CBCS SCHEME

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BAS/BAE515A

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
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.

			M	L	C
		Module – 1			
Q.1	a.	Derive equations of equilibrium for a elemental volume with neat sketch.	10	L3	CO3
	b.	Define Plane stress and Plane strain with examples.	10	L3	CO3
		OR			
Q.2	a.	Define principle of minimum potential energy with an example.	10	L1	CO3
	b.	Explain different types of elements in F E M with neat sketches.	10	L2	CO3
		Module – 2			
Q.3	a.	Drive the natural coordinates for Constant Strain Triangle (CST).	10	L3	CO3
	b.	Derive the natural coordinates for tetrahedron element.	10	L3	CO3
		OR			
Q.4	a.	Define shape function and polynomial of shape function 2 –D.	10	L1	CO3
	b.	Write the convergence requirement of shape function.	10	L1	CO3
		Module – 3			
Q.5	a.	Derive the shape function for two noded beam elements by using general coordinates.	10	L3	CO1
	b.	Derive the shape function for linear strain triangle by using natural coordinates.	10	L3	CO1
		OR			
Q.6	a.	Derive the shape function for rectangle element by using serendipity concept.	10	L3	CO1
	b.	Derive the stiffness matrix for 4-noded quadrilateral element.	10	L3	CO1
		Module – 4			
Q.7	a.	Explain about ISO parametric, sub parametric and super parametric elements.	10	L2	CO1
	b.	Explain various stages of processing in FEM.	10	L2	CO1
		OR			
Q.8	a.	Derive the shape function for Axisymmentric element.	10	L3	CO2
	b.	Write the boundary conditions of Axisymmetric analysis.	10	L1	CO2

Module – 5

Q.9	a.	Drive the mass matrix and stiffness matrix for given Spring – Mass system by using Lagrange and Hamilton principle.	10	L3	CO2

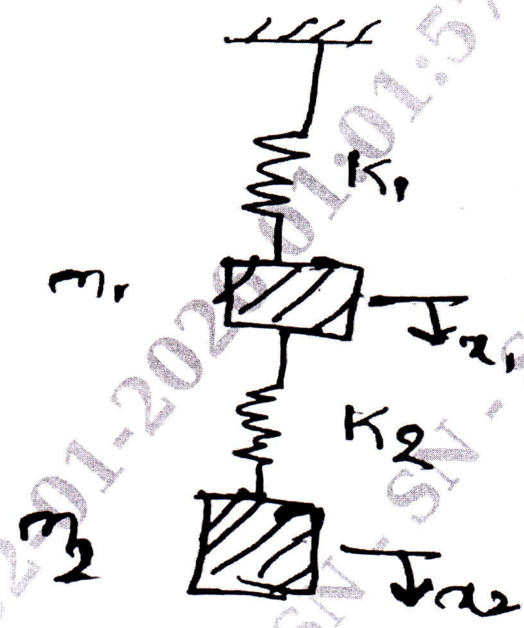

Fig.Q. 9 (a)

	b.	Write an element mass matrices for one dimensional bar element.	10	L1	CO2

OR

Q.10	a.	Heat is generated in a large plate (K = 0.8 w/m°c) the rate of 4000 W/m^3. The plate is 25 cm thick the outside surface of the plate are exposed to the ambient air at 30°C with a convective heat transfer coefficient of 20 w/m^2 °c. Determine the temperature distribution in the wall.	10	L5	CO2

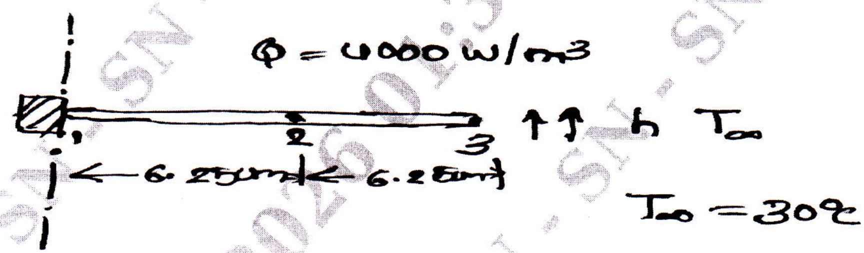

Fig. Q. 10(a)

	b.	A metallic Fin with thermal conductivity K = 360 w/m 0.1 cm thick and 10 cm long extends from a plane wall whose temperature is 235°C. Determine the temperature distribution and amount of heat transferred from the fin to the air at 20°C with h = 9w/m°C. Take the width of the fin to be 1m.	10	L5	CO2

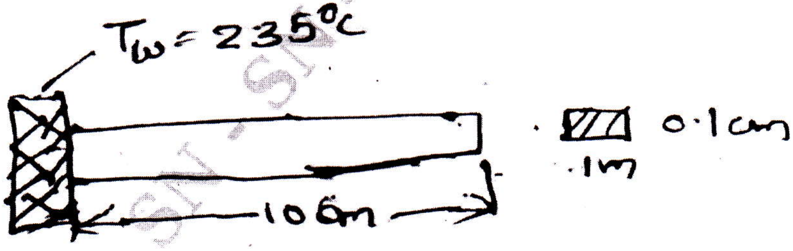

Fig.Q.10 (b)