Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME- SEMESTER II– EXAMINATION – SUMMER 2015

Subject Code: 2722001 **Date:26/05/ 2015**

Subject Name: Finite Element Method for Structural Engineering

Time: 2:30 PM – 5:00 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 discretization process by suitable illustrations.	**07**
	(b)	Select a suitable displacement function for a beam element and show that it satisfies the convergence criteria.	**07**
Q.2	**(a)**	Distinguish between a plane stress and plane strain problem giving suitable example. Also give their strain-stress linking matrices.	**07**
	(b)	Determine the shape functions for the Constant Strain Triangle. Use polynomial functions.	**07**
		OR	
	(b)	For a CST element having co-ordinates (1,1), (2,6) and (3,4) , obtain the strainï displacement matrix. Assume Poissonôs ratio is zero and Young's modulus is constant.	**07**
Q.3	**(a)**	Derive the expression for shape function for a two noded bar element taking natural coordinate ϵ as varying from -1 to 1.	**07**
	(b)	Determine the nodal displacement at node 2, stresses in each material and support reactions in the bar shown in Figure 1, due to applied force P = 700 kN. Where, A_1 = 2200 mm^2, A_2 = 1100 mm^2 , L_1 = 500 mm, L_2 = 500 mm $E_1 = 0.9 \times 10^5$ N/mm^2 and $E_2 = 2.1 \times 10^5$ N/mm^2.	**07**
		OR	
Q.3	**(a)**	Using generalized coordinate approach, find shape functions for two noded truss element.	**07**
	(b)	For pin-jointed truss shown in Figure 2, determine unknown displacements using FEM. Where A_1 = 1000 mm^2, A_2 = 1200 mm^2 , E = 200 GPa.	**07**
Q.4	**(a)**	What do you understand by axisymmetric problem? Explain type of stresses and strains induced in these type of problems.	**07**
	(b)	Enlist four software package of FE Analysis. List 2-D and plate elements used in any standard software.	**07**
		OR	
Q.4	**(a)**	Elaborate the Pascalôs triangle and explain how it will be useful in the selection of displacement function.	**07**
	(b)	Explain the meaning of convergence and discuss various criteria to satisfy the convergence of problem.	**07**
Q.5	**(a)**	Explain the application of Tetrahedral element. Explain the procedure to find the shape function for this element.	**07**
	(b)	Elaborate on flexural vibration on beam elements.	**07**
		OR	
Q.5	**(a)**	Explain the procedure to analyze the plate bending problems with its application.	**07**

(b) What is Jacobian matrix? Give a procedure to find out Jacobian matrix. **07**

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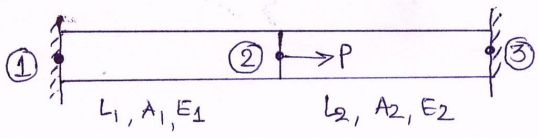

Figure : 1

(Q. 3(b))

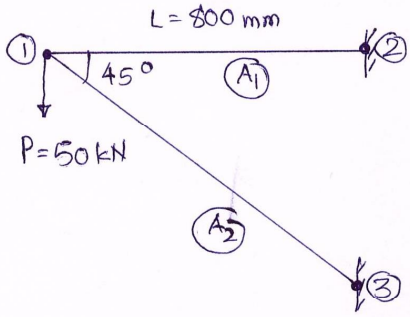

Figure: 2

(OR Q. 3(b))