Total Number of Pages: 02   <u>**B.Tech**</u>
                                                                                      PEMT5305

6thSemester Regular / BackExamination 2016-17
COMPOSITE MATERIALS
BRANCH:METTA, MME
Time: 3 Hours
Max Marks: 70
Q.CODE:Z681
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 is critical fibre length? Give the expression for determining the critical fibre length.
   b) What are whiskers? What are the main characteristics and limitations of whiskers?
   c) What are the basic parameters that decide the strengthening in dispersion strengthened composites?
   d) What is the criterion of using discontinuous fibers in the fiber reinforced composites and what should be the aspect ratio for discontinuous fibers?
   e) In a unidirectional continuous fibre reinforced composite give the expressions for determining the young's modulus of the composite in the fibre direction and in the transverse direction.
   f) Draw the characteristic stress-strain curves of an amorphous polymer and of an elastomer and compare the elastic behaviour.
   g) Explain the strengthening mechanism in dispersion strengthened composites.
   h) Alumina whiskers (density = 3.8 g/cm^3) are incorporated in a resin matrix (density = 1.3 g/cm^3). What is the density of the composite? Take volume fraction of fibres (whiskers), V_f = 0.35.
   i) Draw and explain the variation of longitudinal modulus (E11) and transverse modulus (E22) with fibre volume fraction.
   j) Give the properties and applications of Al / SiC whisker composites.

Q2 a) For a fibre reinforced composite that is subjected to a tensile stress   **(2)**
         equal to the fibre tensile strength σ_f draw and explain the stress
         position profiles in the fibre for three possibilities of fibre lengths (i) $l < l_c$
         (ii) $l = l_c$ (iii) $l > l_c$ where, l_c is the critical fibre length.
   b) A continuous and aligned glass fiber-reinforced composite consists of   **(8)**
         40vol% of glass fibers having a modulus of elasticity of 69 GPa and
         60vol% of a polyester resin that when hardened, displays a modulus of
         3.4 GPa.

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

(b) If the cross-sectional area is 250 mm^2 and stress of 50MPa 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.

Q3 **a)** Describe the different slurry methods for processing of particle reinforced, whisker reinforced and continuous fibre reinforced CMCs with suitable flow sheets and diagrams. **(5)**

b) Describe the matrix transfer moulding method of processing CMCs with suitable diagrams.Give the flow sheet for production of CMCs by sol-gel processing. **(5)**

Q4 **a)** Give a comparison of the physical and mechanical properties of MMCs with that of monolithic metals and the variation of these properties with types of reinforcement, proportion of reinforcement and orientation of fibres in MMCs. **(5)**

b) Describe the filament winding process of fabricating continuous fiber reinforced composites and give the advantages and limitations of the process. **(5)**

Q5 **a)** What is SAP material? Describe the properties and applications of SAP material with examples of some SAP type materials. **(5)**

b) What are cermets? Name the commercially important groups of cermets. Describe the matrices used, properties and uses of tungsten carbide cermets. **(5)**

Q6 **a)** What is a prepreg? Explain with a neat sketch. Explain the different techniques of making prepregs. **(5)**

b) What are hybrid composites? Give the characteristics, advantages and applications of hybrid composites. **(5)**

Q7 A continuous and aligned fibrous reinforced composite having a cross-sectional area of 970 mm^2 is subjected to an external tensile load. If the stresses sustained by the fiber and the matrix phases are 215 MPa and 5.38 MPa respectively, the force sustained by the fiber phase is 76,800N, and the total longitudinal composite strain is 1.56 x 10-3, then determine **(10)**

a) The force sustained by the matrix phase.

b)The modulus of elasticity of the composite material in the longitudinal direction and

c) The moduli of elasticity for fiber and matrix phases.

Q8 **Write short notes on any TWO:** **(5 x 2)**
a) Rheocasting
b) Chemical Vapour Infiltration (CVI)
c) TD-Nickel
d) Sandwich Panels