P3981

[4959]-1020

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]**
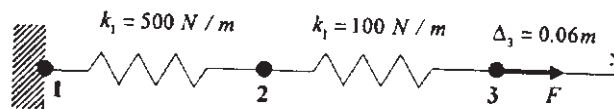

    c)   Derive stiffness matrix and transformation matrix for two noded frame element considering axial deformation, transverse deformation and rotation.   **[8]**

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 $E = 2 \times 10^8 kN/m^2$ and $I = 4 \times 10^{-6}$ m^4
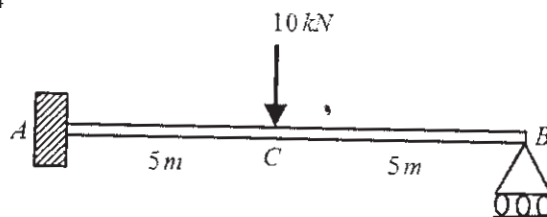
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c) Derive the stiffness matrix for the grid elements as shown in Figure. Take flexural rigidity EI and torsional rigidity GJ same for both the elements.**[8]**
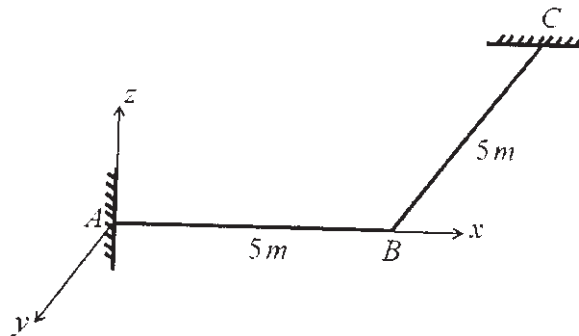
Q3) a) Explain difference between CST and LST element. **[6]**

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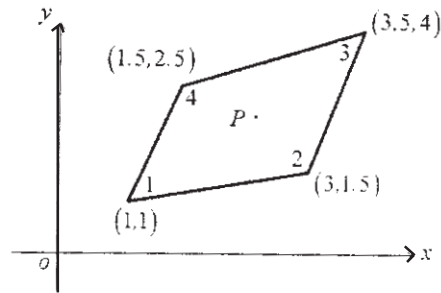
b) Explain in brief isoparametric, superparametric and subparametric elements with suitable example. **[8]**

OR

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