Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (OLD) – • EXAMINATION – SUMMER 2016

Subject Code: 1722001 **Date:17/05/2016**

Subject Name: Finite Element Method

Time:10:30 am to 01:00 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)**	Explain the terms: Constant strain triangle, Linear strain triangle and Quadratic strain triangle.	**07**
	(b)	Discuss the use of Pascalôs triangle for selection of the displacement function.	**07**
Q.2	**(a)**	Distinguish between a plane stress and plane strain problem with suitable examples. Also give their strain stress linking matrices.	**07**
	(b)	Derive the load vector for two-noded bar element if it is loaded with point load at centre and uniformly varying load along length.	**07**
		OR	
	(b)	Using natural co-ordinate system, list and draw, the shape functions and its variation, for four nodded plate element.	**07**
Q.3	**(a)**	Explain axi-symmetric element. Give the various strains those are to be considered.	**07**
	(b)	Derive the expressions for natural coordinates for a two-noded element in terms of natural coordinate ξ, when range is -1 to 1.	**07**
		OR	
Q.3	**(a)**	Derive the shape functions for a three-noded bar element using polynomial form in local coordinates.	**07**
	(b)	Derive stiffness matrix for beam element using general finite element approach.	**07**
Q.4		Calculate strain-displacement matrix for axisymmetric element. The *r* and *z*-coordinates of the nodes of triangular element are (0, 0), (4, 0) and (2, 2). Take modulus of elasticity = 180 GPa, Poissonôs ratio = 0.22. The dimension of coordinates is in meter.	**14**
		OR	
Q.4	**(a)**	For a four nodded plate element having four nodes at (0, 0), (5, 1), (5, 3) and (0, 2.5), calculate the Jacobean matrix using one point integration. All dimensions are in meters.	**07**
	(b)	Write short note on pre and post processors.	**07**
Q.5	**(a)**	Select a suitable displacement function for a beam element and show that it satisfies the convergence criteria.	**07**
	(b)	Write short note on óHermite Polynomialô.	**07**
		OR	
Q.5		A constant strain triangle element has the three nodes as (0, 0), (4, 0) and (4, 4). Calculate the Stiffness matrix for the element to be used in plane stress analysis. Assume E= 220 kN/mm2, thickness = 22 mm and Poissonôs ratio as 0.22.	**14**

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