Registration No: | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech.**
PCMT4404

8th Semester Regular / Back Examination 2017-18
MATERIALS FOR ADVANCED APPLICATIONS
BRANCH : METTA, MME
Time: 3 Hours
Max Marks : 70
Q.CODE : C292

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1. **Answer the following questions :** **(2 x 10)**

a) What are Cellular materials? What quantitative results are obtained from the microstructure of metal foams?
b) What is the chief strengthening mechanism in microalloyed steels?
c) What is meant by sensitization in stainless steel?
d) What is 2-way shape memory effect?
e) Cite one similarity and two differences between precipitation hardening and dispersion strengthening?
f) A thermoplastic matrix contains 30 wt. % glass fiber. If the density of the matrix ρm is 1.5 g cm-3 while that of glass fiber, ρf, is 3 g cm-3, what is the density of the composite? Assume that no voids are present.
g) Draw the stress strain diagram for metal foam and identify various regions
h) Draw the stress- strain diagram for matrix, fibre and composite.
i) Define PECVD technique of thin film deposition.
j) Why conductivity of metal decreases with increase in temperature?

Q2. **a)** Explain the various layers of Thermal Barrier Coatings with suitable diagrams. **(5)**
b) Define Biocompatibility? Discuss briefly the major applications of Biomaterials in medicine and dentistry? **(5)**

Q3. **a)** What are Maraging Steels? Explain the difference in martensitic transformation in Maraging steels and conventional steels **(5)**
b) What are Heat resistant Steels? What are the different types of Heat resistant Steels? Explain the strengthening mechanism in this steel. **(5)**

Q4. **a)** Explain the different phases present in nickel based super alloys? Write about the strengthening mechanisms and applications of nickel based super alloys? **(5)**
b) Name the various methods for characterizing metal foams? Explain briefly the various applications of metal foams? **(5)**

Q5. **a)** Derive an expression for the modulus of elasticity for a continuous and aligned fibrous composite loaded in the direction of alignment? **(5)**
b) What are the different types of High Speed steels? Give one example of each? Explain with suitable diagram the heat treatment cycle of High Speed steels? **(5)**

Q6. **a)** Compare the structure and properties of thermosetting, thermoplastic and elastomeric polymers with examples and applications. **(5)**
b) What do you mean by super alloy? Describe the Co-based super alloys. **(5)**

Q7. A continuous and aligned glass fiber-reinforced composite consists of 40 vol% of glass fibers having a modulus of elasticity of 69 GPa and 60 vol% of a polyester resin that, when hardened, displays a modulus of 3.4 GPa. **(10)**

(a) Compute the modulus of elasticity of this composite in the longitudinal direction.

(b) If the cross-sectional area is 250 mm^2 and a stress of 50 MPa is applied in this longitudinal direction, compute the magnitude of the load carried by each of the fiber and matrix phases.

(c) Determine the strain that is sustained by each phase when the stress in part (b) is applied.

Q8. Write short answer on any TWO : **(5 x 2)**

a) Titanium shape memory alloy

b) Elastic behavior(Transverse Loading)

c) High Strength Low Alloy (HSLA) Steels

d) Bio Composite