# GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER- II(Old course) • EXAMINATION (Remedial) - WINTER- 2015

## Subject Code: 1722001 Subject Name: Finite Element Method Time:2:30 pm to 5:00 pm Instructions:

Date: 09/12/2015

**Total Marks: 70** 

- 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 two-noded bar element if it is loaded with 07 point load at centre and uniformly varying load along length.
  - (b) Derive the expressions for natural coordinates for a two-noded element 07 in terms of natural coordinate  $L_1$  and  $L_2$ , when range is 0 to 1.
- Q.2 (a) Using the theorem of minimum potential energy, derive expression for 07 element stiffness matrix K.
  - (b) What is tetrahedral element? What are the various shape functions for 07 the element? What will be *D* matrix for the same? Discuss the steps involved in the calculating the stiffness matrix for the same.

#### OR

- (b) Derive the expressions for natural coordinates for a two noded element 07 in terms of natural coordinate *s*, when range is -1 to 1.
- Q.3 (a) Distinguish between a plane stress and plane strain problem with 07 suitable examples. Also give their strain stress linking matrices.
  - (b) Determine nodal displacements and reaction forces for bar subjected to 07 torque shown in Figure 1 using FEM.

#### OR

- Q.3 (a) For a constant strain triangle element the three nodes are (0,0), (2,0) 07 and (0,3), derive the strain displacement relationship matrix **B**.
  - (b) Discuss the use of Pascaløs triangle for selection of the displacement 07 function. Also give the various examples for the same giving convergence criteria.
- Q.4 (a) Define axi-symmetric problem. Discuss type of stresses and strains 07 induced in axi-symmetric element.
  - (b) Derive strain displacement matrix for axymmetric element shown in 07 Figure 2. Take E=210GPa, = 0.3.

### OR

- Q.4 (a) Write short note on pre and post processors.
  (b) For the beam and loading as shown in Figure 3, where E=210 GPa and 07 I = 2.0 x 10<sup>6</sup> m<sup>4</sup>. Determine slope at B and C.
- Q.5 Assemble Jacobian matrix and strain displacement matrix 14 corresponding to the Gauss point (0.57735, 0.57735) for the element shown in Figure 4. Also describe how to assemble element stiffness matrix.

#### OR

Q.5 (a) Enlist five commercially available finite element analysis packages and 07

## list the desirable features of those packages.

(b) Write short note on Hermite Polynomialø











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