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12MAR12

First Semester M.Tech. Degree Examination, February 2013

Finite Element Methods

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Explain the steps involved in finite element method, with suitable examples. **(10 Marks)**

b. Write a note on Iso, Sub and Super parametric elements. **(05 Marks)**

c. List the engineering applications of FEM. **(05 Marks)**

2 a. What are shape functions? Derive the shape function for ID linear element. **(10 Marks)**

b. Write a note on properties that a shape function should satisfy. **(05 Marks)**

c. Explain simplex, complex and multiplex elements. **(05 Marks)**

3 a. Determine the nodal displacement using principle of minimum potential energy for the springs shown in Fig.Q3(a). Take $F_1 = 75$ N, $F_2 = 100$ N.

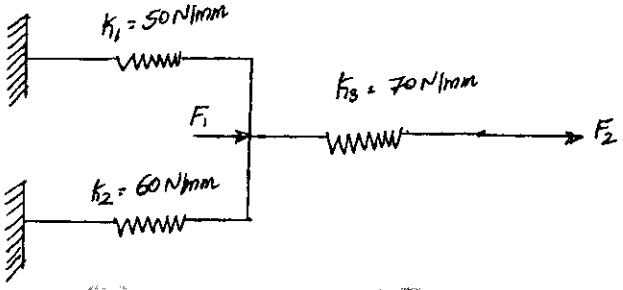


Fig.Q3(a) **(10 Marks)**

b. Using Galerkin's method, find the expression for displacement of a cantilever beam shown in Fig.Q3(b).

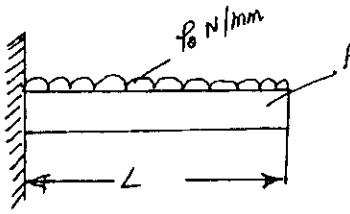
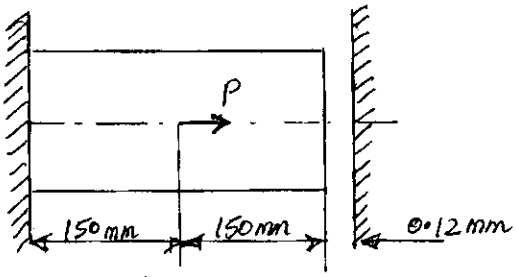


Fig.Q3(b) **(10 Marks)**

4 a. Derive the element stiffness matrix for a bar element using minimum potential energy approach. **(10 Marks)**

b. Determine the displacement at nodes and support reaction for the bar shown in Fig.Q4(b).

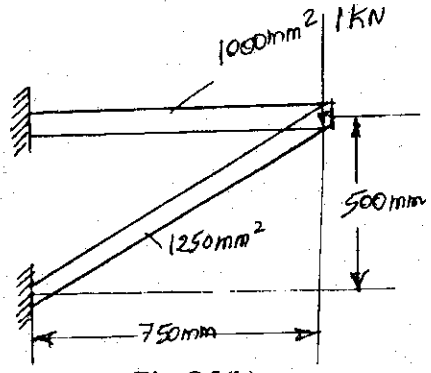


$A = 300$ mm^2
$P = 600$ kN
$E = 200$ GPa

Fig.Q4(b) **(10 Marks)**

5 a. Explain the principle of minimum potential energy and its approach to FEM. **(06 Marks)**

b. For the truss shown in Fig.Q5(b) formulate the stiffness matrix and determine:
i) Nodal displacement ii) Elemental stresses **(14 Marks)**



$E_1 = E_2 = 200$ GPa

Fig.Q5(b)

6 a. Explain parametric and variational design in CAE. **(06 Marks)**

b. Explain the integrated database management system used in CAE. **(08 Marks)**

c. Write a note on simulation based design. **(06 Marks)**

7 a. Explain 3D transformation and 3D rotation of objects. **(10 Marks)**

b. Write a note on concatenation and 2D reflection. **(10 Marks)**

8 a. What are the different representation schemes used for representing 3D solid object? Explain with examples. **(10 Marks)**

b. Write a note on surface creation and NURBS curve. **(10 Marks)**

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