M.E. DEGREE EXAMINATION, MAY/JUNE 2006.

First Semester

Structural Engineering

ST 1601 — EXPERIMENTAL METHODS AND MODEL ANALYSIS

(Regulation 2005)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Enumerate the basic characteristics of measuring devices.

2. Distinguish accuracy and sensitivity of a measuring device.

3. What are stain gauges and list the various types of stain gauges?

4. Differentiate between null and out of Balance Bridge.

5. What are the associated instrumentations for measuring static and dynamic strain?

6. What are multiplexers?

7. Distinguish between isoclines and isochromatics.

8. What are the properties of an ideal photoelastic materials?

9. What are the general and similitude requirements of the model?

10. State Buckingham – Pi theorem.

11. (i) Briefly outline the guidelines to plan and carryout model studies. (6)

(ii) A strain gauge is mounted as shown in fig. Q 11(ii) on a simply supported beam carrying uniformly distributed load over the whole span. The gauge length is 1/20th of the span of the beam. Derive an expression for strain gauge reading in terms of load on the beam (10)
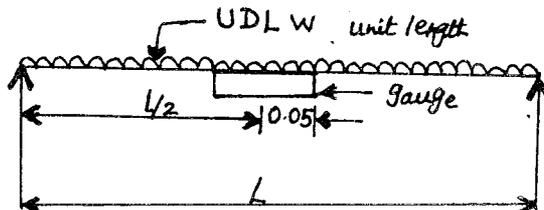

Fig Q 11(ii)

12. (a) (i) With a schematic sketch discuss the various stages of a generalised basic measuring system. (10)

(ii) Distinguish differential transformer transducer and variable inductance displacement transducer. (6)

Or

(b) (i) What are the limitations of optical gauge? (6)

(ii) Enumerate and explain the types of pressure measuring devices with neat sketches. (10)

13. (a) A strain gauge installation has to operate at a temperature of 600° C with a load (strain) cycle duration of 4h. Describe how you would proceed to select the strain gauge, adhesive and strain gauge installation procedure.

Or

(b) A four arm stain gauge bridge is mounted on a steel shaft $(E = 2 \times 10^5 \, N/mm^2, \gamma = 0.3)$ so that two gauges sense maximum tensile strain and other two sense maximum compressive strain. The gauge are arranged to yield maximum strain output due to torque. If the strain indicator reading is 1500 μ strain, determine the maximum torsional stresses in the shaft.

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14. (a) A three element delta rosette serves to find the state of stress at a point 'O' on the surface of strained aluminium components as shown in Fig. Q 14(a). The measured strains referred to a given directions Ox are

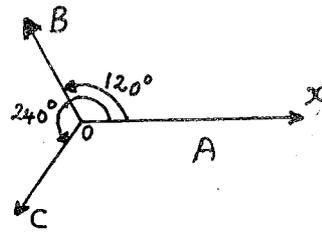| Direction	Strain
0°	500 μ m/m
120°	−250 μ m/m
240°	+250 μ m/m

Fig. Q 14(a)

Assume the following :

Transverse sensitivity $k_t = 0.07$, $\gamma_{al} = 0.33$, $E_{al} = 70$ GPa. Find the actual principal strain and stresses and their directions with respect to Ox.

Or

(b) Write technical notes on :

    (i) Single channel data acquisition system.   (6)

    (ii) Cathode ray oscilloscope.   (6)

    (iii) x-y plotter.   (4)

15. (a) (i) Give an account of the insitu tests to determine

    (1) member behaviour

    (2) honey combing of RCC structures.   (10)

    (ii) Briefly discuss any two method of compensation technique.   (6)

Or

(b) (i) What are the general and similitude requirements of the model? (4)

(ii) A simply supported beam 3 m long having a rectangular cross section 100 × 200 mm is to carry a uniformly distributed load of 10 kN/m over the entire the span. A geometrically similar scale model 500 mm long is to be constructed of a material with E as 2×10^6 N/mm². E for the beam is 2×10^5 N/mm². Determine

(1) the cross section of the beam

(2) the scale for bending moment and the stress if the uniform distributed load for the model is 500 N/m. (12)

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