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

Total Number of Pages : 02 **B.Tech.**
PEMT5305

6th Semester Back Examination 2017-18
COMPOSITE MATERIALS
BRANCH : METTA, MME
Time : 3 Hours
Max Marks : 70
Q.CODE : C360

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 hybrid composites? Give one example.

b) Why do continuous fibre reinforced CMCs have much greater toughness as compared to particulate reinforced CMCs and monolithic ceramics?

c) A thermoplastic matrix contains 40 wt. % glass fibre. If the density of the matrix ρm is 1.1 g cm-3 while that of glass fibre, ρf, is 2.5 g cm-3, what is the density of the composite? Assume that no voids are present.

d) For a fibre reinforced composite that is subjected to a tensile stress 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 <lc (ii) l = lc (iii) l >lc where, lc is the critical fibre length

e) Name the different types of bonds that may form at the fibre matrix interface.

f) Give the properties and applications of Al / SiC whisker composites.

g) Give the various functions that a matrix phase performs in a composite material.

h) With a suitable diagram explain the chemical vapor infiltration (CVI) process.

i) What is glass transition temperature? How is it different from melting temperature?

j) Why is Yttria added to zirconia in zirconia toughened alumina?

Q2 **a)** What is a prepreg? Draw the schematic diagram of a prepreg. Explain the different techniques by which prepregs can be made. And explain the Autoclave process to make a laminated composite. **(5)**

b) Name the different methods for processing of CMCs and explain the different vapour deposition techniques. **(5)**

Q3 **a)** Explain with suitable sketches the filament winding method of producing polymer matrix composites. **(5)**

b) Derive an expression for the modulus of elasticity for a continuous and aligned fibrous composite loaded in the direction of alignment? **(5)**

Q4 **a)** Explain the variation of theoretical strength of composite as a function of volume fraction of fibre for reinforcement with continuous fibres and determine the critical volume fraction. Why is it not desirable to have very large volume fraction in composites? What is the criterion of using discontinuous fibres in the fibre-reinforced composites? What should be the aspect ratio for discontinuous fibres? **(5)**

b) A continuous and aligned fiber-reinforced composite is to be produced consisting of 45 vol% aramid fibers and 55 vol% of a polycarbonate matrix; mechanical characteristics of these two materials are as follows: **(5)**

	Modulus of Elasticity (MPa)	Tensile Strength (MPa)
Aramid fiber	1.3×10^5	3500
Polycarbonate	2.4×10^3	55

For this composite, calculate (i) the longitudinal tensile strength, and (ii) the longitudinal modulus of elasticity.

Q5 **a)** Describe the characteristic features of aramid fibres. What are the characteristic properties that have made Kevlar 49 / resin composites a suitable material in automotives. What are the applications of these composites in automotives? **(5)**

b) Draw and explain the force displacement curves for (i) monolithic ceramics (ii) particulate reinforced CMCs (iii) fibre reinforced CMCs. Explain the different Chemical Vapour Infiltration (CVI) methods of carbon production with suitable sketches. Explain the toughening mechanisms in Zirconia Toughened Alumina CMCs **(5)**

Q6 **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) How does the stress in a discontinuous fiber vary along its length? And explain the factors that must be considered for effective strengthening in discontinuous fibers reinforcement. **(5)**

Q7 A continuous and aligned fibrous reinforced composite having a cross-sectional area of 970 mm2 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 The moduli of elasticity for fiber and matrix phases.

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

a) TD-Nickel

b) Multifilamentary superconductors

c) Cermets

d) SAP