Mechanical Engineering Department

MEL 791 – Composite Materials and Processing

MAJOR EXAM, 27th Nov 2006, 10.30-12.30pm, III-336

Max Marks 40

Q1. a) What is PEEK, write few lines about its properties. (2)

b) A component is to be made by glass fiber reinforced plastic composite, initial information has led to the final choice of matrix being between Epoxy and PEEK. Further details of the working environment of the component were supplied. These were that the component was likely to be used in a moist environment at temperatures as high as 100° C. Which matrix would you select? Justify your selection. (8)

Q2. a) Define critical fiber length. (2)

b) An aligned short fiber composite tensile specimen consists of 40 vol.% of carbon fibers of length 2 mm and diameter 7 μm in a polycarbonate matrix. The tensile strength of the fibers and the shear strength of the fiber matrix interface are 2.5 GPa and 12.5MPa respectively. Calculate the critical fiber length, l_c and then estimate the longitudinal tensile strength of the composite given that the stress on the matrix at the failure strain of the fibers is 30 MPa. If the fibers are not aligned then what will be the change in its multi axial strength. (8)

Q3. a) Determine the extensional, bending–extension coupling, and bending stiffness of an equal thickness bimetallic strip with two different isotropic materials with E_1, ν_1, α_1 and E_2, ν_2, α_2, use the middle surface of the strip as the reference plane. (8)

b) Why classical laminate theory cannot predict failure of finite width laminates? (2)

Q4. a) A quasi isotropic carbon epoxy laminate [0/±45 /90]s is subjected to an inplane normal load Nx per unit width. With increasing values of load, which ply will fail first. Determine the stiffness matrices before and after the first ply failure (FPF). Assume that each ply has a thickness of 1 mm and the material properties are given as under:
E_1 = 133GPA, E_2 =9 GPa, ν_{12} =0.25, G_{12}=3.5GPa (8)

b) Explain why the laminates with the same lay up but different stacking sequence have the same 'A' matrix? (2)
