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

IV B.Tech I Semester Examinations,November 2010
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. Give the classification of laminate configurations Explain laminate code with example for symmetric and hybrid laminate. [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. 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]

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

6. Derive the expression for compliance matrix for a lamina at a distance Z_K. [16]

7. Bring out the comparison between the metals and composites keeping in view their basic characteristics. [16]

8. Explain Tsai-Hill Criteria in brief with appropriate equations and figures wherever necessary to support your answer. [16]

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

IV B.Tech I Semester Examinations,November 2010
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 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]

2 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]

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. Conventional aircraft landing gear brakes are made up of three principal parts. What are these three parts? What is a carbon-carbon brake? Explain its role. [16]

5. How do you obtain the shear stress at the centre of plate. Give the relevant equation for the same. [16]

6. Using the relation$\{\sigma\}^k_{x,y}[Q]^k_{x,y}\{\varepsilon\}_{x,y}+Z[Q]^k_{x,y}\{k\}_{x,y}$. Explain the variations in the laminate. State whether $[Q]^k_{x,y}$ is continuous or discontinuous. [16]

7. 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]

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. 1**

IV B.Tech I Semester Examinations,November 2010
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 coupling effects in brief. Draw a symmetric laminate configuration and explain how the coupling effects would be reduced in this case. [16]

2. Compare the typical properties of tensile modulus, tensile strength and density of Carbon and Graphite fibers. [16]

3. 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]

4. The reduced stiffness matrix is given

$$Q = \begin{bmatrix} 181.8 & 2.897 & 0 \\ 2.897 & 10.34 & 0 \\ 0 & 0 & 7.17 \end{bmatrix} GPa.$$

Determine E_1, E_2, E_6 and ν_{12}. of the orthotropic lamina. [16]

5. Give the stress resultants relating to strains for k^{th} layer for the following cases. Also explain the conditions / mathematical simplifications used to obtain them.

   (a) Anti symmetric cross-ply laminates.

   (b) Anti symmetric angle ply laminates. [8+8]

6. Derive the expression for inplane shear modulus. Give the variation of G_{12} with fibre content. [16]

7. Bring out the comparison between the metals and composites keeping in view their basic characteristics. [16]

8. Prove that the factor K_s= 5/6 for a the plate under shear deformation. [16]

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

IV B.Tech I Semester Examinations,November 2010
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. Write the expressions for inplane compliance, coupling compliance and flexural compliance for a lamina at a distance of Z_k. [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 classifications of composite material? [16]

4. Netting analysis by Imposition of orthotropic elastic symmetry eliminates the coupling between direct stress and shear strain. For this case give the non-zero components of Q . [16]

5. (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]

6. Derive the expression for longitudinal strength and stiffness for a composite structure. [8+8]

7. Explain the buckling of simply supported laminated rectangular plate under uniform uniaxial in-plane compression and support your answer with appropriate equations. [16]

8. Compute all terms of [A] [B] and[D] matrices for [+45/-45] lamina with the following lamina properties. E_1=140 GPa, E_2=10GPa, E_6=5 GPa and ν_{12} is 0.3. Take ply thickness d=0.125 mm.

   [16]

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