ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)

M.Tech II-Semester Regular Examinations, May 2016

ADVANCED FINITE ELEMENT ANALYSIS

(MACHINE DESIGN)

Date: **Time: 3 hours** **Max Marks: 60**

Answer ONE Question from each unit
All questions carry equal marks
All parts of the question must be answered at one place only

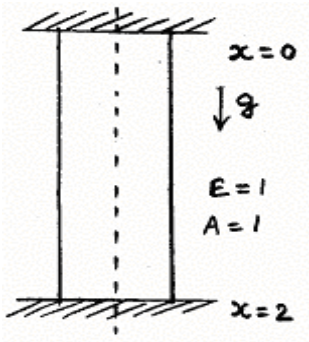
UNIT-I

1. a) Derive the D-matrix using the generalised Hook's law relations. **[6]**

   b) A displacement field is specified by $u = K(x^2 - xy + y^2)$ and $v = K(-x^2 + xy - y^2)$ where 'u' and 'v' are the displacements in x and y directions respectively. $K = 10^{-4}$ cm^{-1}. If E=200 Gpa and Poisson's ratio is 0.28, determine the three planar stress components and the strain components at a point x=1 cm and y = 1 cm. **[6]**

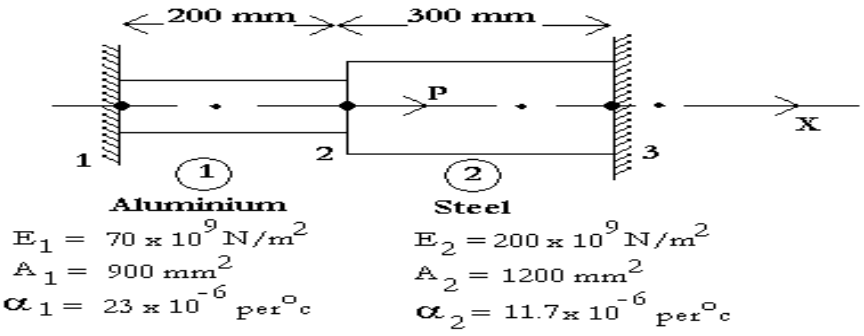
(OR)

2. a) Distinguish plane stress and plane strain problems. [**4**]
   b) Find out the displacement at the midpoint of the given rod as shown in figure below by Galerkin's method. [**8**]



UNIT-II

3. An axial load $P = 300 \times 10^3$ N is applied at 20°C to the rod shown in figure. The temperature is then raised to 60°C, find
   (i) The global stiffness and load matrices.
   (ii) The nodal displacements and element stresses. [**12**]



(OR)

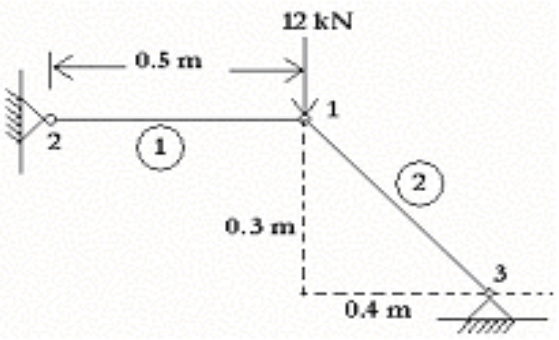
4. For the two bar truss shown in figure, determine the nodal displacement, element stresses and support reactions. [**12**]

$E_1 = 70\ G\ Pa$

$E_2 = 100\ G\ Pa$

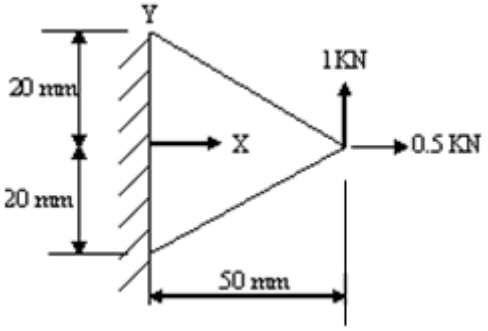
$A_1 = 200 \times 10^{-6} m^2$

$A_2 = 100 \times 10^{-6} m^2$



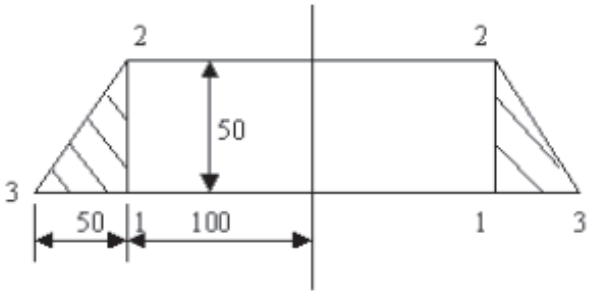
UNIT-III

5. Determine the deflection at the point of load application using a one triangular element model for the configuration shown in the figure. **[12]**



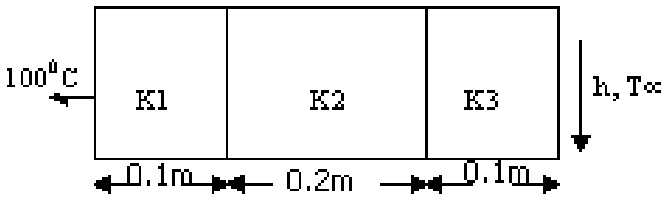
(**OR**)

6. An axisymmetric ring element is shown in figure. Derive the matrices, [B] and [D]. Take E = 2×10^5 N/mm^{2}and $\mu = 0.33$. [**12**]



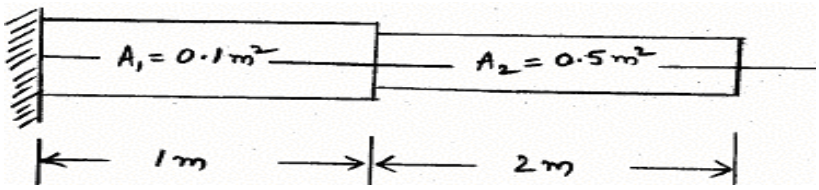
UNIT-IV

7. Estimate the temperature distribution in 1-Dimensional slab as shown in figure. K_1 = 25 W/m K; K_2 = 10 W/m K; K_3 = 5 W/m K; h = 55 W/m^2 K; T∞ = 20^0C. [**12**]



(**OR**)

8. Determine the eigen values and eigen vectors with sketches for the shaft shown in figure. E = 2E11N/m^2 and density ρ = 7850kg/m^3. **[12]**



UNIT-V

9. Write short notes on the following:
   (a) Triangular plate bending elements [**6**]
   (b) Conforming & non-conforming rectangular plate bending elements [**6**]

(**OR**)

10. (a) Explain about C^0, C^1 and C^2 continuity plate bending elements. [**8**]
    (b) Explain the procedure involved in solving a problem through FEA package.[**4**]

*****