

M.Tech. Mechanical Engineering Design (CBCS) Semester - I
MED15(A) - Advanced Engineering Materials

P. Pages : 2

Time : Three Hours



GUG/S/23/14190

Max. Marks : 70

- 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 programable calculator is permitted.
 7. Solve **any five** questions.

1. a) Classify 'Engineering materials' in detail with suitable examples. **7**
b) Suggest suitable materials for following with proper justification: **7**
 - i) Flywheels
 - ii) Passive solar heating
 - iii) Elastic hinges
2. a) Write an engineering brief (composition, heat treatment, properties) about the following steels: **7**
 - a) Tool steel
 - b) HSLA steel
 - c) Micro-alloyed steelsb) What are the general requirements of tool steels? Suggest how would you select the composition of steel for a particular application? **7**
3. a) Compare and contrast between thermoplastics and thermosetting plastics with suitable example. **7**
b) What is equivalent carbon in Cast irons? How this term is useful? Describe the factors which control graphitization? **7**
4. a) What do you mean "Superalloys"? How they improve the creep resisting properties? Explain creep resisting steels with suitable example. **7**
b) What do you understand by hardening of steel? Discuss the reason why martensite is very hard. Also discuss the various characteristics of martensite transformation. **7**

5. a) Explain in detail the process of precipitation hardening for Al-4.5% Cu alloy. **7**
- b) Write short notes on following: **7**
- i) Alloy cast iron
- ii) Rule of mixture
6. a) What are composite materials? Classify them in detail. What unique properties they have over the conventional materials? **8**
- b) A glass fiber reinforced polystyrene contains 40 volume% of parallel fibers. Estimate the young's modulus of the composite in the transverse direction of the fibers. Young's modulus of glass is 70 GN m^{-2} and that of polystyrene is 2.6 GN m^{-2} . **6**
7. A metal matrix composite is made with 6061 Aluminum alloy and 47 volume % of silicon carbide fibers in continuous in one direction. **14**
- a) Assuming iso-strain condition, derive an equation for the modulus of elasticity of the composite in terms of the elastic moduli of the matrix and the fiber material.
- b) Calculate the elastic modulus of the above composite if the modulus of elasticity of 6061 Al-alloy is 69GPa and the modulus of elasticity of SiC is 400GPa.
8. a) 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**
- b) List the important engineering ceramics and its applications. Discuss the properties and applications of Si_3N_4 and SiC. **7**
