Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-II Remedial Examination December 2010

Subject code: 721501
Subject: Finite Element Method

Date: 18 /12 /2010 **Time: 02.30 pm – 05.00 pm**

Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Derive the load vector for 2-noded bar element if it is loaded with **06**
i) Uniformly distributed load along length
ii) Uniformly varying load along length

(b) Derive the shape function for 3- noded two dimensional element. **06**

Q.2 **(a)** Explain the isoparametric concept in finite element analysis. **06**

(b) List and draw, the shape functions and its variation, for four nodded plate element. Use Natural co-ordinate system. **06**

OR

(b) A two noded torsion element is shown in fig-1, where GJ = constant. Calculate
i) Angular rotations at node 2 & 3 ii) Reactive torque

Q.3 **(a)** Derive K matrix for three nodded bar element. **06**

(b) For a given bar shown in fig.2, find nodal displacements & element stresses. **06**

OR

Q.3 **(a)** For the plane truss shown in fig.3, determine the nodal displacements and stresses in each element. All elements have E = 70 GPa and A = 4.0 x 10^{-4} m^2. **06**

(b) For the beam & loading as shown in Fig.4, where E = 200 GPa and I = 4.0 x 10^6 m^4. Determine the slopes at 2 & 3and vertical deflection at midpoint of the distributed load. **06**

Q.4 **(a)** Differentiate between plane stress & plane strain condition. **06**

(b) For a plane stress triangular element shown in fig.-5 , **06**
Nodal displacements are given as
u_1 = 2 mm, u_2 = 0.5 mm, u_3 = 3 mm,
v_1 = 1 mm, v_2 = 0 mm, v_3 = 1mm
Determine the element stresses and principle stresses.
Take E=210 GPa, ν = 0.25 and t = 10 mm.
The coordinates are given units of millimeters.

OR

Q.4 **(a)** Explain the importance of 'element aspect ratio' in modeling FEM problem. Also explain labeling of elements. **06**

(b) For the triangular element shown in fig.- 6,find out load vector . Assume the element thickness is equal to 't'. **06**

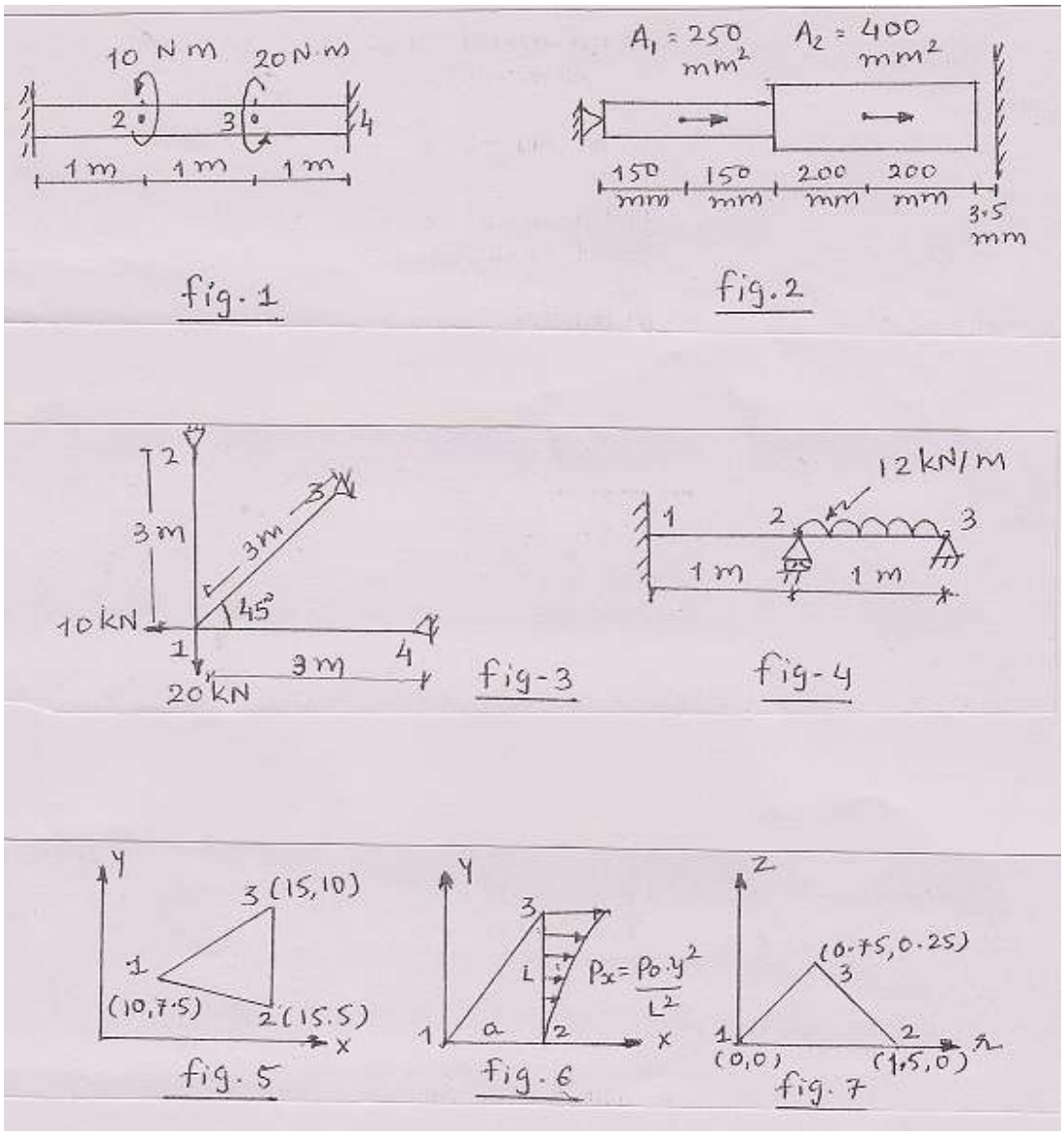
Q.5 **(a)** Define axisymmetric problem. Discuss type of stresses & strains induced in axisymmetric element. **06**

(b) Derive strain displacement matrix for axisymmetric element shown in fig.7.Take E= 200 GPa, $\mu = 0.25$. **06**

OR

Q.5 **(a)** Determine the consistent mass matrix for one dimensional bar element having modulus of elasticity E, mass m, density ρ and cross sectional area A. **06**

(b) Derive the expression for the finding out stiffness matrix & load vector for spring in series and spring in parallel. **06**



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