USN | | | | | | | | | | |

06ME662

Sixth Semester B.E. Degree Examination, June-July 2009
Mechanics of Composite Materials

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Enumerate the classification of composites citing one example in each category. **(06 Marks)**

b. Explain the need for developing composite materials citing some practical situations. **(06 Marks)**

c. i) Enumerate the desirable characteristics of Fibers in a Fiber Reinforced Composite.
ii) What are the different types of Fibers of glass? Explain the manufacturing process for producing glass fibers. **(08 Marks)**

2 a. With the help of a neat sketch, explain the spray-up process. Also explain the different stages of curing. **(06 Marks)**

b. With the help of a neat sketch, explain Vacuum Bag Moulding technique. Highlight the salient features of the process comparing it with an open mould process. **(06 Marks)**

c. i) With the help of a neat sketch, explain Injection moulding.
ii) With the help of a neat sketch, explain Blow Moulding. **(08 Marks)**

3 a. Enumerate the applications of Polymer Matrix composites in Marine Industry. **(06 Marks)**

b. Enumerate the applications of Polymer composites in Recreational and sport goods. **(06 Marks)**

c. What is the current status and future potential for polymer matrix composites? **(08 Marks)**

4 a. Derive an expression for the Young's modulus of composite in the Transverse direction. State the assumptions in the derivation. **(06 Marks)**

b. State and explain Tsai-Hell theory of failure of a Lamina. **(06 Marks)**

c. Write down the elements of reduced stiffness matrix of an uni-directional Lamina stating the assumptions in evolving this matrix. Derive expressions for the reduced stiffness coefficients in terms of elastic constants of the Lamina. **(08 Marks)**

PART – B

5 a. Briefly explain laminate code. Cite some examples to explain the code. **(04 Marks)**

b. Enumerate the inter-laminar stresses highlighting their influence on the service performance. **(06 Marks)**

c. i) For an orthotropic unidirectional Lamina engineering properties along the principal axes are : $E_1 = 150$ GPa ; $E_2 = 50$ GPa ; $\gamma_{12} = 0.2$ and $G_{12} = 5$ GPa. Determine the reduced stiffness matrix elements.
ii) The longitudinal modulus of a glass fiber reinforced lamina is to be doubled by substituting the glass fibers with carbon fibers. The total volume fraction remains unchanged at 0.5. Calculate the volume fraction of Carbon Fibers. Given data :
$E_{carbon} = 300$ GPa ; $E_{glass} = 70$ GPa ; $E_{matrix} = 5$ GPa **(10 Marks)**

6 a. List some of the fibers used in Metal Matrix Composites. List some of the merits and demerits of Metal Matrix Composites. **(06 Marks)**

b. With the help of a neat sketch, explain the production of Boron Fibers. **(06 Marks)**

c. i) Explain the production technique of Carbon Fibers.

ii) What are the types of Carbon Fibers? **(08 Marks)**

7 a. Give an overview of the different fabrication processes for the production of Metal Matrix Composites. **(06 Marks)**

b. With the help of neat sketch, explain squeeze casting. **(06 Marks)**

c. With the help of a flow chart, explain Powder Metallurgy technique for the production of Metal Matrix Composites. **(08 Marks)**

8 a. Compare the specific modulus of different types of Metal Metrix composites with that of Polymer Matrix Composits. **(06 Marks)**

b. Enumerate the specific strengths of different Aluminum Alloy Composites. **(06 Marks)**

c. Enumerate the mechanical properties of Al-SiC composites. **(08 Marks)**

* * * * *