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

IV B.Tech I Semester Examinations,December 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 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]
2. What is FRP? Explain. [16]
3. 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]
4. Give the transformation of stress-strain relation in terms of compliance matrix for
   (a) x,y reference axes
   (b) Principal material directions. [8+8]
5. Explain the maximum strain theory with the help of a neat diagram. [16]
6. 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]
7. For a simply supporting beam carrying UDL. Show that $(\sigma_X)^k_{L/2} = \frac{3}{2} f_1^k Z \frac{p_o}{b} \frac{L^2}{h^2}$. [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,December 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 basic assumptions in classical laminate plate theory. [16]
2. Explain the classifications of composite materials? [16]
3. Give relative merits of the following
   (a) Carbon fibre
   (b) Glass fibre
   (c) Aramid fibre
   (d) Natural fibre [16]
4. Write a short note on
   (a) Poisson's mismatch
   (b) Mechanics of materials approach. [8+8]
5. For a plate consisting of constant thickness, which is composed of thin layers of orthotropic material, derive the generalized stress-strain relations highlighting the plate stiffnesses A_{ij}, B_{ij} etc. [16]
6. Derive the expression for compliance matrix for a lamina at a distance Z_K. [16]
7. For a particular FRP material, the following are the material properties in the principal material direction. E_1=145 GPa, E_2=10.45 GPa, E_6=6.9GPa and ν_{12}=0.28. Calculate $(\nu_{xy})45^0$. [16]
8. Explain the buckling of simply supported laminated rectangular plate under uniform uniaxial in-plane compression and support your answer with appropriate equations. [16]

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

IV B.Tech I Semester Examinations,December 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. Give the classification of laminate configurations Explain laminate code with example for symmetric and hybrid laminate. [16]
2. Briefly discuss the theory and relevant buckling equations for laminated plates. [16]
3. Explain the coupling effects in brief. Draw a symmetric laminate configuration and explain how the coupling effects would be reduced in this case. [16]
4. What is the role of reinforcement in composite materials? [16]
5. 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]
6. A high strength composite has the following elastic constants E_1= 145 GPa, E_2= 12 Gpa, E_6=6 GPa and ν_{12}=0.25. Determine the transformed reduced stiffness matrix for the lamina with ply angle $\theta = 45^0$. [16]
7. Prove that the factor K_s= 5/6 for a the plate under shear deformation. [16]
8. 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]

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

IV B.Tech I Semester Examinations,December 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. Compare the typical properties of tensile modulus, tensile strength and density of Carbon and Graphite fibers. [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. What is laminate and how is it classified? [16]
4. Derive the expression for transverse modulus. Write the semi empirical relation to evaluate E_2 given by Halpin and Tsai. [16]
5. Explain the buckling of rectangular symmetric angle-ply plates under uniform compression, Nx and support your answer with appropriate equations. [16]
6. 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]
7. Prove the transformation of stress $\{\sigma\}_{1,2} = [\mathrm{T}]\{\sigma\}_{\mathrm{x,y}}$ [16]
8. Derive the expression $\begin{Bmatrix} \{N\} \\ \{M\} \end{Bmatrix} = \begin{bmatrix} A & B \\ B & D \end{bmatrix} \begin{Bmatrix} \{\varepsilon^o\} \\ \{k\} \end{Bmatrix}$. [16]

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