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

Total number of printed pages – 2

B. Tech

PEMT 5305

Sixth Semester Regular Examination – 2014

COMPOSITE MATERIALS

BRANCH : MM, MME

QUESTION CODE : F 311

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) What are the advantages of metal matrix composites over monolithic metals ?

   (b) Why does a multifilamentary superconducting composite have a higher ductility compared to monolithic intermetallic compound, Nb_3Sn ?

   (c) Show and explain the variation of specific volume with temperature in a crystalline material and a glass.

   (d) Explain briefly the effect of the difference in the coefficients of thermal expansion, α, between the matrix and the reinforcement on the mechanical behaviour of CMCs.

   (e) Distinguish between thermosetting and thermoplastic polymers.

   (f) Explain with diagram the effect of silane coupling agent on interfacial behaviour of glass fibre reinforced epoxies in presence of water.

   (g) 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, $V_f = 0.35$.

   (h) Give a classification of composite materials based on the reinforcements and based on the matrix.

   (i) What is the difference in structure between High Density Polyethylene (HDPE) and Low density Polyethylene (LDPE) ?

   (j) Why is yttria added to zirconia in zirconia toughened alumina ?

2. (a) Explain the production route of Aramid fibres. Describe the structure and characteristics of Aramid fibres. 5

(b) Explain briefly the different methods for measuring interfacial bond strength of composites. 5

3. (a) Explain with suitable sketches the different liquid state processing methods for producing metal matrix composites. 5

(b) Explain the production of in situ metal matrix composite by unidirectional solidification. 5

4. Explain the different fabrication processes and mechanical properties of dense carbon-carbon composites. 10

5. (a) Discuss in detail the physical and mechanical properties of metal matrix composites. 5

(b) Discuss the importance and the characteristics of aluminium matrix composites reinforced with silicon carbide particles. 5

6. (a) Explain with suitable sketches the matrix transfer moulding method of processing CMCs. 5

(b) Explain the sol-gel processing of CMCs with the help of flow sheets. 5

7. (a) Briefly explain the different toughening mechanisms operative in a composite. 5

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

8. (a) Explain the different moulding methods of fabricating polymer matrix composites. 5

(b) Explain the processing and properties of PEEK matrix composites. 5