

Engineering Material-II

Assignment One (2nd year: Mechanical Engineering Students)

1. “The field of Materials Science and Engineering (MSE) is often defined by the interrelationship between four basic elements: - synthesis and processing, structure and composition, properties, and performance.” Suppose that you are Material Engineer, and you have gained basic knowledge about four basic elements of Materials Science and Engineering. **What are the Responsibilities of Materials Engineer?**
2. Briefly describe the effects of the following **alloying elements** on **Alloy steels**. Manganese, Tungsten, Cobalt, Molybdenum, Vanadium, Aluminium, Copper and Silicon.
3. Briefly explain the difference between heat treatable and non-heat treatable alloys?
4. Briefly explain the effect of Carbon content and alloying elements on **Hardenability**.
5. Distinguish between (a) Hardness and Hardenability (b) Full annealing and spheroidizing Annealing (c) Martempering and Tempering (d) Annealing and Tempering (e) Solute and Precipitation Hardening
6. Write short notes on the **Surface Hardening** heat treatment. Briefly explain the **purposes** and **procedures** for each type of Surface Hardening. **Hint:** Toughness of a material decreases as hardness and strength increases. Shafts and gears, for example, require a tough material of high surface hardness. The solution for this problem would be to create **a very hard surface layer** on a comparatively soft and tough material. Surface hardening of steels is accomplished by a variety of methods: Nitriding, Carburizing, Carbonitriding, Flame hardening, Induction hardening, Boronizing, Cold working...etc.
7. Give the distinctive features, limitations, and applications of the following alloy groups: Titanium alloys, Refractory metals, Super-alloys, and Noble metals.
8. What do you understand by polymerization? What is the difference between addition polymerization and condensation polymerization?
9. Discuss the mechanism involved in the following types of corrosion: (i) Intergranular corrosion (ii) Stress corrosion (iii) Erosion corrosion.
10. Compare Gray and Malleable cast irons with respect to: a) Composition and heat treatment, b) Microstructure, c) Mechanical characteristics and d) Application area.
11. Explain the mechanism of electrochemical corrosion. What are the various factors which influence the corrosion of iron and steel?
12. Write short notes: (a) Fillers for plastics (b) Plasticizers (c) Bakelite (d) Polyvinyl chloride (e) Plastic as an insulating material (f) Wood as a natural polymer (g) Polymerization (h) Difference between thermosetting and thermoplastic resins (i) Protective coatings (j) Natural rubber (k) Copolymerization (l) Vulcanization