Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **M.TECH**

CEPE 207

2nd Semester Back Examination – 2016-17

FINITE ELEMENT ANALYSIS OF STRUCTURES

BRANCH(S): STRUCTURAL & FOUNDATION ENGG, STRUCTURAL ENGG

Time: 3 Hours

Max Marks: 70

Q.CODE: Z1076

Answer Question No.1 which is compulsory and any five from the rest.

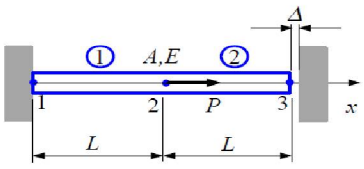
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

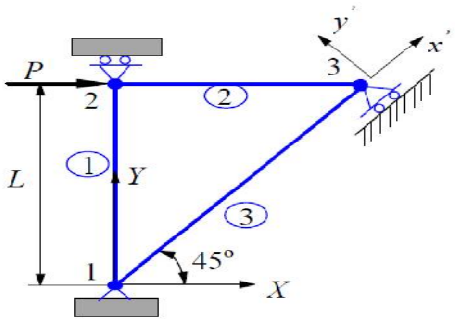
a) Show the polynomial coefficients of *serendipity elements* with Pascal's triangle in 2D.
b) What do you mean by *discretization* ?
c) State the advantages of FEA.
d) What do you mean by *conforming elements* ?
e) State *principle of stationary potential energy*.
f) What are *primary and secondary unknowns* in FEA?
g) Element Stiffness Matrix is singular… Comment.
h) Enumerate the solution stages of FEA.
i) What do you mean by *parasitic terms* in FEA?
j) Show the forces on an *axisymmetric element*.

Q2 **a)** Derive the shape functions for a linear rectangular element in natural coordinates. **(5)**
b) Derive the element stiffness matrix of a two noded bar element having length 'L'. AE is constant throughout. **(5)**

Q3 Determine the support reactions at the two ends of the bar shown below. Given, P = 60 kN, E = 2 x 10^4 N/mm^2, A = 250 mm^2, L = 150 mm and Δ = 1.2 mm. **(10)**



Q4 Assemble the global stiffness matrix of the truss shown in figure below and put the boundary conditions to get reduced stiffness matrix. P = 1000 kN, L = 1m, AE constant for all members. **(10)**



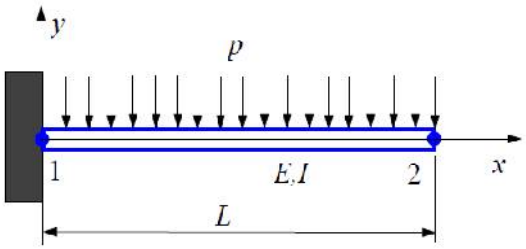
Q5 **a)** For a cantilever bar of length 'L', AE constant, a force of 'P' acting at the free end, show that the stress at any point is P/A. Take one element and two nodes. **(5)**

b) Compute the element nodal load vectors for an element under udl. **(5)**

Q6 **a)** Using Gaussian quadrature, evaluate the integral $\int_{-1}^{1}\int_{-1}^{1} r^2 s^2 \, dr \, ds$ by two point rule. **(5)**

b) Taking a brick element, with 8 nodes, calculate the shape functions of corner nodes. **(5)**

Q7 Determine the rotation and deflection at the right end and the reactions at the left end of a cantilever beam shown in figure below. **(10)**



Q8 **Write short notes on any two.** **(5 x 2)**

a) Shape function
b) Jacobian Matrix
c) Convergence requirements
d) Natural coordinate system