Second Semester Examination 2013

MECHANICS OF COMPOSITE MATERIALS
Time: 3 Hours
Max marks: 70

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 x 10)
   a) What is a composite material?
   b) Distinguish among special orthotropic lamina and general orthotropic lamina.
   c) What are cermets? Give advantages of cermets?
   d) Give a brief classification of composite materials?
   e) What is the significance of reinforcement?
   f) What are the applications of composite materials in surface transport?
   g) Classify various type of materials based on number of independent elastic constants.
   h) What are the applications of composite materials in biomedical fields?
   i) Give stress – strain diagram of following fibers in the same plot. Carbon, Boron, Aramid, and E-Glass.
   j) What is Stacking sequence? Elaborate with example.

2. (a). Derive the stress-strain relationship for a transversely isotropic material. (5)
   (b). Derive rule of mixture for Youngs modulus when the composite having single matrix and number of fibers. (5)

3. For a composite CFRP, calculate the following transformed matrix for a unidirectional lamina with the fibers oriented at 45° to the X (stress) axis.
   Given: E_{11} = 135GPA E_{12} = 8GPA G_{12} = 7.1GPA v_{12} = 0.32. (10)

4. Explain the following phenomena for continuous FRCM
   (a) Failure due to compressive load acting in the direction of the fibers. (5)
   (b) Transverse failure of the composites. (5)

5. (a). Compare the longitudinal and transverse stiffness of two composites with the same matrix but different fibers. For the first case (E_f / E_m)$_1$ = 60 and for the second case (E_f / E_m)$_2$ = 30. Assume V_f = 0.5 . (6)
   (b). With neat sketches, elaborate the filament winding technique for manufacturing of composite material. (4)

6. (a). Explain with sketch Resin Transfer molding process. (5)
   (b) Describe an injection molding process. (5)

7. for a lamina with fiber orientation 60° to the horizontal, loaded as;
   σ_x = -3.5 MPa, σ_Y = 7 MPa, τ_{XY} = -1.4 MPa.
   Given E_1 = 14 GPa, E_2 = 3.5 GPa, G_{12} = 4.2 GPa, v_{12} = 0.4.
   Determine ε_X, ε_Y and γ_{xy}. (10)

8. Distinguish between: (2.5 x 4)
   a) Lamina and laminate;
   b) Micromechanics and Macro mechanics;
   c) Isotropic materials and Transversely Isotropic Materials;
   d) Thermo plastics and Thermoset;