Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2014

Subject code: 1721501 Date: 16-06-2014

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)**	Explain the principles of discretization.	**07**
	(b)	Determine the shape functions for constant strain triangle using polynomial function.	**07**
Q.2	**(a)**	Determine the shape function for two noded truss element using generalized coordinate approach.	**07**
	(b)	Determine element stiffness matrix for plane frame element.	**07**
		OR	
	(b)	Determine the shape for two noded bar element adopting natural coordinate varying from -1 to 1.	**07**
Q.3	**(a)**	Explain the various convergence criteria adopted in the solution of FEM.	**07**
	(b)	Explain axisymmetric problems and derive stress-strain relationship matrix for axisymmetric element	**07**
		OR	
Q.3	**(a)**	Enlist the software packages, based on FEM used in structures. Explain the pre processors for FEA modeling.	**07**
	(b)	Define the plane stress and plane strain problems with illustrations. Also mention different parameters differ in both types of problem.	**07**
Q.4		A three noded truss element, having length ‘ô’ between each node, obtain the shape function corresponding to the three degree of freedom. Also verify the same. Using the displacement function formulate the stiffness matrix.	**14**
		OR	
Q.4	**(a)**	For a plane truss shown in fig. 1, determine the nodal displacements and stresses in each element. Take A= 3.0x 10^{-4} m^2 and E=60 GPa for all elements.	**07**
	(b)	What is Jacobian matrix? Give a procedure to find out Jacobian matrix .	**07**
Q.5	**(a)**	Find displacement at concentrated load of 30 kN applied at centre of propped cantilever beam of 5 m span. Take EI=22000 kN.m^2. For a 2 noded beam element, shape function is {1-3S^2+2S^3, L(S-2S^2+S^3), 3S^2-2S^3, L(S^3-S^2)}, where S=X/L.	**07**
	(b)	Explain C^0 and C^1 continuity with illustrations.	**07**
		OR	
Q.5	**(a)**	Derive the expression for the finding out stiffness matrix and load vector for the spring in series and spring in parallel.	**07**
	(b)	Elaborate the Pascal’s triangle and explain how it will be useful in the selection of displacement function.	**07**

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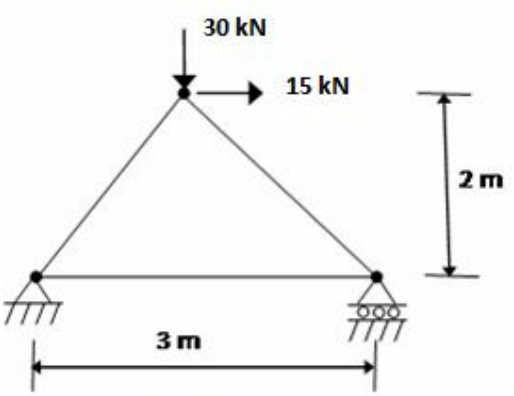

Fig. 1