Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– II • EXAMINATION – WINTER 2015

Subject Code:2722001 **Date:08/12/ 2015**

Subject Name: Finite Element Method in Structural Engineering

Time:02:30 p.m. to 05:00 p.m. **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)**	Find the optimum locations of sampling points for a 2 x 2 Gauss quadrature rule	**07**
	(b)	A four noded quadrilateral element used for a plane stress problem in x-y plane has its vertices 1(0,0), 2(350, 80), 3(520,310) and 4(250,420). Find the Jacobian matrix at GP $\left(\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}\right)$. Also find minimum required elements of strain-displacement matrix [B] necessary to find element K_{23} of stiffness matrix	**07**
Q.2	**(a)**	For problem of Q.1(b) above find element K_{23} if E=200GPa, ν=0.3 and thickness of element t=12 mm. Consider co-ordinates in mm	**07**
	(b)	Find the shape functions using Lagrange interpolation for a 3-noded axially loaded bar element	**07**
		OR	
	(b)	Discuss use of FEM in vibration analysis	**07**
Q.3	**(a)**	Enlist at least 8 plate bending elements. Discuss ACM element in detail	**07**
	(b)	Write displacement functions for a 4-noded tetrahedron and a 10-noded tetrahedron. How will you find shape functions for a 4-noded tetrahedron using the above chosen displacement function?	**07**
		OR	
Q.3	**(a)**	Write in detail on – Use of BFS element for FE analysis of plate bending problem	**07**
	(b)	Write a note on convergence requirements of displacement function	**07**
Q.4	**(a)**	Distinguish clearly between CST and LST	**07**
	(b)	Discuss with examples – lumped loads and consistent loads	**07**
		OR	
Q.4	**(a)**	What do you understand by axisymmetric problem? Enlist various elements used for axisymmetric analyses. State the strain-displacement matrix [B] for any one element	**07**
	(b)	What do you understand by discretization? What is a focussed grid? Describe in general the process of discretization and care that must be taken while discretizing the structure	**07**
Q.5	**(a)**	What is h-analysis and p-analysis? Discuss their suitability	**07**
	(b)	Generate row 2 of stiffness matrix of truss element using principle of minimum potential energy	**07**
		OR	

Q.5	**(a)**	Write the displacement function in the form of polynomial for a 4-noded rectangular element (2a x 2b). Using the same how will you find the shape functions [N] and strain-displacement matrix [B]?	**07**
	(b)	Enlist various commercial software packages available for FE analyses. Enlist various types of elements available in these packages.	**07**

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