(Pages 2)

Reg. No: ……

Name : ……

Model Question Paper

Second Semester M.Tech Degree Examination, October 2014

(2013 Scheme)

Branch: Mechanical, Stream: Machine Design

MDE 2006: MECHANICS OF COMPOSITE MATERIALS

Time: 3 Hours Max. Marks: 60

Instructions: Answer ***any two*** questions from each Module

Module - I

1. a) What is a composite material? What are the properties that can be improved by forming a composite material? **(04)**

   b) How are composites classified? Explain each category with 2 examples. **(06)**

2. a) What are Volume and Mass fractions? **(03)**

   b) A uni directional glass/epoxy lamina has 70% Fibre volume fraction. Find the following.
   i) Longitudinal elastic modulus
   ii) Ratio of load taken by fibre to that of the composite.
   iii) Transverse Young's Modulus.
   iv) Major and Minor Poisson's ratio.
   v) In plane shear modulus.

   Given: Young's Modulus of Fibre = 85 GPa
   Young's Modulus of Matrix = 3.4 GPa
   Poisson's Ratio of Fibre = 0.2
   Poisson's Ratio of Matrix = 0.3 **(07)**

3. Derive the expression for Longitudinal Young's Modulus (E_1), Transverse Young's Modulus (E_2), Major Poisson's Ratio and in-plane Shear Modulus (G_{12}) using micro mechanics approach in terms of properties of matrix and fibre. Comment on the dependence of these properties on fibre and matrix.

   (10)

P.T.O

Module - II

4. a) Write down the Stiffness Matrix and Compliance Matrix for the following composite lamina.
   i) Aniosotropic Material ii) Monoclinic Material iii) Orthotropic Material
   iv) Transversly Isotropic Material **(04)**

   b) For a 60˚ angle lamina of Graphite/Epoxy, find the following.
   i) Transformed Compliance Matrix ii) Transformed Reduced Stiffness Matrix
   iii) Global Strains iv) Local Strains v) Local Stress
   Given : $\sigma_1 = 2MPa$, $\sigma_2 = -3MPa$, $\tau_{12} = 4$ MPa, $E_1 = 181GPa$, $E_2 = 10.3GPa$, $G_{12} = 7.17GPa$, $\gamma_{12} = 0.28$. **(06)**

5) Find maximum value of $S > 0$, if a stress of $\sigma_x = 2S$, $\sigma_y = -3S$ and $\tau_{xy} = 4S$ is applied to a 60˚ angle lamina of Graphite/Epoxy using the following theories of failure.
   i) Maximum Stress Failure Theory
   b) Maximum Strain Failure Theory
   c) Tsai – Hill Failure Theory
   d) Tsai – Wu Failure Theory
   Given $(\sigma_1^T)_{ult} = 1500MPa$, $(\sigma_1^C)_{ult} = 1500MPa$, $(\sigma_2^T)_{ult} = 40MPa$, $(\sigma_2^C)_{ult} = 246MPa$, $(\tau_{12})_{ult} = 68MPa$ **(10)**

6) Find the 3 stiffness matrices [A], [B] and [D] for a 3 ply [0/35/-45] Graphite/Epoxy laminate. Assume each laminate has a thickness of 5mm. **(10)**

Module – III

7) Explain different machining techniques of composite materials. **(10)**

8) Explain different testing process of composite materials. **(10)**

9) Write a note on Impact Resistance, Fracture Resistance and Fatigue Resistance of a composite material. **(10)**