

Total No. of Questions :8]

SEAT No. :

P3981

[4959]-1020

[Total No. of Pages :3

B.E. (Civil Engineering)

FINITE ELEMENT METHOD IN CIVIL ENGINEERING

(2012 Course) (Semester - II) (Elective - III)

Time : 2½ Hours

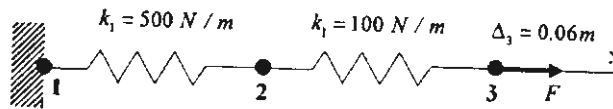
[Max. Marks :70]

Instructions to the candidates:

- 1) Answer to the two sections should be written in separate books.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Use of non programmable calculator is allowed.
- 5) Assume suitable data, if necessary.

SECTION - I

- Q1) a) Explain in brief 2D and 3D Pascal's triangle with example. [6]
- b) Determine elongation at node 2 and pulling force 'F' at node 3 for the spring assembly given below. Take pull at node 3 is 0.06m. [6]

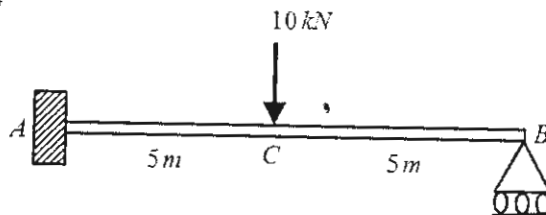


- c) Derive stiffness matrix and transformation matrix for two noded frame element considering axial deformation, transverse deformation and rotation. [8]

OR

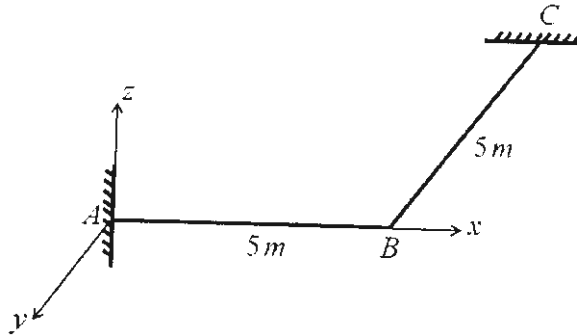
- Q2) a) Explain in brief state of stress and state of strain at a point in 3D elasticity problem. [6]
- b) Obtain rotation at B for the beam shown below using finite element method. [6]

Consider given beam as one element. Take $E = 2 \times 10^8 \text{ kN/m}^2$ and $I = 4 \times 10^{-6} \text{ m}^4$



P.T.O.

- c) Derive the stiffness matrix for the grid elements as shown in Figure. Take flexural rigidity EI and torsional rigidity GJ same for both the elements. [8]



- Q3)** a) Explain difference between CST and LST element. [6]
b) Derive stiffness matrix for the two noded bar element using finite element formulation. [12]

OR

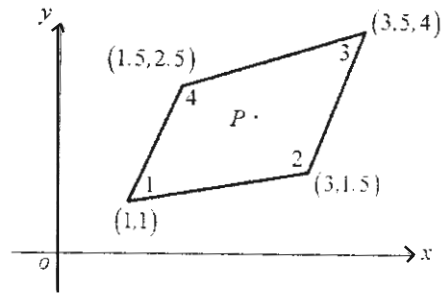
- Q4)** a) Write short note on applications of 3D elements in FEM and draw neat sketch of hexahedron element in natural coordinate system [6]
b) Derive strain displacement matrix $[B]$ for the four noded rectangular element using finite element formulation. [12]

- Q5)** a) Derive the shape function for two noded bar element using polynomial in Cartesian coordinate system. [6]
b) Derive shape functions for the four noded and nine noded rectangular elements in natural coordinate (ξ, η) system using Lagrange's interpolation function. [10]

OR

- Q6)** a) Derive area coordinates for the three noded CST element. [8]
b) Derive shape functions for the two noded beam element using polynomial in Cartesian coordinate system. [8]

Q7) a) Determine Cartesian coordinates of the point P ($\xi=0.8, \eta=0.9$) as shown in Figure. **[8]**



b) Explain in brief isoparametric, superparametric and subparametric elements with suitable example. **[8]**

OR

Q8) Derive the Jacobian matrix for the four noded quadrilateral isoparametric elements as shown in Figures. **[16]**

