CBCS SCHEME

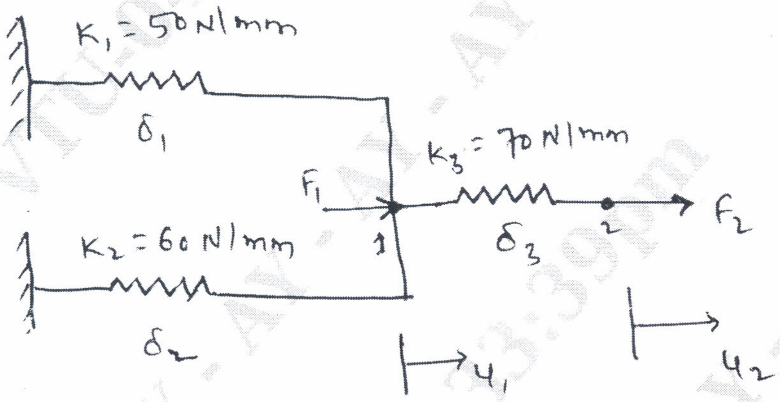
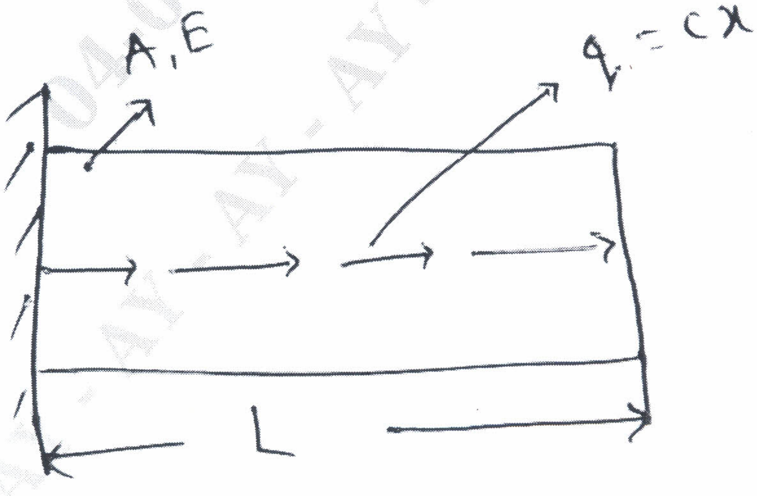
USN | 1 | A | Y | 2 | 3 | A | E | 4 | 0 | 0 |

BAE/BAS515A

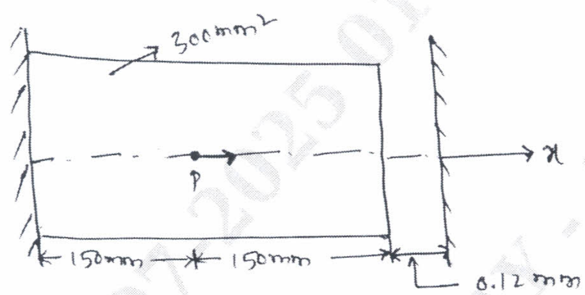
Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Finite Element Methods

Time: 3 hrs. Max. Marks: 100

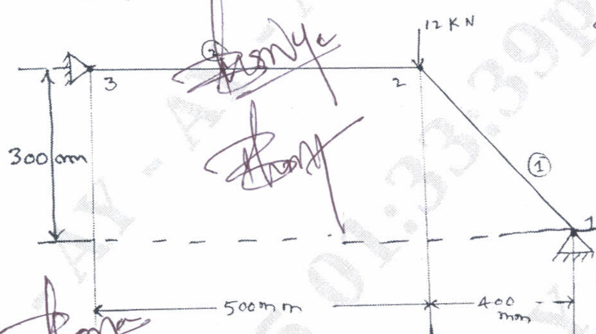
Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define FEM. List and explain the basic steps in FEM.	8	L1	CO1
	b.	For the spring system shown in Fig.Q1(b), using the principle of minimum potential energy, determine the nodal displacements. Take F_1 = 75 N and F_2 = 100 N.  Fig.Q1(b)	12	L3	CO1
		OR			
Q.2	a.	List and explain the simple elements in FEM.	10	L1	CO1
	b.	A bar of length L, cross sectional area A and modulus of elasticity E, is subjected to distributed axial load q = cx, where 'c' is a constant as show in Fig.Q2(b). Determine the displacement of the bar at the end using Rayleigh – Ritz method.  Fig.Q2(b)	10	L3	CO1

