Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (OLD) EXAMINATION – SUMMER 2017

Subject Code: 1721501 **Date:09/05/2017**

Subject Name: Finite Element Method

Time:10:30 A.M. to 01:00 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)**	Derive the shape function for two noded truss element.	**07**
	(b)	Determine element stiffness matrix for plane frame element.	**07**
Q.2	**(a)**	Enlist and explain the various convergence criteria adopted in the solution of FEM.	**07**
	(b)	Explain plain stress and plain strain problems and derive stress-strain relationship matrix for both.	**07**
		OR	
	(b)	Enlist the software packages, based on FEM used in structures. Explain the pre processors for FEA modeling.	**07**
Q.3	**(a)**	A three noded truss element, having length '*l*' between each node, obtain the shape function corresponding to the three degree of freedom. Using the displacement function formulate the stiffness matrix also.	**10**
	(b)	Enlist the basic steps to solve the problem with finite element method.	**04**
		OR	
Q.3	**(a)**	Explain C^0 and C^1 continuity with illustrations.	**04**
	(b)	Determine displacement at concentrated load of 50 kN applied at centre of propped cantilever beam of 4.0 m span. Take EI=21000 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.	**10**
Q.4	**(a)**	Find the shape functions for constant strain triangle using polynomial function.	**07**
	(b)	Explain the Pascal's triangle. How it will be useful in the selection of displacement function?	**07**
		OR	
Q.4	**(a)**	Explain the principles of discretization.	**07**
	(b)	What is Jacobian matrix? Give a procedure to find out Jacobian matrix.	**07**
Q.5		For a plane truss shown in fig. 1, determine the nodal displacements and stresses in each element. Take A= 3.5x 10^{-4} m^2 and E=62 GPa for all elements.	**14**
		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)	The nodal coordinates of triangular element are (1,2), (5,3) and (4,6). Find the equivalent nodal loads due to concentrated load of 100 kN applied at the interior point (3,4) in the direction towards (5,3).	**07**

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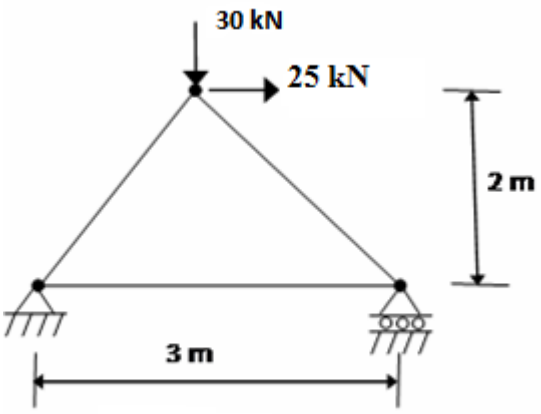

Fig. 1