Quiz 2 (11/7/03) – Sample questions

1. Develop expressions for the transverse and fiber-direction moduli for a transversely isotropic composite lamina.

2. Plot and explain the variation of fiber-direction strength of a unidirectionally-reinforced lamina as a function of fiber fraction.

3. Explain the variation of normal and shear stress in a short reinforcing fiber. What is the "critical fiber length?"

4. Write out the 2-D compliance matrices for isotropic and transversely isotropic laminae. Define the various elastic parameters.

5. Develop an expression for the compliance of a transversely isotropic lamina in terms of the properties referenced to the principal material directions and the angle between the fiber direction and an arbitrary direction.

6. Draw and explain the biaxial yield locus for the Tresca and von Mises criteria. Draw and explain how the v. Mises locus is effected by the hydrostatic stress state.

7. What is a craze? How is it related to the hydrostatic and deviatoric stress states. Draw and explain the Sternstein crazing locus for biaxial stresses.

8. Develop a rate-process model for the effect of rate and temperature on the tensile yield strength. What is the physical significance of the activation energy and volume?

9. Derive the Griffith equation and explain how it can be used in design.

10. Explain the compliance calibration method of determining the critical strain energy release rate.

11. Explain the difference between the Griffith energy approach to fracture and the stress-intensity view. Develop an expression for the relation between the critical strain energy release rate and the critical stress intensity factor.

12. Describe the Considere construction for true stress-strain curves, and show why the slope of the secant line gives the engineering stress. Explain how the inflections of the curve give the yield strain and draw ratio.

13. How can rubber modification toughen normally brittle polymers? What advantages does ABS offer in comparison with HIPS?

14. Why are thick specimens often more brittle than thin ones?

15. Describe the phenomenon of physical ageing.

16. Give the chemical formulas of three typical matrices and three fibers for fiber-reinforced composites.

17. Give brief descriptions of filament winding, sprayup, and lamination processing.

18. Sketch a "TTT" diagram plotting the times to gelation and vitrification for a typical epoxy thermoset. Explain the mechanisms underlying these two transitions.