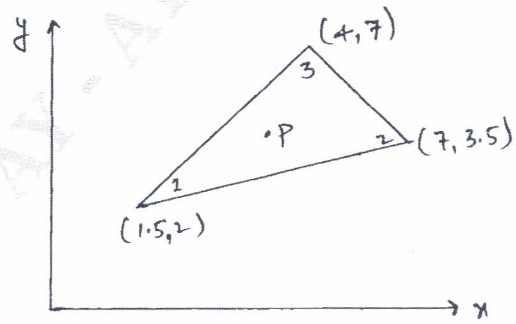
Module – 2

Q.3	**a.**	Derive the shape function for 1-D bar element in natural co-ordinate system.	8	L2	CO2
	b.	A bar is having inform cross sectional area of 300 mm^2 and is subjected to a load P = 600 kN as shown in Fig.Q3(b) . Determine the displacement field, stress and support reaction in the bar. Consider two elements and use elimination method. Take E = 200 GPa.  Fig.Q3(b)	12	L3	CO2

OR

Q.4	**a.**	Derive the Hermite – Shape function for beam element.	8	L2	CO2
	b.	For the two bar truss shown in Fig.Q4(b), determine the nodal displacement, stresses in each element, and reaction at the support. Take $E = 2 \times 10^5$ N/mm², $A_e = 200$ mm².  Fig.Q4(b)	12	L3	CO2

Module – 3

Q.5	**a.**	Derive the shape function for 2-D quadrilateral element. Also show the variation of shape function for it.	10	L2	CO3
	b.	Determine the N_1, N_2 and N_3 for a triangular element as shown in Fig.Q5(b). The x-coordinate of interior point 'P' is 3.85 and y-coordinate of interior point 'P' is 4.8.  Fig.Q5(b)	10	L3	CO3

		OR			
Q.6	**a.**	Derive the shape function for HEXA – 8.	**10**	**L3**	**CO3**
	b.	Derive the shape function for TET – 4.	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the ISO, para and super – parametric elements with equations and diagrams.	**10**	**L3**	**CO3**
	b.	Explain different phases of FEM.	**10**	**L3**	**CO3**
		OR			
Q.8	**a.**	Elucidate the structure of computer program for FEM analysis.	**10**	**L2**	**CO2**
	b.	Explain various software packages used in FEM.	**10**	**L2**	**CO2**
		Module – 5			
Q.9	**a.**	Derive the differential equation for 1-D heat conduction.	**8**	**L3**	**CO3**
	b.	Find the distribution in the 1-D fin shown in Fig.Q9(b). Take two elements for FE idealization.	**12**	**L3**	**CO3**

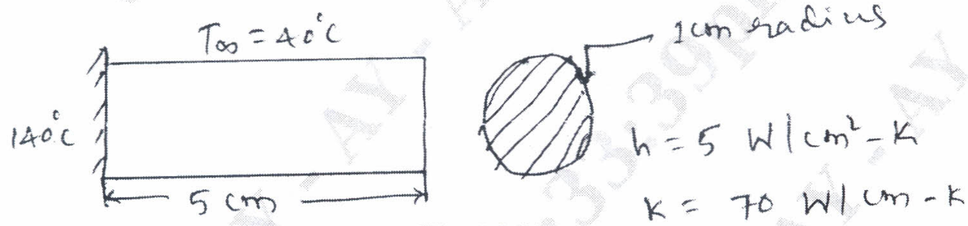


Fig.Q9(b)

		OR			
Q.10	**a.**	Derive the conductivity matrix for 1-D bar element.	**8**	**L3**	**CO3**
	b.	Determine the temperature distribution through the composite wall subjected to convention heat loss on the right side surface with convective heat transfer coefficient as shown in Fig.Q10(b). The ambient temperature is – 5°C.	**12**	**L3**	**CO3**

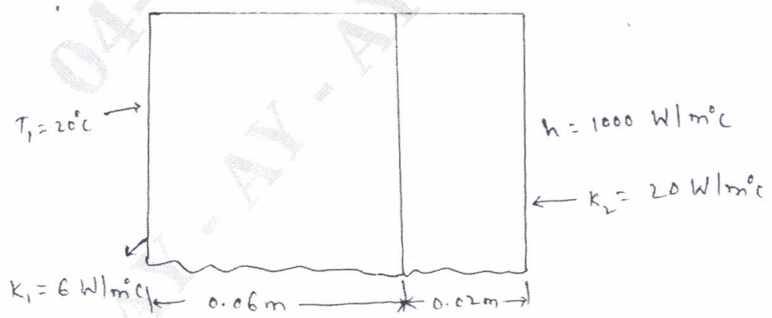


Fig.Q10(b)

* * * * *