30.5.07

BE (CIVIL) 8TH SEMESTER EXAMINATION 2007
MODEL ANALYSIS OF STRUCTURES – CE 803/8
(ELECTIVE I)

Full Marks 100 Time 3 hours

Use separate answer script for each half
*Answer **SIX** Questions taking **THREE FROM EACH HALF***
Two Marks are reserved for neatness in each half.

FIRST HALF

1. a) Describe the principles of lateral extensometer and shear difference method for separating the individual principal stresses obtained by a photoelastic test.
b) In a photoelastic test, the isochromatic fringe order observed at a point is 1.5. At the same point, the reduction of thickness as measured by a lateral extensometer is 3.725×10^{-3} mm. The model thickness is 6 mm. The material fringe value is 11 N/mm. $E=0.04\times10^{5}$ MPa. $\nu=0.3$. Determine the individual principal stresses and also maximum shear stress.

10+6=16

2. a) Discuss how a hyperstatic structure can be analyzed by a photoelastic test. Establish the stress-optic relationship and calculate the maximum shear stress from this relationship.
b) In a photoelastic test, the isochromatic fringe order at a point is 0.33. The sum of the principal stresses at the same point is 3 in terms of fringe order. The material fringe value of the model is 12N/mm. Model thickness=5mm. What are the individual principal stresses ? If the model load scale factor =1/60 and the thickness scale factor =1/20. What are the corresponding principal stresses in the prototype?

8+8 =16

3.What are the basic criteria of a model material? Describe the advantages of mortar as a model material. Discuss the properties of plaster showing the variation of compressive and tensile strength with water/plaster ratio.

8+3+5=16

4. a) Distinguish between direct and indirect model studies.
b)Compute the influence line ordinates for the reaction at point B in the two span continuous beam ABC at 2.5 m interval. AB= 10m, BC= 10m. The points A and B are simply supported and B contains roller support. Assume EI as a constant.

6+10=16

5. What is the principle of moment deformeter? Also prove Maxwell Betti's reciprocal theorem mathematically.

10+6=16

SECOND HALF

6. (a) Discuss various types of experimental error and its quantification.

(b) Resistance of a copper wire is measured by the relation as describe below. Obtain the possible error in measurement of resistance. Also obtain the increase in error if uncertainty in T is doubled.

$$R = R_0[1+\alpha(T-20)] \text{ and Uncerta int y in measurements are :}$$

$$R_0 = 6\Omega \pm 0.3\%,\ \alpha = 0.004 \pm 1\%,\ T = 30^oC \pm 1^oC$$

6+10=16

7.(a) State Buckingham's Π Theorem. Explain the application of the theory to obtain non dimensional parameters.

(b) A simply supported beam of length L is subjected to a concentrated load at a point having distance of c_1 from left support and c_2 from right support. A model is needed to build for flexural behaviour study. Assuming geometric similarities derive the condition of similarities.

6+10=16

8. (a) Derive the expression of sensitivity of a typical potentiometer circuit used to measure dynamic strain.

(b) Explain the basic circuit application in load cell to measure axial load and torsion. Also obtain the sensitivity of the measurement.

8+8=16

9. (a) A delta rosette mounted on a surface and the gauge readings are taken as:

$$Q_1 = 850\mu, Q_2 = -50 \text{ and } Q_3 = -850.$$

Obtain the principle strain with direction. Assume K =-0.07

(b) Three strain gages are placed in series in arm R_1 of a fixed voltage whetstone bridge circuit. If the train experienced by all gages is same, determine the increase in circuit sensitivity over that obtained with single gage. Assume the resistance ratio 'm' as 9.0

8+8=16

10. Write short notes on: (any FOUR)

i. LVDT ii. Impulse Hammer and Modal Testing

iii. Vibration Exciter iv. Piezoelectric Accelerometer

v. Gauge factor and gauge sensitivity

vi. Dimensional Matrix vii. Strain Rosette 4 x 4=16