MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL
(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (AERONAUTICAL/ AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATION, DEC 2021/JAN 2022

SUBJECT: COMPOSITE STRUCTURES [AAE 4050]

PART-B

REVISED CREDIT SYSTEM
(20/12/2021)

Duration: 3 Hours   Max. Marks: 20

Instructions to Candidates:

❖ Answer **ALL** the questions.
❖ Missing data if any, may be suitably be assumed.
❖ Use of supplied data sheet is permitted

| Q. No	Question	Max. Marks	CO	BT Level
1	An element of an orthotropic lamina (E_1=105 GPa, E_2=28 GPa, υ_{12}=0.24, G_{12}=10 GPa) is subjected to an off-axis shear stress τ_{xy} at an angle θ as shown in Figure 2. If the fiber orientation angle, θ = 45°, determine the value of the applied shear stress τ_{xy} that would generate the following stresses along the 1, 2 axes: σ_1 = 1000 MPa, σ_2 = −1000 MPa, τ_{12} = 0. What are the normal strains along the principal material axes 1 and 2?	(05)	CO3	L3
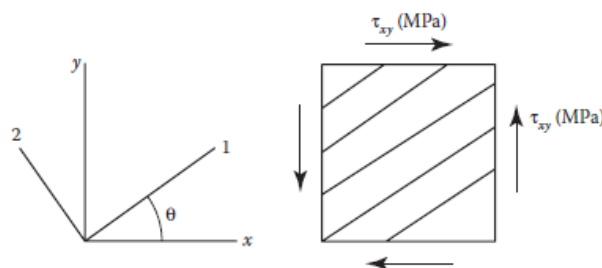
Figure 2 Lamina subjected to an off-axis shear stress

Q. No	Question	Max. Marks	CO	BT Level
2	Define the coefficients of mutual influence of (a) First kind (b) Second kind	(02)	CO2	L2
3	Derive the expression for the density of a composite material based on weight fractions and densities of the constituents, namely the fiber and matrix respectively.	(03)	CO2	L2

4	An orthotropic lamina has long continuous fibers oriented at an angle 'θ' w.r.t. the global x-axis. Determine the moduli along the global x-direction in terms of the material properties along the principal axes 1 and 2.	(03)	CO3	L3
5	Compare the stiffness matrices of the laminates [0/45/45/0] and [0/45/0/45]. Assume each ply has a thickness of "h/4" mm.	(04)	CO4	L4
6	With a neat sketch, explain the failure phenomena of De-lamination and Debonding in composite structures.	(03)	CO4	L2