

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

P. Pages : 2

Time : Three Hours



**GUG/W/23/14190**

Max. Marks : 70

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- 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. Use of non programmable calculator is permitted.
  6. Answer **any five** questions.

1. a) Draw Fe – Fe<sub>3</sub>C phase equilibrium diagram showing critical lines, critical temperatures and composition. 7  
b) What do you mean 'precipitation hardening'? Illustrate with an example of Al-4.5% Cu alloy. 7
2. a) 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<sup>-2</sup> and that of polystyrene is 2.6 GN m<sup>-2</sup>. 7  
b) What are the general requirements of tool steels? Suggest how would you select the composition of steel for a particular application? 7
3. a) What are composite materials? Classify them in detail. What unique properties they have over the conventional materials? 7  
b) What are the invariant reactions takes place in Fe – Fe<sub>3</sub>C phase equilibrium diagram. Calculate the amount of phases present. 7
4. a) Suggest suitable materials for following with proper justification: 7  
i) Flywheels  
ii) Passive Solar Heating  
b) Write short not on following: 7  
i) Micro-alloyed steel  
ii) Bio-compatible materials

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| <b>5.</b> | a) | What are ceramics? List and briefly explain five important properties of ceramics that make them useful engineering materials.  | <b>7</b> |
|           | b) | 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>7</b> |
| <b>6.</b> | a) | What do you understand by ‘secondary hardening’ of steel? Discuss the various characteristics of martensitic transformation.  | <b>7</b> |
|           | b) | What is ‘equivalent carbon’ in cast irons? How this term is useful? Compare and contrast between white cast iron and gray cast iron.                                  | <b>7</b> |
| <b>7.</b> | a) | Write short notes on following:   | <b>8</b> |
|           | a) | Ball bearing steel  |          |
|           | b) | Inverse rule of mixture   |          |
|           | b) | Classify ‘Engineering materials’ in detail with suitable examples.  | <b>6</b> |
| <b>8.</b> | a) | Write short notes on following:   | <b>7</b> |
|           | a) | Polymer matrix composites   |          |
|           | b) | Inverse Rule of mixture   |          |
|           | b) | Discuss the structure and applications of any four thermoplastic and any four thermoset plastic materials.  | <b>7</b> |

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