

Code No: 58091

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. Tech IV Year II Semester Examinations, May - 2017****ANALYSIS OF COMPOSITE STRUCTURES****(Aeronautical Engineering)****Time: 3 Hours****Max. Marks: 75****Answer any Five Questions
All Questions Carry Equal Marks**

- 1.a) What is laminated composite materials and explain?
b) Differentiate between lamina and laminate.
c) What are the different types of matrices and filaments? [7+4+4]
2. Explain the determination of properties of laminates with fibers and matrices. [15]
- 3.a) Explain the stress-strain relations for plane stress in an orthotropic material?
b) The reduced stiffness matrix $[Q]$ is given for a unidirectional lamina is given as follows:
- $$[Q] = \begin{bmatrix} 391.69 & 21.81 & 0 \\ 21.81 & 83.91 & 0 \\ 0 & 0 & 41.41 \end{bmatrix} \text{ GPa}$$
- What are the four engineering constants, E_1 , E_2 , ν_{12} , and G_{12} of the lamina? [7+8]
- 4.a) What are the assumptions to be made in the strength of materials approach for evaluation of four elastic moduli of a unidirectional lamina?
b) What do you mean by representative volume element of a material? [9+6]
- 5.a) State and explain maximum strain and maximum stress failure theories for the unidirectional lamina.
b) What is meant by orthogonally anisotropic material? Give an example. [8+7]
6. Find the extensional and bending stiffness matrices for 3-ply $[0/90/0]_T$ graphite/epoxy lamina using classical lamination theory. Given $E_1 = 181$ GPa, $E_2 = 10.3$ GPa, $\nu_{12} = 0.28$, $G_{12} = 71.7$ GPa and each ply having thickness of 6 mm. [15]
7. What is shear deformation of laminated composite plate? Explain the basic difference between first order and higher order shear deformation theories. [15]
8. Determine the maximum value of $\alpha > 0$, if stresses of $\sigma_x = 3\alpha$, $\sigma_y = -2\alpha$, $\tau_{xy} = 5\alpha$ are applied to a 45° lamina of glass/epoxy. Use the Tsai-Wu failure theory. The material properties of this lamina are given as follows:
 $V_f = 0.45$, $E_1 = 38.6$ GPa, $E_2 = 8.27$ GPa, $\nu_{12} = 0.26$, $G_{12} = 4.14$ GPa, $X = 1062$ MPa, $X' = 610$ MPa, $Y = 31$ MPa, $Y' = 118$ MPa and $S = 72$ MPa. [15]