



- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Due credit will be given to neatness and adequate dimensions.
  9. Assume suitable data whenever necessary.
  10. Diagrams and chemical equations should be given whenever necessary.
  11. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Discuss classification, properties & applications of engineering materials in detail. **7**
- b) Calculate atomic packing factor for FCC crystal structure. **7**

**OR**

2. a) Explain in brief various imperfections found in crystal structure. **7**
- b) Differentiate between metal and non-metal in brief with applications. **7**
3. a) Draw and explain binary phase diagram for two elements A & B which are completely soluble in each other in solid state. **7**
- b) What is nucleation? Differentiate between homogeneous Nucleation & heterogenous nucleation. **6**

**OR**

4. Draw Iron-Iron carbide equilibrium diagram in detail. Also explain three invariant reactions in it with the help of neat sketch. **13**
5. a) Explain Flame hardening & Induction hardening with neat sketch. **6**
- b) Explain Jominy End Quench Test to determine hardenability of steel. **7**

**OR**

6. a) What is retained austenite? Explain how it is eliminated. **6**
- b) What is annealing? Explain following terms with respect to **7**
- i) Recovery
  - ii) Recrystallization
  - iii) Grain growth

7. a) Define & classify stainless steel with applications. **6**
- b) Discuss the effects of following alloying elements on the properties of steel **any three.** **7**
- i) Nickel ii) Chromium  
iii) Manganese iv) Tungstan

**OR**

8. a) Explain the term "Red Hardness". How it is achieved in H.S.S. **7**
- b) Differentiate between ferritic stabilizer & austenite stabilizer. **6**
9. a) Explain classification of cast iron in detail. **6**
- b) Define brass. What are various types of brasses? Enlist their applications. **7**

**OR**

10. a) Explain Ni-Hard & Ni-Resist cast iron with properties & applications. **7**
- b) Explain how white cast iron is converted into malleable cast iron. **6**
11. a) How hardness is measured in Rockwell Hardness Tester? Explain in detail. **7**
- b) What is NDT (Non destructive Testing)? Explain radiography test. **7**

**OR**

12. a) Explain production of cemented carbide tool by powder metallurgy technique. **7**
- b) Explain powder metallurgy. State the advantages and limitations of powder metallurgy techniques. **7**

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