Printed Pages:02 **Sub Code:CE920**

Paper Id: | 2 | 0 | 0 | 2 | 1 | 2 | **Roll No.** | | | | | | | | | | |

M.TECH.
(SEM II) THEORY EXAMINATION 2017-18
FINITE ELEMENT ANALYSIS

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a. Define positive definite matrix.
b. Explain basic steps in FEM
c. Define isoparametric element concept.
d. What is plane stress and plane strain conditions?
e. Define Variational approach.
f. What is Hermitian shape functions.
g. What are the principles of continuum method?
h. What are interpolation models?
i. What is a higher order element?
j. Define principle of virtual work.

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. A beam element carries a concentrated load P at L/3 from one end. Obtain nodal load using the formulae of fixed beam.
b. Explain the concept of isoparametric formulation.
c. Describe briefly the penalty approach for handling displacement boundary conditions.
d. Solve the following system of simultaneous equations by Matrix inversion method.
$X_1+2x_2+x_3=4$
$3x_1-4x_2-2x^3=2$
$5x_1+3x_2+5x_3=-1$
e. Derive the strain displacement relations.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) Explain the concepts of plane stress and plain strain with suitable examples. Also derive the corresponding equations.
(b) A uniform rod of length l fixed at both ends is subjected to a constant axial load of W kN/m . Establish the displacement field and compute the stresses at the fixed ends and mid span.

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) What are the nature and magnitude of the reactions at the two ends ? Use Rayleigh- Ritz method.

(b) A bar element carries load of q N/m , which varies from q1 at one end to q2 at other end. Calculate consistent nodal loads.

5. Attempt any *one* part of the following: 10 x 1 = 10

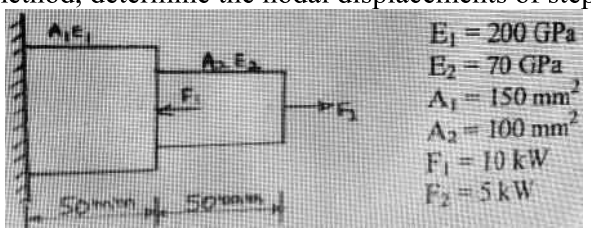
(a) For a two noded one directional element , derive the expression for load vectors due to body force and surface force.

(b) Write displacement model for (i) Linear strain 10 bar element (ii) 4 noded quadrilateral element also sketch the elements indicating their degrees of freedom.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) Solve for deflection at the centre of simply supported beam carrying a point load P at its centre by Rayleigh –Ritz method.

(b) Using the direct stiffness method, determine the nodal displacements of stepped bar shown in figure.



7. Attempt any *one* part of the following: 10 x 1 = 10

(a) Derive the shape function for a nine noded quadrilateral element. Using Larangian method.

(b) Derive the linear interpolation polynomial in terms of natural co-ordinate for 2-D triangular elements.