Code No: 07A72106 **R07** **Set No. 2**

IV B.Tech I Semester Examinations,MAY 2011
ANALYSIS OF COMPOSITES STRUCTURE
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the historical development of composites in brief? [16]
2. Write the expressions for inplane compliance, coupling compliance and flexural compliance for a lamina at a distance of Z_k. [16]
3. Compare the typical properties of tensile modulus, tensile strength and density of Carbon and Graphite fibers. [16]
4. For a laminated plate, show that $\left\{\begin{matrix}\{N\}\\ \{M\}\end{matrix}\right\} = \left\{\begin{matrix}A & B\\ B & D\end{matrix}\right\}\left\{\begin{matrix}s\\ \frac{s}{x}\end{matrix}\right\}$ [16]
5. Give the stress resultants relating to strains for kth layer for the following cases. Also explain the conditions / mathematical simplifications used to obtain them.
   (a) Quasi-isotropic laminate.
   (b) Unsymmetric laminate with isotropic layers. [8+8]
6. (a) Give the stress-strain relations for an orthotropic material subjected to uniaxial tension in terms of poisson's ratio and Young's modulus.
   (b) For an orthotropic material subjected to pure inplane shear what are the components of strain that reduce to a value of zero. Explain with a neat diagram.
   (c) Give the compliance matrix in terms of engineering constants. [16]
7. Explain Tsai-Wu Criteria in brief with appropriate equations and figures wherever necessary to support your answer. [16]
8. A glass/epoxy specimen weighing 0.98 gm was burnt and the weight of the remaining fibres was found to be 0.49 gm. Densities of glass and epoxy are 2.4 gm/ml and 1.20 gm/ml respectively. Determine the density of composite in the absence of voids. If the actual density of the composite was measured to be 1.50 gm/ml, what is the void fraction? [16]

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Code No: 07A72106 **R07** **Set No. 4**

IV B.Tech I Semester Examinations,MAY 2011
ANALYSIS OF COMPOSITES STRUCTURE
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. What are the basic assumptions that are to be made in the analysis of laminated composites? [16]
2. Give relative merits of the following
   (a) Carbon fibre
   (b) Glass fibre
   (c) Aramid fibre
   (d) Natural fibre [16]
3. Give the independent elastic constants for the following materials
   (a) General anisotropic material
   (b) Anisotropic material with symmetric stress and strain components
   (c) Anisotropic material with energy considerations
   (d) Monoclinic material.
   (e) Specially orthotropic material
   (f) Orthotropic material with transverse isotropy
   (g) Isotropic material [16]
4. The density of semi-crystalline polymer matrix is expressed as $\rho_m = \rho_{mc} V_{mc} + \rho_{ma} V_{ma}$ are the densities of the crystalline and the amorphous phase respectively and V_{mc} *and* V_{ma} are the corresponding volume fractions. The density of the fibres of the composite is 1.8g/ml and the density of the composite is 1.6g/ml. Given $V_f = 0.6$, $\rho_{mc} = 1.4$g/ml and $\rho_{ma} = 1.25$ g/ml. Determine the volume and weight fractions of the crystalline and amorphous phase of the matrix. [16]
5. What is the role of reinforcement in composite materials? [16]
6. How do you obtain the shear stress at the centre of plate. Give the relevant equation for the same. [16]
7. Explain Tsai-Hill Criteria in brief with appropriate equations and figures wherever necessary to support your answer. [16]
8. Compute all terms of[A] [B] and[D] matrices for [0/90] lamina with the following lamina properties. E_1=140 GPa, E_2=10 GPa, E_6=5 GPa and ν_{12} is 0.3. Take ply thickness d=0.125mm. [16]

Code No: 07A72106 **R07** **Set No. 4**

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Code No: 07A72106 **R07** **Set No. 1**

IV B.Tech I Semester Examinations,MAY 2011
ANALYSIS OF COMPOSITES STRUCTURE
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. For the shear deformation in the laminated plates write the equations for the ply stress in terms of initial strain and rotations about mid-plane. Write the equations for inter laminar shear stress also. [16]

2. Explain the relative uniaxial buckling of a square antisymmetric angle - ply laminated plates with the help of a graph plotted between $\frac{N_x}{N_{xo}}$ and Modulus ratio E_1/E_2. [16]

3. Give the relation between stiffness coefficients Ci_j and Si_j for a transversely isotropic material. What are the relations that hold good for this case? [16]

4. Write the strain displacement relationship for a laminate undergoing deformation. Derive $[\varepsilon] = \{\varepsilon\} + Z[K]$ [16]

5. Explain the relation between strain components and θ_i (initial fibre rotation)with the help of Graphs. In a laminate, the stable angle of inclination θ_s is not equal to θ_N. For this case, mention the assumptions to find the value of θ_s. [16]

6. Write a short note on
   (a) Poisson's mismatch
   (b) Mechanics of materials approach. [8+8]

7. Compute all terms of [A] matrix for [0/+45] lamina with the following lamina properties. E_1=140 GPa, E_2=10.5 GPa, E_6=7.5 GPa and ν_{12} is 0.28. Take ply thickness d=0.25mm. [16]

8. What are the main characteristics of the composites? Explain each with a suitable example? [16]

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Code No: 07A72106 **R07** **Set No. 3**

IV B.Tech I Semester Examinations,MAY 2011
ANALYSIS OF COMPOSITES STRUCTURE
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A general anisotropic material requires 81 elastic constants for analysis. Support the statement by giving the stress-strain relationship matrix. use the Tensor notation of stress-strain relationship. [16]

2. Give the boundary condition for the following beams
   (a) simply supported,
   (b) hinged -free in the normal direction,
   (c) hinged-free in the tangential direction and
   (d) Clamped types? [16]

3. Explain the following with appropriate equations wherever required
   (a) Buckling loads.
   (b) Bifurcation buckling loads.
   (c) Pre buckling under in plane loading.
   (d) Pre buckling under out-of-plane. [16]

4. Prove that the bending - extension coupling stiffness is zero for a symmetric laminate [16]

5. What are the limitations of composite materials? Explain. [16]

6. Explain the elasticity approach in brief. [16]

7. With the help of a suitable graph explain the theoretical variation in tensile modulus with the angle of load relative to the principal fibre direction consider unidirectional carbon fibre reinforced plastic (UD CFRP)with fibre volume fraction $V_f = 0.5$. [16]

8. For a laminate plate subjected to arbitrary transverse load 'q'. Give the equilibrium equation of elasticity and show that $\frac{\partial^2 M_x}{\partial x^2} + 2\frac{\partial^2 M_{xy}}{\partial x \partial y} + \frac{\partial^2 M_y}{\partial y^2} + q = 0$. [16]

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