Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013

Subject code: 1721501 Date: 24-12-2013

Subject Name: Finite Element Method

Time: 10.30 am – 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)**	Define the term finite element and Explain in detail general steps of finite element method.	**07**
	(b)	Derive the load vector for 2-noded bar element if it is loaded with (i) Uniformly distributed load along the length (ii) Uniformly varying load along length	**07**
Q.2	**(a)**	Using the theorem of minimum potential energy, derive expression for element stiffness matrix K for bar element.	**07**
	(b)	Using natural co-ordinate system, list and draw, the shape functions and its variation, for four nodded plate element.	**07**
		OR	
	(b)	Derive the shape function for 3-noded two dimensional elements.	**07**
Q.3	**(a)**	(i) Explain the term "Element Aspect Ratio and element shape" (ii) List any four software used for FE analysis. (iii) List 2-D elements used by ANSYS or other software.	**07**
	(b)	(i) Why pre-processing and post-processing capabilities are strength of any FEM software? (ii) Describe the analytical capabilities and range of application of ANSYS or any other software.	**07**
		OR	
Q.3	**(a)**	Discuss with illustration discretisation process.	**07**
	(b)	For the four spring in series assemblage obtain (a) the global stiffness matrix, (b) the displacements of intermediate nodes (c) the global nodal forces, and (d) the local element forces. Extreme left node is fixed while extreme right node is given a fixed, known displacement d = 20:0 mm. The spring constants are all equal to k = 200 kN/m.	**07**
Q.4	**(a)**	Explain basic concept of plane stress and plane strain problems with suitable examples. Also give their strain stress linking matrices.	**07**
	(b)	Will you use the plane stress or plane strain element to model the following: (i) a flat slab floor of a building (ii) a wall subjected to wind loading (the wall acts as a shear wall) (iii) a tensile plate with a hole drilled through it (iv) a soil mass subjected to a strip footing loading (v) a wrench subjected to a force in the plane of the wrench (vi) a wrench subjected to twisting forces (the twisting forces act out of the plane of the (vii) a triangular plate connection with loads in the plane of the triangle	**07**
		OR	
Q.4	**(a)**	Identify axsymmetric problem. Discuss type of stresses and strains induced in axsymmetric element.	**07**
	(b)	Derive strain displacement matrix for axsymmetric element shown in fig.1. Take E=210GPa, μ= 0.23.	**07**

Q.5 **(a)** Select a suitable displacement function for a beam element and show that it satisfies the convergence criteria. **07**

(b) For the beam and loading as shown in fig.2, where E=210 GPa and I =6 x 10^6 m^4. Determine slope at A and B. **07**

OR

Q.5 Obtain [B] matrix for the CST element whose nodal co-ordinates are as under: Node-1 (4, -2), Node-2 (3,6) and Node-3 (8,-8). **14**

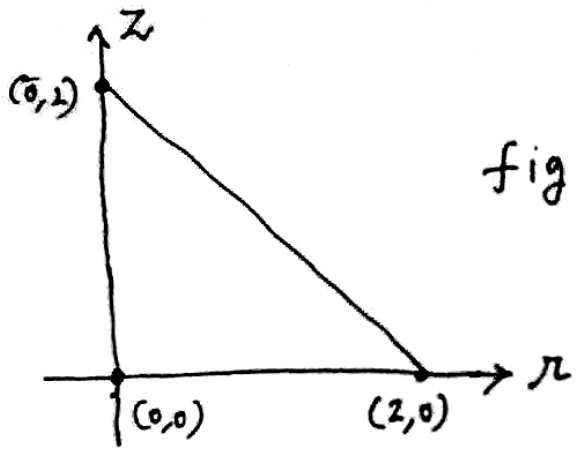

fig.1.

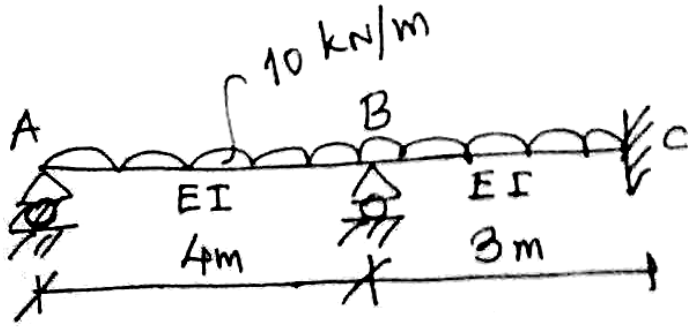

fig.2.

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