



- Notes :
1. All questions carry equal marks.
  2. Due credit will be given to neatness and adequate dimensions.
  3. Assume suitable data wherever necessary.
  4. Illustrate your answers wherever necessary with the help of neat sketches.
  5. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
  6. Use of non programmable calculator is permitted.
  7. Solve **any five** questions.

1. a) Discuss the properties and applications of the following four ceramics. 7  
(1) Silica (2) Zirconia (3) SiC (4) Cubic boron nitride.
- b) Classify 'Engineering materials' in detail with suitable examples. 7
2. a) Draw Fe-Fe<sub>3</sub>C phase diagram and label all the phases. Discuss the structural transformation while cooling from liquid to solid. 7
- b) What is equivalent carbon in Cast irons? How this term is useful? Describe the factors which control graphitization? 7
3. a) Write an engineering brief (composition, heat treatment, properties) about the following steels : [a] Tool steel [b] HSLA steel [c] Maraging steels. 7
- b) What are hardening and tempering of high carbon steels? Give the process details. What are the advantages of hardened and tempered steels? 7
4. a) What is precipitation hardening? Illustrate with an example of Al – 4.5% Cu alloy. 7
- b) What do mean 'Superalloys'? How they improve the creep resisting properties? Explain creep resisting steels with suitable example. 7
5. a) Define a composite material and give the broad classification of it and explain in detail. 7
- b) Write a short note on light weight non-ferrous alloys and discuss the aluminium and its alloys with respect to alloying and heat treatment. 7
6. a) What are composites? Explain the role of matrix material in a composite. Give two examples of particulate reinforced metal matrix composites. 7

- b) Write short notes on following: **7**  
i) Hybrid composites  
ii) Rule of mixture
- 7.** a) Discuss the structure and applications of any four thermoplastic and any four thermoset plastic materials. **8**
- b) A glass fiber reinforced polystyrene contains 40 volume % of parallel fibers. Estimate the Young's modulus of the composite in the longitudinal direction of the fibers. Young's modulus of glass is  $70 \text{ GN m}^{-2}$  and that of polystyrene is  $2.6 \text{ GN m}^{-2}$ . **6**
- 8.** a) What are fibers reinforced plastics? Name any four fibers and their matrix material. **7**
- b) What are ceramics? List and briefly explain five important properties of ceramics that make them useful engineering materials. Explain the main classification of ceramic materials. **7**

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