Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CE-NEW)/SEM-6/CE-604/2010

2010

STRUCTURAL ANALYSIS — III

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) In flexibility method of structural analysis, basic unknowns are

      a) Displacements b) Forces

      c) Bending moments d) Rotations.

   ii) In portal method of analysis the horizontal shear in any interior column is assumed as ..... of that in an exterior column.

      a) twice b) thrice

      c) equal d) half.

   iii) Structure flexibility matrix is symmetric due to

      a) Maxwell's reciprocal theorem

      b) Three moment theorem

      c) Second area-moment theorem

      d) Principle of super position.

iv) Dynamic magnification factor depends on

a) Frequency ratio only

b) Damping ratio only

c) Both frequency and damping ratios

d) None of these.

v) Error function in finite difference expression can be found using

a) Talyor's series

b) Complex series

c) Algebraic polynomials

d) De Alembert's principle.

vi) The function which relates the field variable at any point within the element to the field variables of nodal points is called

a) Polynomial function b) Interpolation function

c) Shape function d) Either (b) or (c).

vii) The ratio of stiffness of a beam at the near end when far end is hinged to the stiffness when far end is fixed, is

a) $\frac{1}{2}$ b) $\frac{3}{4}$

c) 1 d) $\frac{4}{3}$.

viii) A structure after vibration in reality comes to rest is mathematically best explained by

a) Coulomb damping

b) Negative damping

c) Viscous damping

d) Inertia of the structure.

ix) Natural frequency of vibration of a structural element is

a) directly proportional to '*k*' and '*m*'

b) inversely proportional to '*k*' and '*m*'

c) inversely proportional to '*k*' and directly proportional to '*m*'

d) directly proportional to '*k*' and inversely proportional to '*m*'.

x) A uniform cross-section beam of the length 2L and flexural rigidity EI is fixed at the ends. The moment required for unit rotation at the centre of span is

a) 8EI/L b) 6EI/L

c) 4EI/L d) 2EI/L.

xi) The portal and cantilever method is related to

a) Vertical load analysis

b) Horizontal load analysis

c) Either (a) or (b)

d) Both (a) and (b).

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Derive 4th order derivatives in finite difference technique.

3. A mass m is attached to the mid-point of a beam of length L as shown in the Fig.1 the mass of the beam is small in comparison to m. Determine the spring constant and the frequency of the free vibration of the beam in the vertical direction. The beam has a uniform flexural rigidity EI.

Fig. 1

4. Draw the influence line diagram for the reaction at B as shown in the following Fig. 2.

Fig. 2

5. Write short notes on :
   i) System stiffness matrix
   ii) Shape functions
   iii) Critically damped system.

6. Develop the flexibility matrix for the continuous beam as shown in the Fig. 3

Fig. 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Draw the bending moment diagram of the frame as loaded shown in Fig. 4. Geometric and elastic properties of all the beam and column members are same. Apply portal or cantilever method of analysis.

Fig. 4

8. Draw the influence lines for (i) reaction at *B* (ii) moment at *A* for the propped cantilever shown in Fig. 5. Compute the ordinates at intervals of 1·25 m.

Fig. 5

9. Analyze the continuous beam of uniform section (EI = constant) shown in Fig. 6 using matrix flexibility method of analysis.

Fig. 6

10. Analyze the portal frame shown in Fig. 7 using stiffness matrix method of analysis.

Fig. 7

11. Determine the reactions at *A*, *B* and *C* and the deflections at the mid-span of AB and BC of the beam loaded as shown in Fig. 8.

Fig. 8

12. Calculate the modal deflection u_2 and v_2 of the node 2 of the truss as shown in Fig. 9 by finite element method.

Fig. 9

13. Obtain the undamped natural frequency of the beam and attached mass as shown in Fig. 10. Neglect mass of the beam and spring.

Fig. 10