Materials & Mechanical Design – IDL721

Major

Dated: November 28, 2006

Time 10:30 – 12:30 hrs.

Maximum Marks: 35

Do **Question 1** and any other **Four Questions.** In total **Five Questions** to be attempted. All question carry equal marks.

Q1. a) Explain the methodology you followed in design of a cantilever beam transducer in your lab class. Explain in brief (max. one page). (*No calculations please*). (3)

b) Explain how you would put the strain gauges, so as to eliminate the effect of axial forces, temperature strains and get amplification. (2)

c) Describe the other types of load transducers discussed. Sketch a few of them, giving its working principle.(max. half page). (2)

Q2. a) What are thin cylinders? (1)

b) A tank of 250 mm inside radius has a wall thickness of 15 mm. It is subjected to an internal pressure of 1000 kPa. Compute the hoop stress and the longitudinal stress in the walls of the cylinder. Derive the expressions used. (4)

c) Also calculate the maximum in-plane shear stress. (2)

Q3. a) Differentiate between Dispersion Strengthened Composites and Particulate Strengthened Composites. (3)

b) What are the methods of preparing Dispersion Strengthened Composites? (2)

c) What are the typical applications of Dispersion Strengthened Composites? (2)

Q4. a) What are Continuous and Discontinuous Fibre Composites? Explain one method of fabrication for each one of them. (3)

b) How is load transferred in short fibre composites (Critical Length). (4)

Q5. a) What are composites? Explain why they are known as tailor-made materials, giving examples. (3)

b) Explain Law of Mixtures for Composites. What are dilute mixtures? (4)

Q6. Write short notes on any **two** of the following.

a) Thick cylinders (3.5)

b) Strengthening mechanism in composites by impediment of dislocations (3.5)

c) Fatigue Failure and Endurance limit. (3.5)

Q7. a) Explain one theory of failure each for the following: (4)

i) Ductile material in static loading

ii) Brittle material in static loading.

b) Briefly describe the three theories for variable loading, and depict them graphically through a diagram. (3)

Q8. Write short notes on any two of the following:

a) Annealing of steel (3.5)

b) Shear stresses during bending of beams (3.5)

c) Precipitate or Solution hardening (Aluminum alloys) (3.5)

****