Code No: 138CC **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year II Semester Examinations, July - 2021
FINITE ELEMENT METHODS FOR CIVIL ENGINEERING
(Civil Engineering)

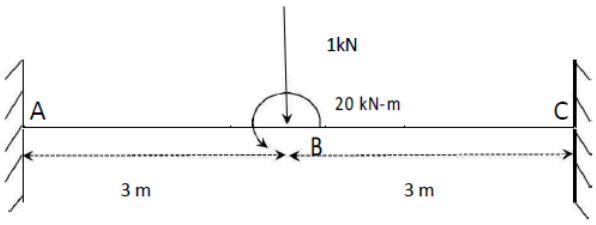
Time: 3 hours **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks
- - -

1.a) Discuss the steps involved in solving structural problems using Finite Element Analysis and also discuss its merits and demerits.
b) Derive the equations of equilibrium in case of a three dimensional stress system with a neat illustration. [7+8]

2.a) The nodal coordinates of the triangular element are 1 (1,1), 2 (4,2), 3 (3,5). At the interior point P, the x coordinate is 3.5 and N_1 is 0.4. Determine N_2, N_3 and y coordinate at point P.
b) Evaluate element stiffness matrix for a bar element. Also obtain the stiffness matrix in global coordinates with transformed displacement. [8+7]

3. Given that E=210 GPa and I=4×10^{-4} m^4, cross section of the beam is constant. Determine the deflection and slope at point C. Calculate the reaction forces and moments. [15]



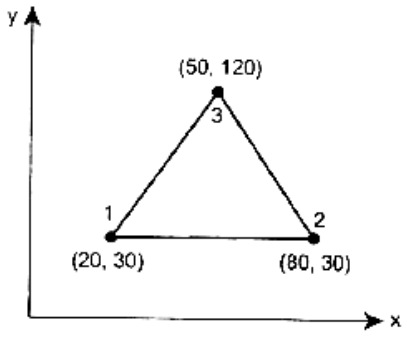
4.a) What is an Iso-parametric, Sub-parametric and Super-parametric element and explain briefly with examples.
b) Compare and contrast CST element with LST element and discuss the Balient points.[8+7]

5.a) Explain the static condensation of stiffness matrix with an example.
b) Briefly explain the process of 'Assembly of elements and solution techniques for static loading'. [7+8]

6.a) Explain lagrangian and serendipity elements for a higher order element formulation using Pascal triangle.
b) Derive the constitutive matrix for 2D element with proper example. [8+7]

7.a) Derive the strain-displacement matrix for the Constant Strain Triangular element

b) Determine the stiffness matrix for the CST Element shown in figure. The coordinates are given in mm. Assume plane strain condition. E =210 GPa, μ = 0.25 and thickness, t = 10 mm. [7+8]



8.a) Evaluate the integral $\int_{-1}^{1} Cos\left(\frac{x}{2}\right) dx$ by applying three point gaussian quadrature.

b) Evaluate $\int_{1}^{3} \frac{dx}{x}$ using numerical integration technique. Check the solution with exact answer. [7+8]

--ooOoo--