U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

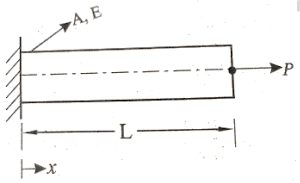
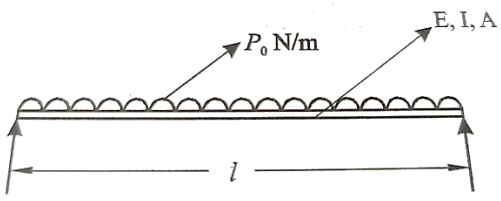
Autonomous Institute Affiliated to VTU

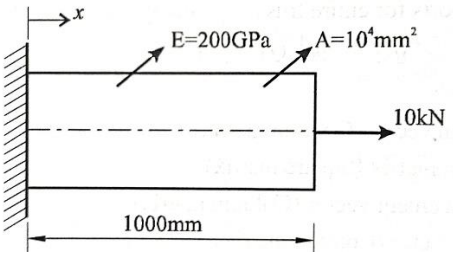
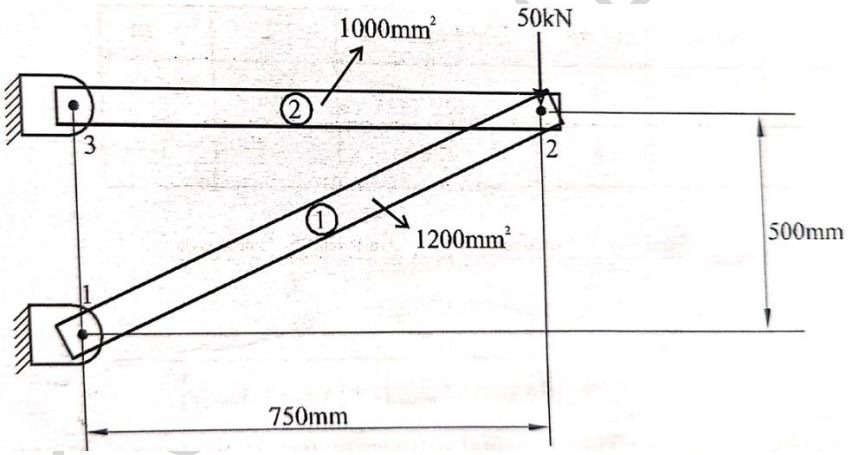
July / August 2024 Semester End Main Examinations

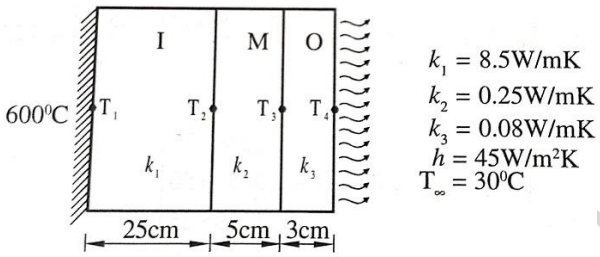
Programme: B.E. **Semester: VI**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 20ME6DCMFE **Max Marks: 100**
Course: Modelling and Finite Element Analysis

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		What are the basic steps involved in finite element method to solve mechanical engineering problems.	*CO1*	*PO1*	**05**
	b)		Explain the concept of plain stress and plain strain conditions.	*CO1*	*PO1*	**05**
	c)		Find the maximum deflection for following element in Fig.Q1(c), using Galerkin's approach.  Fig.Q1(c)	*CO1*	*PO2*	**10**
			OR			
2	a)		Describe the convergence criteria used for the displacement functions in FEM?	*CO1*	*PO1*	**05**
	b)		Derive the strain displacement relations for two-dimensional Element.	*CO1*	*PO1*	**05**
	c)		Using Rayleigh Ritz method, derive an equation for maximum deflection at the center using trigonometric function of a simply supported beam is subjected to uniformly distributed load P_0 N/m as shown in Fig.Q2(c)  Fig. Q2(c)	*CO1*	*PO2*	**10**

			UNIT - II			
	3	a)	Derive the shape function in natural coordinate system of 1D bar element.	*CO2*	*PO1*	**05**
		b)	Derive the stiffness matrix for a single element bar.	*CO2*	*PO2*	**05**
		c)	Determine the nodal displacement at loading point, reaction, strain and stress far 1D bar subjected to axial load as shown in Fig. Q2(c). Consider P = 10 kN, E = 200 GPa, A = 0.01m^2 and L = 1 m.  Fig. Q2(c)	*CO2*	*PO2*	**10**
			UNIT - III			
	4	a)	For the truss element shown in Fig. Q4(a), determine the nodal displacement and stress in each member. Take E = 200 GPa.  Fig. Q4(a)	*CO3*	*PO2*	**10**
		b)	Define Hermite shape functions, also derive the stiffness matrix for beam elements using strain energy concept.	*CO3*	*PO1*	**10**
			UNIT – IV			
	5	a)	Define isoparametric, sub parametric and super parametric Element with sketch.	*CO4*	*PO1*	**06**
		b)	Derive shape function for Triangular element in Natural Co-ordinates system.	*CO4*	*PO1*	**08**
		c)	What is the axisymmetric elements? Derive Jacobian for Axisymetric triangular element.	*CO4*	*PO1*	**06**
			OR			
	6	a)	Explain 2-D Pascal's Triangle.	*CO4*	*PO1*	**05**

		b)	Derive shape function for Rectangular element in Natural Co-ordinates system.	*CO4*	*PO1*	**09**
		c)	Derive shape function for quadratic bar element using Lagrange interpolation Method.	*CO4*	*PO1*	**06**
			UNIT - V			
	7	a)	Derive differential equation for an 1D heat condition problem.	*CO4*	*PO1*	**05**
		b)	An induction furnace wall is made up of three layers, inside, middle and other layer with thermal conductivity k_1, k_2, k_3 respectively as shown in Fig Q 7(b). Determine the nodal temperature.  Fig Q 7(b)	*CO4*	*PO2*	**09**
		c)	Derive the conductivity Matrix for 1 D bar element.	*CO4*	*PO1*	**06**

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