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

10AE52

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Introduction to Composite Materials

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define composite material. How are they classified? **(10 Marks)**

b. Explain clearly the role of matrix phase and reinforcement phase. **(05 Marks)**

c. Justify the need of developing composite materials with aerospace applications infocus. **(05 Marks)**

2 a. Sketch and explain typical epoxy curing cycle. **(10 Marks)**

b. Explain following with neat sketch:
(i) Structural laminates (ii) Pressure bag molding. **(10 Marks)**

3 a. Explain with neat sketch thermo forming and injection moulding process. **(10 Marks)**

b. Discuss with sketch the liquid molding and blow molding. **(10 Marks)**

4 a. Explain water jet cutting of composite material. **(10 Marks)**

b. With neat sketch, describe bonding process used in manufacturing of composite laminates. **(10 Marks)**

PART – B

5 a. Derive stress-strain relations for a lamina of arbitrary orientation. **(10 Marks)**

b. Find the compliance and stiffness matrix for a graphite/apoxy lamina, the material properties are given as,
$E_1 = 181$ GPa, $E_2 = 10.3$ GPa, $E_3 = 10.3$ GPa, $\gamma_{12} = 0.28$, $\gamma_{23} = 0.60$, $\gamma_{13} = 0.27$
$G_{12} = 7.17$ GPa, $G_{23} = 3.0$ GPa, $G_{31} = 7.00$ GPa **(10 Marks)**

6 a. Derive an expression for the modulus of elasticity of PMC under iso-strain, iso-stress condition. **(10 Marks)**

b. A Glass/epoxy lamina with 70% fiber volume fractions has following fiber and matrix properties,
$E_f = 85$ GPa, $E_m = 3.4$ GPa, $\gamma_f = 0.2$, $\gamma_m = 0.3$
Find out following:
(i) In-plane shear modulus
(ii) Major and minor Poisson's ratio. **(10 Marks)**

7 a. Explain CLT and derive expression for A, B and D matrices for laminate. **(10 Marks)**

b. Compute [A], [B], [D] matrices for a $\left[\frac{0^\circ}{90^\circ}\right]$ laminate with the following properties thickness of each lamina is 0.125 mm, $E_1 = 140$ GPa, $E_2 = 10$ GPa, $\gamma_{12} = 0.3$, $G_{12} = 5$ GPa. **(10 Marks)**

8 a. What are MMC's? Mention type of matrix and reinforcements used. **(05 Marks)**

b. Describe powder metallurgy technique. **(10 Marks)**

c. List advantage, limitations and applications of MMC's. **(05 Marks)**

* * * * *