Subject Code: H8701/R13

M. Tech –II Semester Regular/ Supply Examinations, October, 2015

FINITE ELEMENT METHOD

(Common to SE &SD, SM&FE, GE)

Time: 3 Hours **Max Marks: 60**

Answer any FIVE questions

All questions carry EQUAL marks

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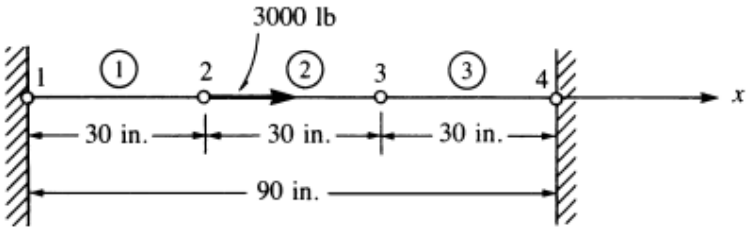
1	a	Explain about different weighted residual methods.	4
	b	Taking a differential equation , explain the process of weak formulation.	8
2	a	A simply supported beam is subjected to uniformly distributed load over entire span. Determine the bending moment and deflection at the mid span using Rayleigh –Ritz method and compare with exact solution. Use a two term trial function $y=a_1\sin(\pi x/l)+a_2\sin(3\pi x/l)$.	8
	b	Explain the applications of FEM.	4
3	a	Derive the shape functions of two node and three node bar elements.	5
	b	For the three-bar assemblage shown in Figure , determine (i) The global stiffness matrix, (ii) The displacements of nodes 2 and 3, and (iii) The reactions at nodes 1 and 4. (iv) Stress in each element. A force of 3000 lb is applied in the x direction at node 2. The length of each element is 30 in. Let E = 30 X 10^6 psi and A = 1 in^2 for elements 1 and 2, and let E =15 X 10^6 psi and A = 2 in^2 for element 3. Nodes 1 and 4 are fixed.	



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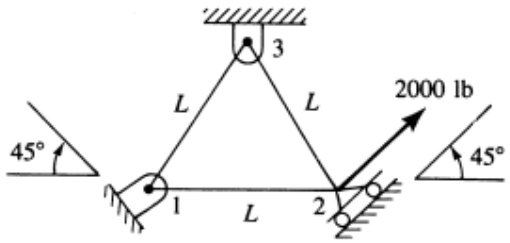
4	a	For the plane trusses with inclined supports shown in Figure, solve for the nodal displacements and element stresses in the elements. Let A = 2 in^2, E = 30 10^6 psi, and L = 30 in. for each truss.	



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	b	Explain the properties of stiffness matrix	4

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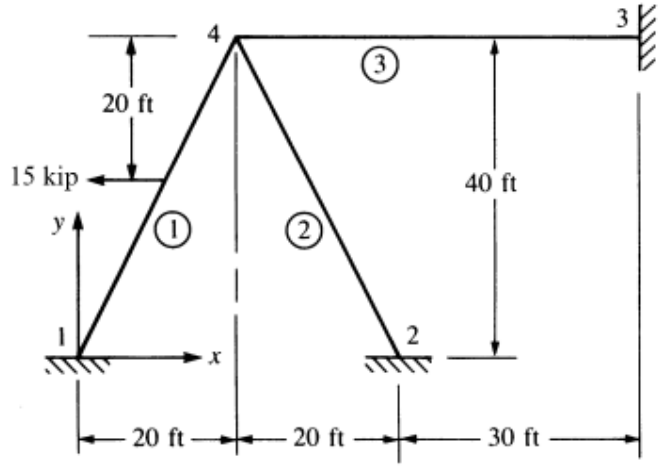
5	a	Derive the stiffness matrix for a beam element.	2
	b	Derive the load vector for UDL and point load at the center for a beam element.	6
	c	Explain how thermal loads are considered in finite element analysis?	4
6	a	Solve the frame shown in Figure. The frame consists of the three elements shown and is subjected to a 15-kip horizontal load applied at midlength of element 1. Nodes 1, 2, and 3 are fixed, and the dimensions are shown in the figure. Let E = 30 X 10^6 psi, I =800 in^4, and A = 8 in^2 for all elements.	7



	b	What is meant by an Isoparametric element?	5
7	a	Explain the concept of plane stress and plane strain with examples.	6
	b	Derive the strain displacement matrix and equation for element stiffness for a LST element.	6
8	a	Derive and plot the shape functions of quadratic plane element.	4
	b	What is numerical integration? Taking a simple example and evaluate the intigral value by gauss quadrature method considering one gauss point and two gauss points. Compare these results with the exact result	4
	c	How error is evaluated in finite element analysis?	4

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