CBCS SCHEME

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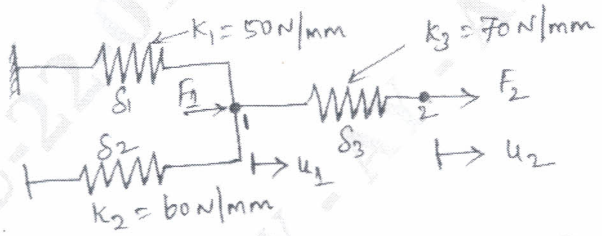
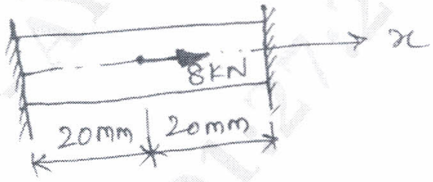
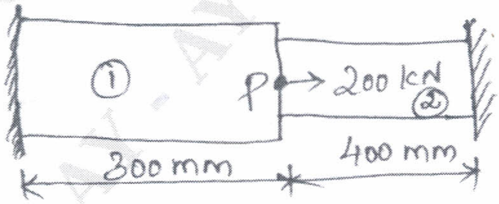
BAE515A/BAS515A

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Finite Element Methods

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Describe steps involved in the Finite Element Analysis.	10	L1	CO1
	b.	Explain about simplex, complex and multiplex element.	10	L1	CO1
		OR			
Q.2	a.	Determine the Nodal displacements for the given spring as shown in Fig. Q2 (a), using the principle of minimum potential energy method.  Fig. Q2 (a)	10	L2	CO2
	b.	Use R-R method to find stress and displacement at the midpoint of a bar shown in Fig.Q2 (b). Take E = 70 GPa, A = 100 mm^2. Assume the displacement model to be a 2^{nd} order polynomial.  Fig. Q2 (b)	10	L2	CO2
		Module – 2			
Q.3	a.	Derive the stiffness matrix for One Dimensional bar element.	10	L2	CO2
	b.	Consider a bar as shown in Fig. Q3 (b), (i) An axial load of 200 kN is applied at point P. Take A_1 = 2400 mm^2, $E_1 = 70\times10^9$ N/m^2, A_2 = 600 mm^2, $E_2 = 200\times10^9$ N/m^2. Calculate (i) Nodal displacement at point P (ii) Stress in each material.  Fig. Q3 (b)	10	L2	CO2
		OR			

Q.4	a.	Give a brief note about the analysis of trusses with neat sketch.	10	L3	CO3
	b.	An axial load $P = 300\times10^3$ N is applied at 20°C to the rod as shown in Fig. Q4 (b), then the temperature is then raised to 60°C. Take $A_1 = 900$ mm^2, $A_2 = 1200$ mm^2, $E_1 = 70\times10^9$ N/m^2, $E_2 = 200\times10^9$ N/m^2, $\alpha_1 = 23\times10^{-6}/^\circ C$, $\alpha_2 = 11.7\times10^{-6}/^\circ C$. Calculate the following : (i) Assemble the global stiffness matrix (K) and global load vector {F}.	10	L3	CO3

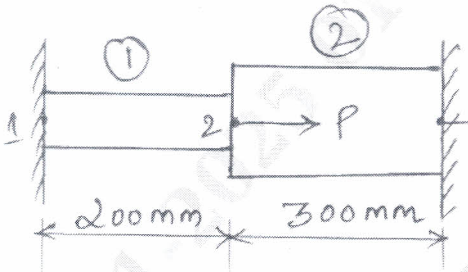


Fig. Q4 (b)

		Module – 3			
Q.5	a.	Explain the properties of shape function.	8	L2	CO3
	b.	Derive the shape function for constant strain triangular element.	12	L2	CO3
		OR			
Q.6	a.	Explain the Lagrange's method to derive the shape function for 4-nodes quadrilateral element.	10	L3	CO3
	b.	Determine the shape functions N_1, N_2 and N_3 at the interior point 'P' for the triangular element shown in Fig. Q6 (b).	10	L3	CO3

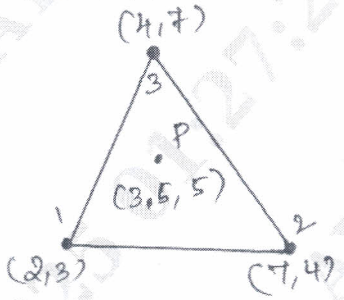
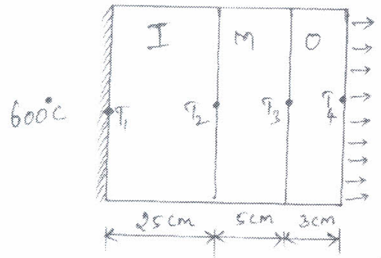


Fig. Q6 (b)

		Module – 4			
Q.7	a.	Explain about Isoparametric, Subparametric and Super parametric elements.	10	L3	CO3
	b.	Explain various stages of processing in FEM.	10	L3	CO3
		OR			
Q.8	a.	Derive the shape function for Axisymmetric Element. (Triangular Element)	15	L3	CO3
	b.	Write the boundary conditions of axisymmetric analysis.	5	L3	CO3
		Module – 5			
Q.9	a.	Explain the modes of heat transfer.	8	L2	CO3
	b.	Derive the stiffness matrix for one dimensional heat conduction.	12	L3	CO3

		OR			
Q.10	**a.**	A wall is made up of three layers with thermal conductivity K_1, K_2 and K_3 respectively as shown in Fig. Q10 (a). Determine the nodal temperature.  $K_1 = 8.5$ W/mK $K_2 = 0.25$ W/mK $K_3 = 0.08$ W/mK $h = 45$ W/m^{2}K $T_\infty = 30^\circ$C Fig. Q10 (a)	**16**	**L3**	**CO3**
	b.	Write the types of boundary conditions in heat transfer problems.	**4**	**L3**	**CO3**

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