Department of Applied Mechanics

AML 835 (Mechanics of Composite Materials)
Major Test, Semester II (2009-10)

Time: 2 Hours Max. Marks : 80

Note:- ***Any additional data which you may require can be assumed. Clearly state your assumption.***

Q1. A 3-ply laminate with stacking sequence ($+45^O/0^O/-45^O$) is fabricated from 6 mm thick laminae having the following stiffness matrix in principal material coordinates:

$$[Q_{ij}] = \begin{bmatrix} 134.03 & 2.29 & 0 \\ 2.29 & 8.82 & 0 \\ 0 & 0 & 3.254 \end{bmatrix} GPa$$

Determine the matrices [A], [B] and [D] for this laminate. The laminate is loaded in uniaxial tension in the fiber direction of the middle lamina. Discuss the deformation of the laminate in terms of the mid-plane strains and curvatures. Indicate various couplings which will be shown by the laminate. How can these coupling be eliminated or reduced?

(25)

Q2. With reference to the fracture of the aligned continuous fiber-reinforced composite materials, discuss the following phenomena:

(a) Various modes of failure due to compression in fiber direction. (8)

(b) Strength variability of glass fibres and its influence on the composite strength in tension,along the fibre direction. (7)

Q3. A T-300 carbon fiber/ epoxy lamina with $v_f = 0.6$ is shown below. The fibers are inclined at 45^O to the axis. The laminate is subjected to a biaxial stress state shown in the figure. Determine :

(a) The state of strain. Also, sketch the approximate deformed shape of the lamina.

(b) Strains in the principal material directions. (12)

Use the following data
$E_f = 220$ Gpa , $\upsilon_f = 0.2$;
$E_m = 3.6$ GPa and $\upsilon_f = 0.35$