Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –II Examination Dec. - 2011

Subject code: 1722001 **Date: 09/12/2011**
Subject Name: Finite Element Method
Time: 02.30 pm – 05.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	(i) Give merits and demerits of FEM.(ii) Give stepwise procedure of solution by FEM.	**07**
	(b)	Derive the load vector for 2-noded bar element if it is loaded with (i) Point load at center (ii) Uniformly varying load along length	**07**
Q.2	**(a)**	Using the theorem of minimum potential energy, derive expression for element stiffness matrix K.	**07**
	(b)	Using natural co-ordinate system, list and draw, the shape functions and its variation, for four nodded plate element.	**07**
		OR	
	(b)	Derive the shape function for 3-noded two dimensional elements.	**07**
Q.3	**(a)**	(i) Explain the term "Element Aspect Ratio" (ii) List any four software used for FE analysis. (iii) List 2-D elements used by ANSYS or other software.	**07**
	(b)	(i) Why pre-processing and post-processing capabilities are strength of any FEM software? (ii) Describe the analytical capabilities and range of application of ANSYS.	**07**
		OR	
Q.3	**(a)**	Discuss with illustration discretisation process.	**07**
	(b)	Using FEM, determine nodal displacements, elemental stresses and reaction forces for bar subjected to axial force shown in fig.1.	**07**
Q.4	**(a)**	Distinguish between a plane stress and plane strain problem with suitable examples. Also give their strain stress linking matrices.	**07**
	(b)	Using FEM, determine nodal displacements and reaction forces for bar subjected to torque shown in fig.2.	**07**
		OR	
Q.4	**(a)**	Identify axsymmetric problem. Discuss type of stresses and strains induced in axsymmetric element.	**07**
	(b)	Derive strain displacement matrix for axsymmetric element shown in fig.3. Take E=210GPa, μ= 0.22.	**07**
Q.5	**(a)**	Select a suitable displacement function for a beam element and show that it satisfies the convergence criteria.	**07**
	(b)	For the beam and loading as shown in fig.4, where E=210 GPa and I =4.5 x 10^6 m^4. Determine slope at B and C.	**07**
		OR	
Q.5		Obtain [B] matrix for the CST element whose nodal co-ordinates are as under: Node-1 (4, -1), Node-2 (2,6) and Node-3 (8,-8).	**14**

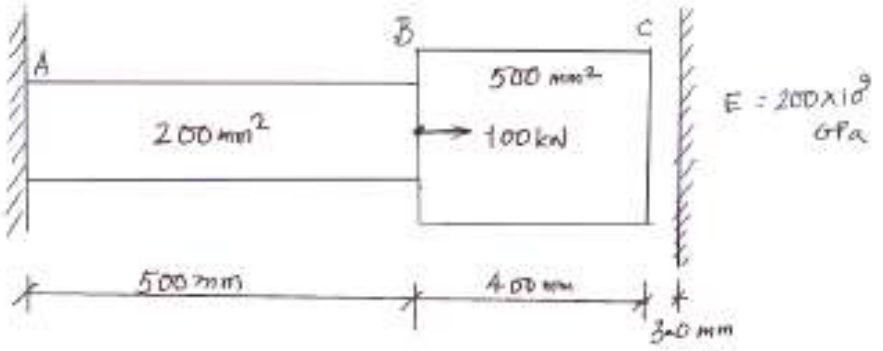

Fig. 1

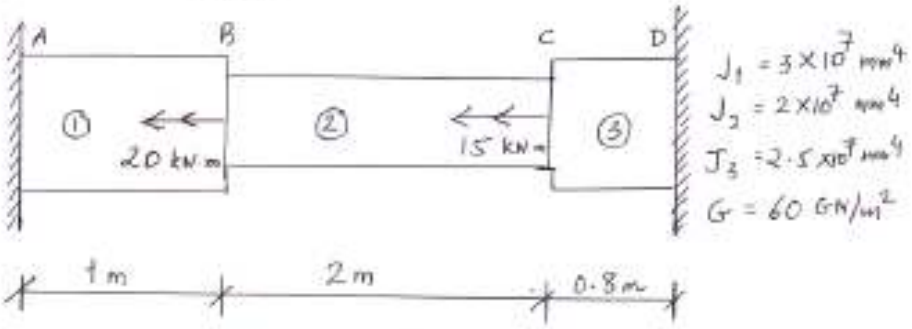

Fig. 2

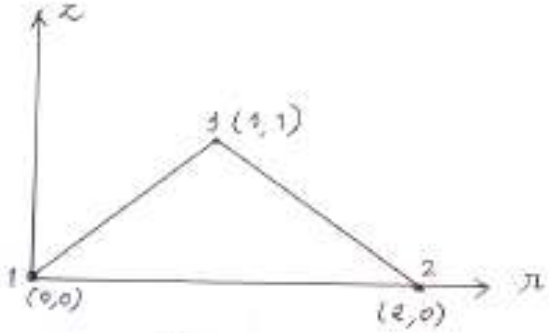

Fig. 3

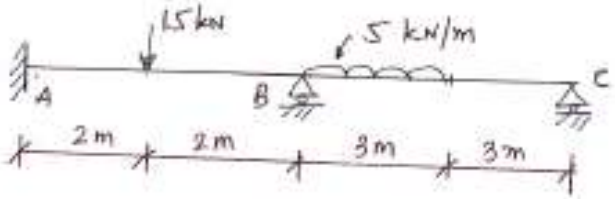

Fig. 4