Exam.Code:0942
Sub. Code: 6731

2014

B.E. (Mechanical Engineering)

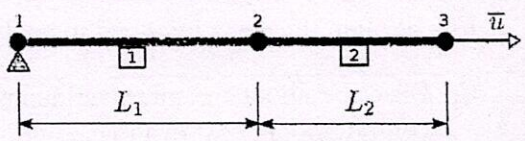
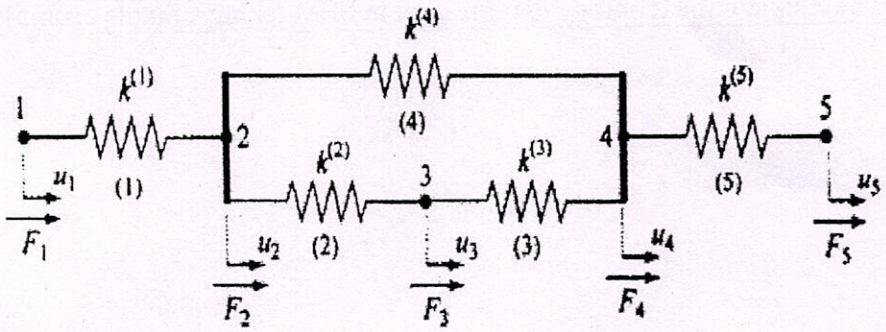
Sixth Semester

MEC-602: Finite Element Methods

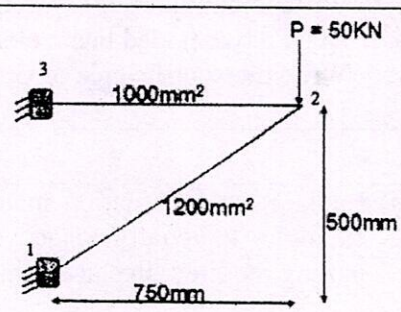
Time allowed: 3 Hours | Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part.

x-x-x

1	i. Describe the displacement functions of any 1d and 2d element. ii. What is the significance of lumped mass matrix? Write lumped mass matrix of 1d linear element. iii. Write temperature load vector for 1d linear element. iv. Draw a two noded beam element with degree of freedom indicated on it v. Write the significance of Guyan reduction.	(2x 5 = 10)
	Part A	
2	a) Explain the elimination method of imposing boundary conditions with suitable example. In axially loaded cases, how do you find the support reactions after getting required displacements?	(4)
	b) Consider a two bar structure as shown in the diagram. Determine the displacement of node #2. Also calculate the stresses at each element. (u1=0). Given : E=30GPa, L1=2m, L2=3m, $A=10^{-2}\,m^2$, $u^- = 4$ mm (=u3). 	(3)
	c) Derive and plot the shape functions for a 2D three-node triangular element.	(3)
3	a) Explain the situations where axisymmetric analysis can be used. What are non zero stress and strain components of axisymmetric elements. Explain.	(4)
	b) The figure shows a system of springs. Find the global stiffness matrix and put it in the form of F=Kq. 	(3)
	c) Discuss the concept of Galerkin's Method in FEM.	(3)

P.T.O.

4	a) Estimate the stiffness matrix for the triangular element with the (x,y) coordinates of the nodes are (0,-4), (8,0) and (0,4) at nodes i, j, k. Assume plane stress condition E= 200 GPa, Poisson's ratio = 0.35	(8)
	b) Differentiate 1-d two noded linear elements, 1-d three noded quadratic elements and 2-d three noded triangular elements w.r.t. displacement function and strain.	(2)
	Part B	
5	a) For the two bar truss shown in the diagram, Determine the nodal displacements and stresses in each element. Also find support reactions. Take E =200 GPa, 	(8)
	b) Explain the steps involved in analysis of beams.	(2)
6	a) Describe about the mesh refinement and explain how it affect the accuracy and computational cost of FEM solutions.	(5)
	b) Discuss the concept of the eigenvalue problem in finite element analysis, including the formulation of the eigenvalue equation and its solution.	(5)
7	a) What is the need for optimization in FEM. State various important considerations while formulating an optimization problem	(5)
	b) Explain the topology optimization in FEM taking suitable example.	(5)

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