USN

10ME64

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Finite Element Method

Time: 3 hrs. Max. Marks:100

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

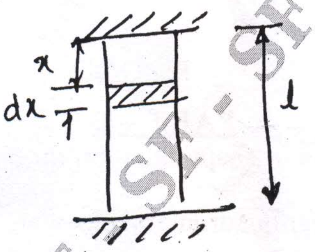
PART – A

1 a. Explain the concept of stress-strain relations for plane stream and plane strains. **(10 Marks)**

b. Explain the concept of FEM, applications, Advantages and disadvantages. **(05 Marks)**

c. Discuss the basic steps in the formulation of FEA. **(05 Marks)**

2 a. Use Rayleigh Ritz method to find the displacement at the midpoint of the rod shown in the Fig Q2(a).



Body force/unit length
g = 1, E = 1, A = 1.

Fig Q2(a) **(10 Marks)**

b. Determine the expression for displacement at load point is as shown in Fig Q2(b), using Galerkin method.

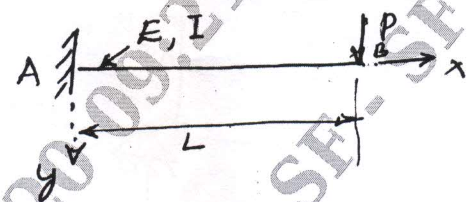


Fig Q2(b) **(10 Marks)**

3 a. Derive an shape function for CST element in general co-ordinate system. **(10 Marks)**

b. For the triangular plate shown in Fig Q3(b) below, compute the strain displacement matrix considering the plate as one element

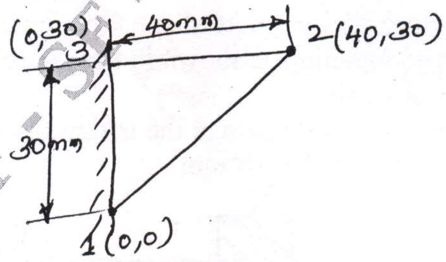


Fig Q3(b) **(06 Marks)**

c. Explain simplex, complex and multiplex elements. **(04 Marks)**

4 a. Figure Q4(a) shows a bar subjected to uniformly distributed load 'P_0' as shown Fig Q4 (a). Taking E = 70GPa, Area A = 10^4mm^2, determine : i) Nodal displacement ii) Stresses

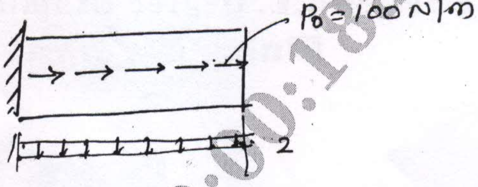


Fig Q4(a) **(10 Marks)**

b. Using penalty method, find out nodal displacement, stress in each elements and support reactions for the bar shown in Fig Q4(b) E_{steel} = 200GPa, E_{cu} = 100GPa.

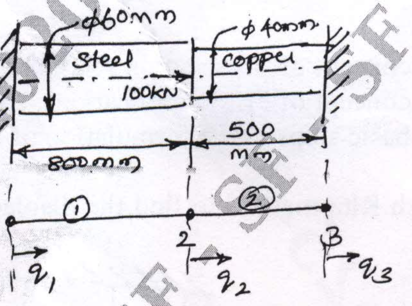


Fig Q4(b) **(10 Marks)**

PART – B

5 a. Explain with a sketch variation of shape function for 3 noded 1D quadratic bar element. **(10 Marks)**

b. Derive shape function for linear quadrilateral element. **(10 Marks)**

6 a. Consider a 3 bar truss as shown below in Fig Q6(a). Determine the nodal displacement and elemental stresses

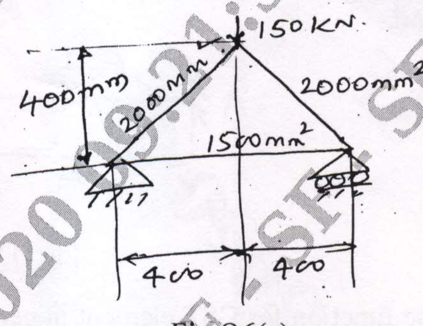


Fig Q6(a) **(14 Marks)**

b. Define truss? What are the assumptions made in the analysis of truss? **(06 Marks)**

7 a. Derive an equation for Hermite shape function of a beam element. **(10 Marks)**

b. For the beam and loading as shown in Fig Q7 (b). Find out
   i) Steps at 2 and 3
   ii) The vertical deflection at the midpoint of the UDL

Take E = 200GPa, J = 4 × 10^6mm^4

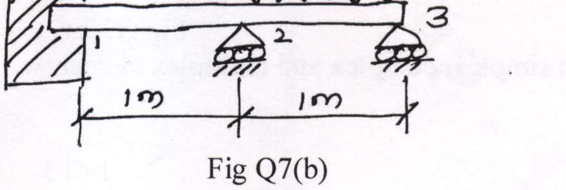


Fig Q7(b) **(10 Marks)**

8 a. Find the temperature distribution in one dimensional fin shown in Fig Q8(a)

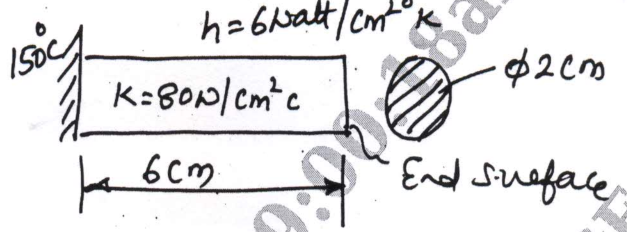


Fig Q8(a) **(10 Marks)**

b. Solve for temperature distribution in the composite wall shown in Fig Q8(b), using 1D heat elements the penalty approach of handling boundary conditions

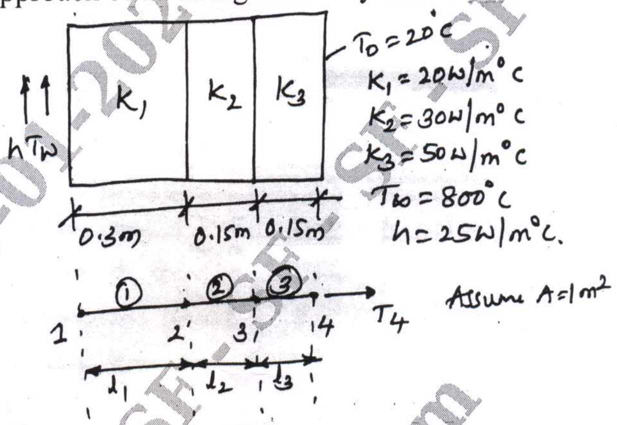


Fig Q8(b) **(10 Marks)**

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