?
9. What is the effect of welding parameters on the grain structure of the weld metal?
10. Explain the fundamental mechanism of grain refinement using magnetic arc oscillation method?
11. Explain the metallurgical discontinuities in weld namely segregation and banding and factors lead to their development.
12. What is the need to protect the weld pool from atmospheric gases during welding?
13. Describe common approaches used to protect the weld pool from atmospheric gases?
14. What are factors affecting protection the weld pool in general?
15. How does type of shielding gas affect the cleanliness of the weld?
16. Explain the effect of welding parameters on protection of the weld pool?
17. Explain the factors affecting protection the weld pool associated following processes
    i. SMAW
    ii. SAW
    iii. GMAW
    iv. ESW
    v. GTAW
18. Cleanliness of the weld metal produced using different welding processes is found different; why?
19. Describe the effect of atmospheric gases namely oxygen, hydrogen, and nitrogen on composition and mechanical performance of welds?
20. How does hydrogen affect the weld joints of steel and aluminium alloys?

21. What are different types of fluxes and write about their stability and application.
22. What is basicity index (BI) of the flux?
23. How does BI affect the quality of the weld?
24. Define weldability of metals? Describe the metal properties affecting weldability.
25. Explain the factors determining the weldability of metals.
26. How does composition of steel affect its weldability?
27. What is carbon equivalent and how is it related with weldability of steel?
28. Describe following common problems associated with welding of steel in respect of factors contributing towards their development, mechanism and remedial method
    i. Porosity
    ii. Hardening and embrittlement
    iii. Cold cracking tendency
29. What are properties of aluminium alloy that make it somewhat difficult to weld?
30. What is softening of HAZ in heat treatable aluminium alloy weld joints?
31. Explain the mechanism of solidification cracking using suitable sketch.
32. What are factors affecting the solidification cracking tendency.
33. Explain the effect of metallurgical aspects on solidification cracking of aluminium weld joints.
34. How does alloy composition affect the solidification cracking behaviour of aluminum weld joints?
35. What is need of failure analysis?
36. Describe fundamental causes of failure of mechanical components.
37. When a mechanical component is said to have failed?
38. How does selection of improper material for design of mechanical components lead to failure?
39. Write steps of general procedure of failure analysis of mechanical components.
40. What information can be gathered from preliminary examination of failed component?
41. What is role of testing techniques in failure analysis?
42. How does macroscopic observation of fracture surface helpful in failure analysis?

43. What are techniques available for microscopic observation of the fracture surface? How these techniques help in failure analysis?
44. Using schematic diagram explain following microscopic feature of fracture surfaces and their significance
    i. Dimple
    ii. Cleavage
    iii. Inter-granular fracture
    iv. Striation
45. How does metallographic examination of the failed component help in failure analysis?
46. What information must be included in report of failure analysis?