Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2722001 **Date: 24/05/2016**

Subject Name: Finite Element Method in Structural Engineering

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		For a standard 2-noded beam element derive shape functions using an appropriate polynomial. Find the elements of strain-displacement matrix {B} that are required to find elements K_{14}, K_{22} of stiffness matrix [K]	**14**
Q.2	**(a)**	For problem of Q.1 find elements K_{14}, K_{22} of stiffness matrix [K]	**07**
	(b)	Define axi-symmetry. Enlist various elements used for axisymmetric problems. Write the strain displacement matrix [B] for any one element	**07**
		OR	
	(b)	Enlist various software packages that are commercially available for finite element analyses. Enlist various types of problems that can be solved using such software packages.	**07**
Q.3	**(a)**	Find the locations of optimum sampling points for a 3 x 3 Gauss quadrature rule	**07**
	(b)	A 4-noded element used in FEA is in the form of a rectangle of size 160mm x 140mm with origin at its centroid in the Cartesian system. Find the Jacobian matrix at GP $\left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$.	**07**
		OR	
Q.3	**(a)**	A 4-noded rectangular element has side 200mm parallel to óxô and 170mm parallel to óy. It carries a point load of magnitude 10kN in x-y plane, line of action of which makes an angle of 30^0 with x-axis, at GP $\left(\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}\right)$ acting towards it. Find the element load vector	**07**
	(b)	A 2-noded bar of prismatic section has length óíô. Using natural co-ordinates find shape functions, strain displacement matrix [B] and element stiffness matrix [K]	**07**
Q.4	**(a)**	What is meant by a graded mesh? When is it necessary to provide the same? Enlist various types of errors that may creep in the process of discretization leading to inferior/wrong results	**07**
	(b)	What are convergence requirements of polynomial functions?	**07**
		OR	
Q.4	**(a)**	Find shape functions for 8-noded rectangle 2a x 2b considering its centroid as origin in Cartesian co-ordinates	**07**
	(b)	Suggest a suitable displacement function for a 10-noded tetrahedron element. How will you find strain-displacement matric [B] for the same?	**07**
Q.5	**(a)**	Write a note on ï Use of FEM in flexural vibration of beam	**07**

	(b)	What is understood by lumped mass? How do you find consistent mass matrices?	**07**

OR

Q.5	**(a)**	Enlist at least six plate bending elements used in Finite Element Analysis. Discuss any one triangular plate bending element	**07**
	(b)	Write a note on BFS element	**07**

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