Total No. of Questions : 8]

SEAT No :

P2968

[Total No. of Pages :3

[5154]-520

B.E.(Civil Engineering)

FINITE ELEMENT METHOD IN CIVIL ENGINEERING

(2012 Course) (End Sem.) (401009-E) (Semester-II) (Elective-III)

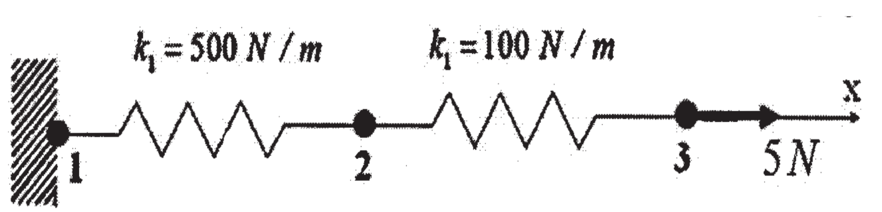
Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

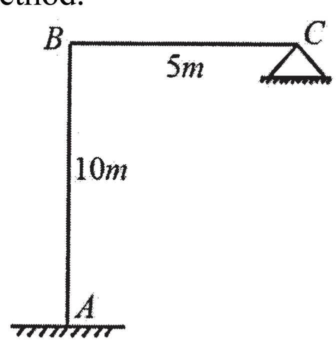
1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicates full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Derive differential equations of equilibrium for 3D elasticity problem. **[6]**

b) Detrmine the axial displacements at nodes 2 and 3 for the spring assembly given below. **[6]**



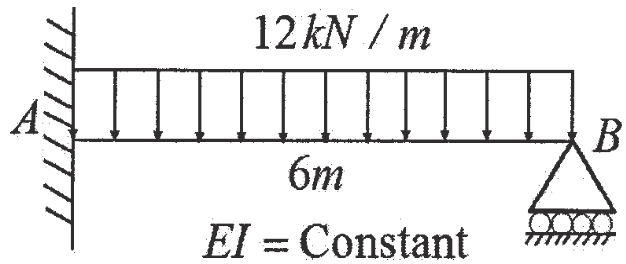
c) Derive the stiffness matrix of portal frame ABC as shown in figure using finite element method. **[8]**



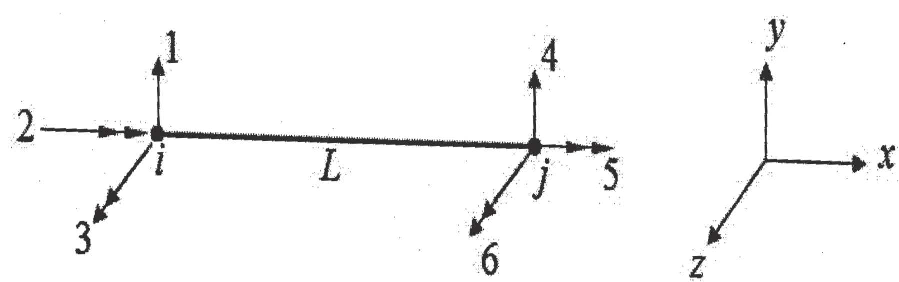
OR

Q2) a) Explain step by step procedure for finite element method. **[6]**

b) Obtain fixed end moment at support A using finite element method. Take $E = 2\times10^8$ kN/m^2 and $I = 4\times10^{-6}$m^4. **[6]**



c) Derive the stiffness matrix for the grid element considering six degrees of freedom. **[8]**



Q3) a) Write short note on principle of minimum potential energy and principle of virtual work. **[6]**

b) Derive 4×4 stiffness matrix for the truss member 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]**

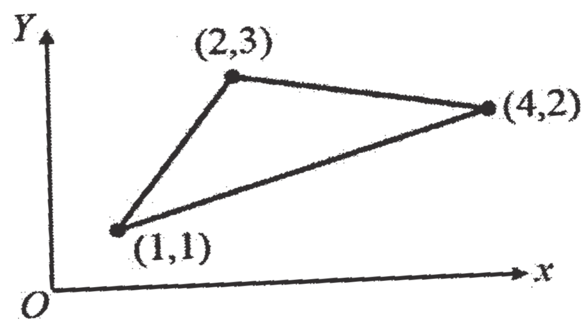
b) Derive strain displacement matrix [B] for the four noded rectangular element using finite element formulation. **[12]**

Q5) a) Derive the shape function for two noded beam element using polynomial in Cartesian coordinate system. **[10]**

b) Derive shape functions for the nine noded rectangular elements in natural coordinate (ξ,η) system using Lagrange's interpolation function. **[6]**

OR

Q6) a) Derive the area coordinates for the three noded CST elements as shown in figure. **[8]**



b) Derive shape functions for the eight noded serendipity element in natural coordinate (ξ,η) system. **[8]**

Q7) Derive the stiffness matrix for 1D isoparametric element using principle of virtual work. **[16]**

OR

Q8) Derive the Jacobian matrix for the four noded quadrilateral isoparametric element having Cartesian coordinates at node 1(1,1), node 2(3,2), node 3(4,4) and node 4(2,3). **[16]**

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