Code No: **19MET504**

R19

III B. TECH I SEMESTER REGULAR EXAMINATIONS, FEB - 2022
FINITE ELEMENT METHODS
(MECHANICAL ENGINEERING)

Time: 3 Hours **Max. Marks: 60**

Note: Answer **ONE** question from each unit **(5 × 12 = 60 Marks)**

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UNIT-I

1. a) Differentiate plane stress and plane strain problems with suitable examples. [6M]

   b) Determine the strain components ε_x, ε_y and γ_{xy} for the displacement field [6M]

   $u = 2x^2 + 2y^2 + 6xy$ and $v = 3x + 6y - 2y^2$ at the point x = -1, y = 0.

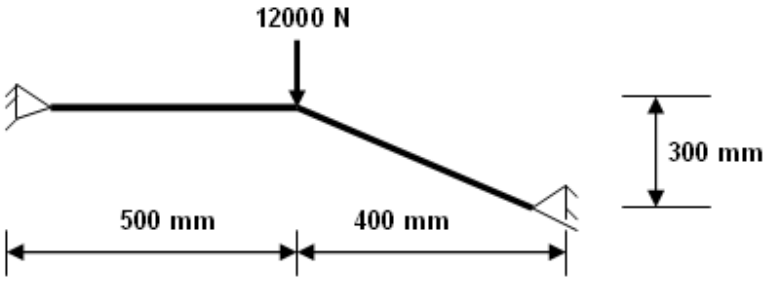
(OR)

2. a) Describe the basic steps involved in finite element analysis. [6M]

   b) Discuss the various element shapes in FEA. [6M]

UNIT-II

3. Compute the displacements at nodes in elements shown in figure . [12M]
   Take the Modulus of Elasticity as 70,000 N/mm^2 and A=200 mm^2.



(OR)

4. Show that the central deflection of the beam of length L m (both the ends are fixed) carries a load of W at the center is given by $WL^3/192$ EI using FEM by dividing the beam into two elements. [12M]

UNIT-III

5. a) Discuss the properties of constant-strain triangular element. [6M]

   b) The nodal coordinates of a triangular element are 1(1,3), 2(5,3) and 3(4,6). At a point 'P' inside the element, the x-coordinates is 3.3 and the shape function $N_1 = 0.3$. Determine the shape functions and y-coordinates of the point P. [6M]

(OR)
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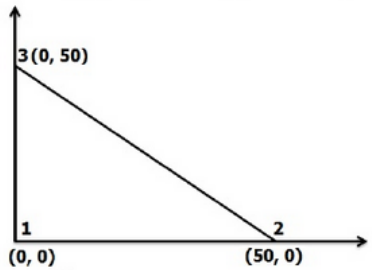
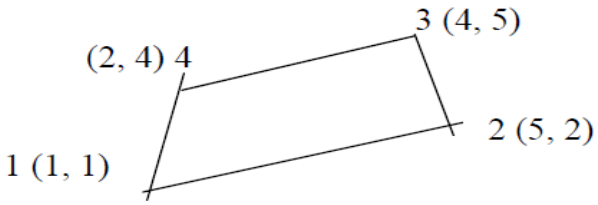
6. Evaluate the stiffness matrix for the axi-symmetric element shown in Figure. Take the Modulus of Elasticity as 2.1 x 10^5 N/mm^2 and Poisson's ratio as 0.3. [12M]



UNIT-IV

7. Find the Jacobian determinant [J] of the two dimensional element at $\xi=0$ and $\eta=0$ as shown in figure. [12M]



(OR)

8. a) Describe about Gauss quadrature technique in numerical integration. [6M]

b) Check what order of the Gauss quadrature could exactly integrate the following. [6M]

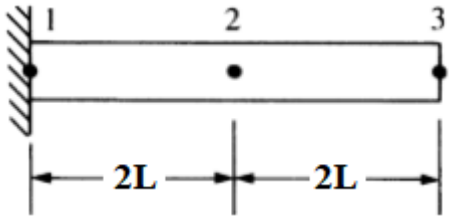
$\Phi = (2+ 3x+5x^3 + 8 x^6)$.

UNIT-V

9. A metallic fin with thermal conductivity k=360 W /m ^{0}C, 0.001 m thick and 0.1m long, extends from a plane wall whose temperature is 235^{0}C. Determine the temperature distribution and amount of heat transferred from the fin to the air at 20^{0}C with h= 9 W/m^{2}C. Take the width of fin to be 1 m. [12M]

(OR)

10. Determine the Eigen values and Eigen vectors of the bar shown in figure. Take E = 200 Gpa, ρ = 7862 kg/m^2, A = 6 cm^2 and L = 2.5 m. [12M]



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