M.E. Second Semester (Civil (Structural Engineering)) (New-CGS)

13091 : Finite Element Method : 2 SFSE 1

P. Pages : 1 **AW - 3889**

Time : Three Hours * 1 1 1 2 * Max. Marks : 80

Notes : 1. Answer **three** question from Section A and **three** question from Section B.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answer necessary with the help of neat sketches.
5. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. Derive stiffness matrix for 1D truss / spring element (2 Noded Element) **14**

2. a) Explain plane stress and plane strain problems with example. **8**

b) Derive constitutive matrix for plane stress condition from 3-Dimensional Elastic body constitutive matrix. **5**

3. a) Define shape function and state it's properties. **4**

b) Calculate and draw variation of shape function by using Natural co-ordinate system for 3-node beam element. Use Lagrangian concept. **9**

4. For the spring assemblage shown in Fig. Q. (4) Obtain **13**

i) The assembled stiffness matrix. ii) The displacement of nodes 2 and 3;

iii) The reaction forces at node 1 and 4; and iv) The forces in each spring.

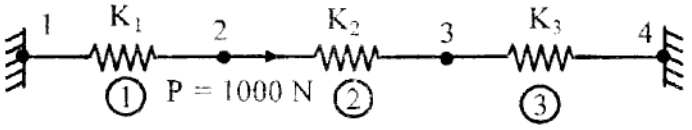


Fig. Q (4)

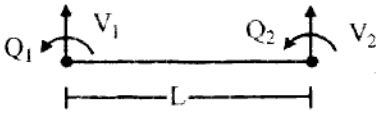
$K_1 = 1000\ N/mm$; $K_2 = 2K_1$; $K_3 = 1.5K_2$

5. Explain step-by-step formulation for Two-Dimentional FEA of CST Element. **13**

SECTION – B

6. Develop the formulation for analysis and axi-symmetric structure subjected to axi symmetric loading, using 2D-three noded iso-parametric element. **14**

7. Derive the shape function and strain displacement matrix for two noded beam element as shown in fig. Q. (7) **13**



8. What do you mean by Jacobian matrix? Derive stiffness matrix for four node Isoparametric element for plane strain problem. **13**

9. Develop formulation for element stiffness matrix for a 2D four noded element using Mindlin plate theory. **13**

10. Formulate elemental stiffness matrix for an ACM element with 12 DOF. **13**

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