Total No. of Questions : 08]

SEAT No. :

P2127

[Total No. of Pages : 3

[5254] -520
B.E. (Civil Engineering)
FINITE ELEMENT METHOD IN CIVIL ENGINEERING
(2012 Pattern) (Elective - III) (Semester - II)

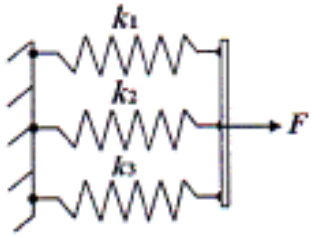
Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

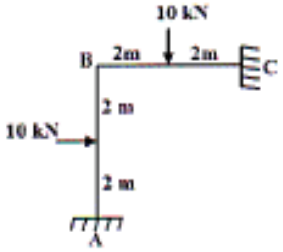
1) ***Answer Q.1 or 2, Q.3 or Q.4, Q.5 or 6, Q.7 or 8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data if necessary.***

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

b) Figure shows three springs connected parallel. Take k_1 = 10 N/mm, k_2 = 20 N/mm, k_3 = 40 N/mm and F = 700 N. Using finite element method determines the deflections of individual springs. **[6]**



c) Determine the rotation of joint B for the frame supported and loaded as shown in figure. Take EI constant and neglect axial deformations. **[8]**



OR

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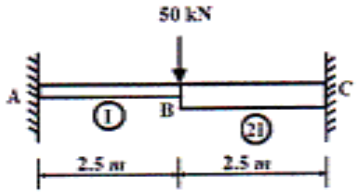
Q2) a) Derive strain displacement relations for 3D elasticity problem. **[6]**

b) Find the vertical deflection and rotation at joint B of the beam loaded and supported as shown in figure using finite element method. Take EI constant. **[6]**



c) Derive the stiffness matrix for the two noded grid element considering six DOF. **[8]**

Q3) a) What is node? Explain types of nodes with suitable example. **[6]**

b) What is aspect ratio of element? How it affect the FEM solution? Explain with suitable example. **[6]**

c) Explain step by step procedure of FEM. **[6]**

OR

Q4) a) Write difference between CST and LST elements. **[6]**

b) Write short note on applications of 3D elements in FEM. **[6]**

c) What is the convergence criteria of displacement function? **[6]**

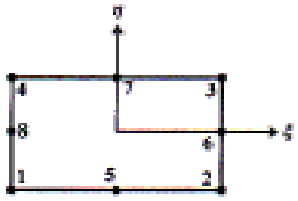
Q5) a) Derive the shape function for two noded beam element using polynomial in Cartesian coordinate system. **[10]**

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

OR

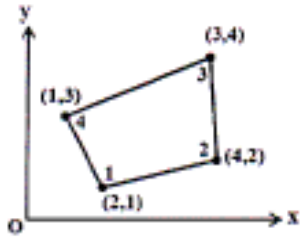
Q6) a) Derive shape functions for two noded bar element using polynomial in natural (ξ,η) coordinate system. **[8]**

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



Q7) a) Explain isoparametric, sub - parametric and super - parametric elements with suitable example. **[8]**

b) Determine the Cartesian coordinate (x, y) of the any point $P(\xi = 0.4, \eta = 0.5)$ as shown in figure. **[8]**



OR

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

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