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10CV841

Eighth Semester B.E. Degree Examination, June/July 2017
Finite Element Analysis

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Indicate state of stress and strain at a point interms of $\{\sigma\}$ and $\{\in\}$. Mention its practical importance. **(05 Marks)**

b. How potential energy functions are classified as stable/unstable/neutral? Give examples. **(08 Marks)**

c. Obtain stiffness relation(K) with nodal force(F) and nodal displacement(Q) using energy principles. **(07 Marks)**

2 a. Mention the steps followed in Galenkin's method while finding displacement of a cantilever beam. **(08 Marks)**

b. Using Rayleigh-Ritz method, derive an equation for maximum deflection for a simply supported beam at the center using Trignometric function. **(12 Marks)**

3 a. What are displacement functions? Mention its types. Which one of them is widely used and why? **(08 Marks)**

b. Obtain the expression of variation of shape functions for one dimensional bar element interms of :
i) L_1 and L_2 ii) x_1 and x_2. **(12 Marks)**

4 a. Obtain the relation between nodal displacement of truss element in local and global coordinates. **(04 Marks)**

b. Determine nodal displacements and forces for the truss (two bar) shown in Fig.4(b).

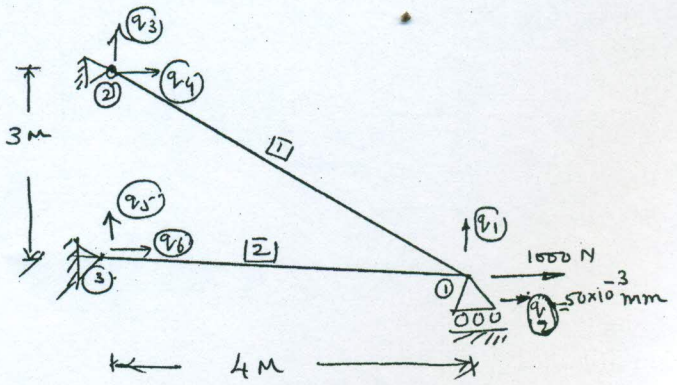

Fig.Q4(b)

Assume $q_2 = 50 \times 10^{-3}$mm at node (i) roller support no nodal displacements at hinge support. **(16 Marks)**

PART – B

5 a. Obtain strain-displacement matrix for 4 noded 2 dimensional rectangular element assuming 2DOF at each node. Consider natural coordinates. **(10 Marks)**

b. Obtain strain-displacement matrix and strains $\in_x$, $\in_y$ and γ_{xy} for the element shown in Fig.Q5(b). Assume nodal displacements vector $\{q\} = \{2, 1, 1, -4, -3, 7\} \times 10^{-2}$ mm. **(10 Marks)**

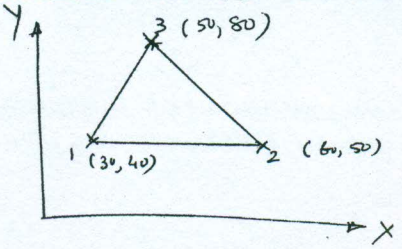

Fig.Q5(b)

6 Obtain shape functions for the following elements using Lagrange interpolation function and sketch the variation, shown in Fig.Q6. **(20 Marks)**

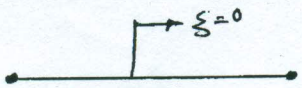

Fig.Q6(i)

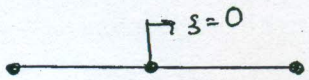

Fig.Q6(ii)

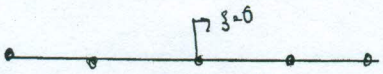

Fig.Q6(iii)

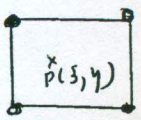

Fig.Q6(iv)

7 a. What are isoperimetric elements? Distinguish super from sub parametric elements with sketches. **(08 Marks)**

b. Convert the following parent elements shown in Fig.Q7 to global Cartesian coordinate system having arbitrary curved/surfaces. No equations be derived. Only sketch the transformed shapes. **(12 Marks)**

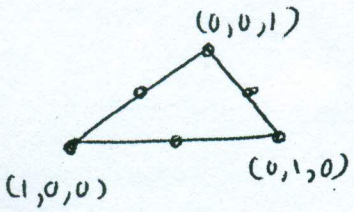

Fig. Q7(b)(i)

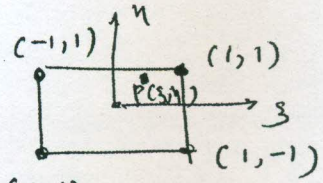

Fig.Q7(b)(ii)

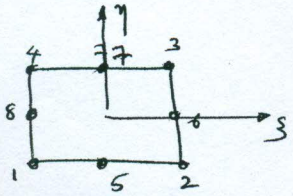

Fig.Q7(b(iii)

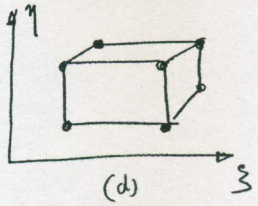

Fig.Q7(iv)

8 Write note on :

a. Numbering of nodes
b. Patch test
c. Softwares used in FEM
d. Constitutive law. **(20 Marks)**

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