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06ME63

Sixth Semester B.E. Degree Examination, June/July 2011
Modeling & Finite Element Analysis

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Explain plane stress and plane strain cases with examples. **(04 Marks)**

b. Find an expression for the displacement at the loading point for the bar shown in Fig. Q1 (b).

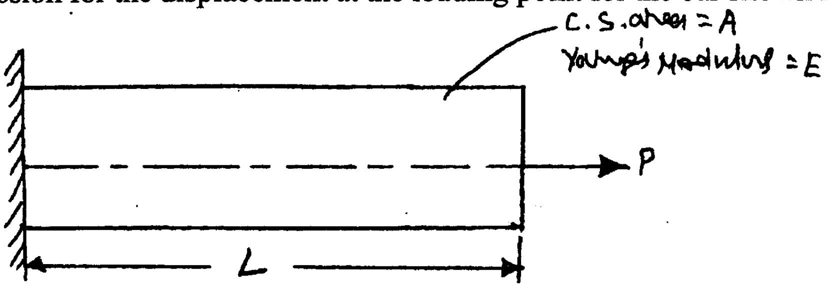


Fig. Q1 (b) **(10 Marks)**

c. Evaluate the following integral using two-point Gauss integration method:

$$I = \int_{-1}^{+1} (a_0 + a_1 x + a_2 x^2 + a_3 x^3 + a_4 x^4) dx.$$ **(06 Marks)**

2 a. Write the general description of the finite element method. **(10 Marks)**

b. Write down the properties of stiffness matrix. **(05 Marks)**

c. Explain node numbering scheme for a finite element mesh. **(05 Marks)**

3 a. Write down the general guidelines for selecting the interpolation polynominal. **(03 Marks)**

b. Derive shape function for a 1-D bar element in terms of global coordinates. **(07 Marks)**

c. Derive shape function bar a 2-D simplex triangular element in terms of local coordinates. **(10 Marks)**

4 a. Derive interpretation polynomial (Shape functions) for 1-D quadratic element. **(10 Marks)**

b. Derive shape functions for Isoparametric Linear Quadrilateral element in terms of local coordinates. **(10 Marks)**

PART – B

5 a. Explain different approaches used in developing element stiffness matrices and load vectors in FEM. **(05 Marks)**

b. Derive stiffness matrix for a 1-D bar element under axial loading. **(05 Marks)**

c. Derive strain-displacement matrix [B] for a isoparametric linear triangular element. **(10 Marks)**

6 a. Write down the differential equation governing the heat conduction in an orthotropic solid body and describe each term. **(06 Marks)**

b. Find the temperature distribution in the 1-D fin shown in Fig. Q6 (b). Take two elements for FE idealisation.

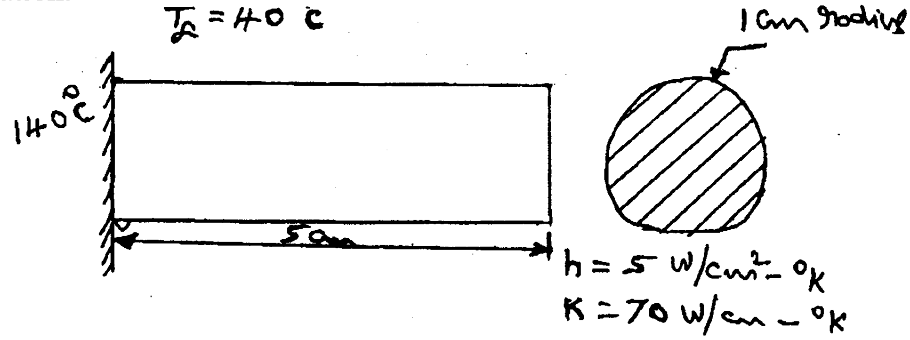


Fig. Q6 (b) **(14 Marks)**

7 a. Describe different methods of applying boundary conditions in FEM. **(06 Marks)**

b. For the two-bar truss shown in Fig. Q7 (b), determine the modal displacements through FEM. Take $E = 210 \times 10^9$Pa; $A = 0.01m^2$.

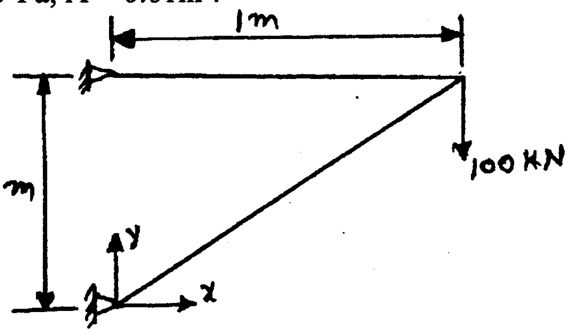
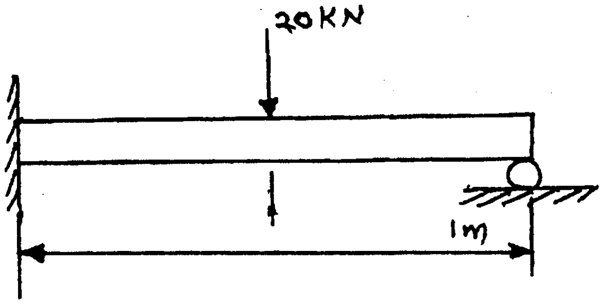


Fig. Q7 (b) **(14 Marks)**

8 A uniform cross sectional beam is fixed at one end and supported by a roller at the other end. A concentrated load 20kN is applied at the mid length of the beam as shown in Fig. Q8. Determine the reflection under load.



E = 210GPa
$I = 2500mm^4$

Fig. Q8 **(20 Marks)**

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