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10ME64

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

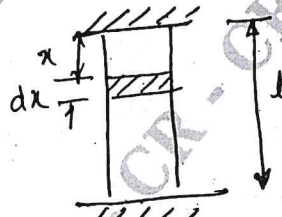
Time: 3 hrs.

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 stress 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.

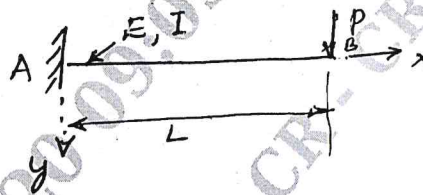


Fig Q2(b)

(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

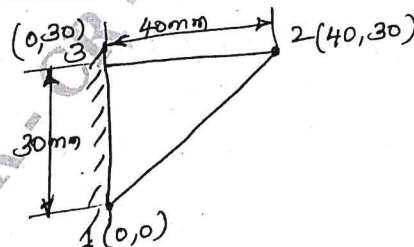


Fig Q3(b)

(06 Marks)

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

(04 Marks)

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.

- 4 a. Figure Q4(a) shows a bar subjected to uniformly distributed load 'P₀' as shown Fig Q4 (a). Taking E = 70GPa, Area A = 10⁴mm², determine : i) Nodal displacement ii) Stresses

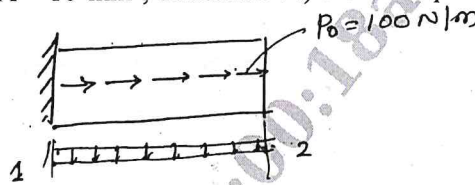


Fig Q4(a)

(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) $E_{\text{steel}} = 200\text{GPa}$, $E_{\text{cu}} = 100\text{GPa}$.

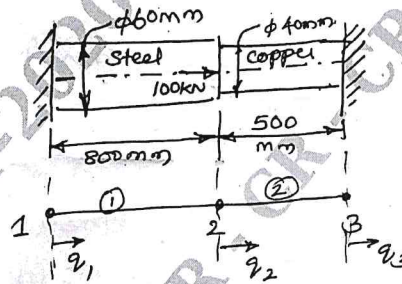


Fig Q4(b)

(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

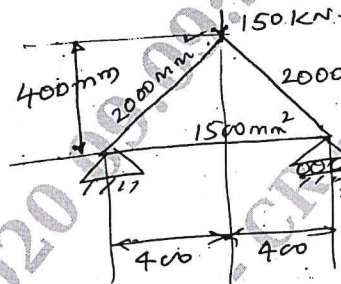


Fig Q6(a)

(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 $E = 200\text{GPa}$, $J = 4 \times 10^6 \text{ mm}^4$

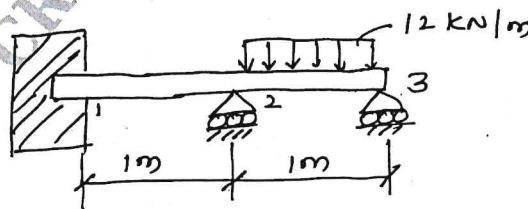


Fig Q7(b)

(10 Marks)

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

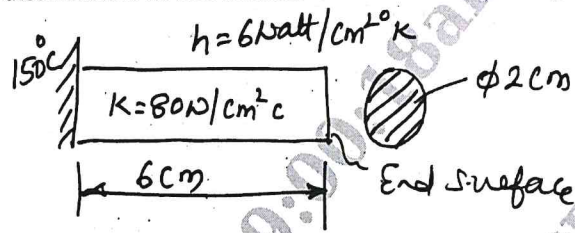


Fig Q8(a)

(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

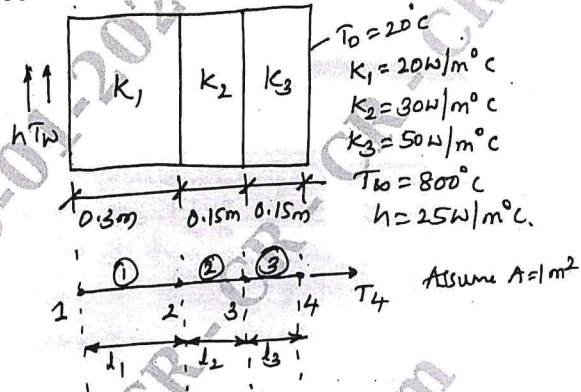


Fig Q8(b)

(10 Marks)
