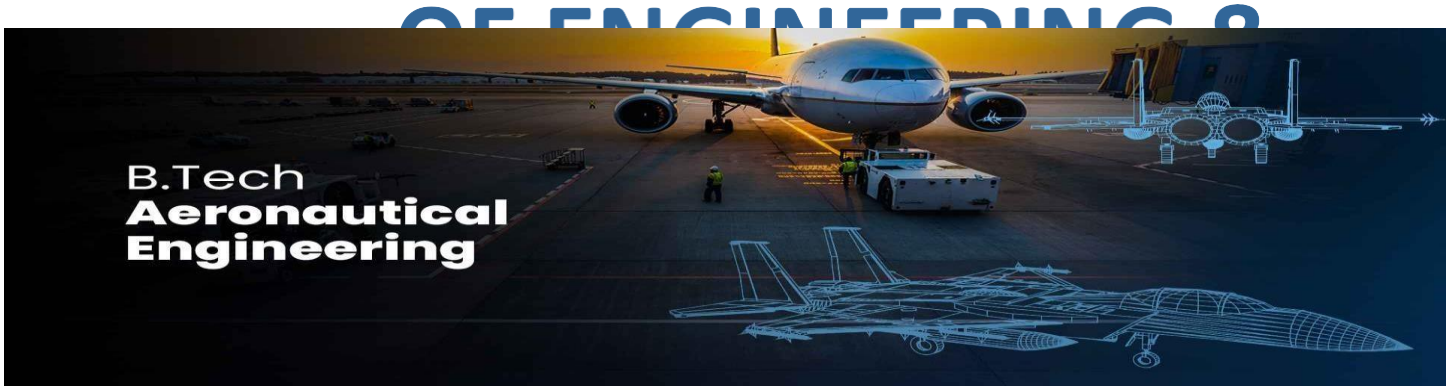
MRCET CAMPUS

MALLA REDDY COLLEGE

(AUTONOMOUS INSTITUTION – UGC, GOVT. OF INDIA)



Department of AERONAUTICAL ENGINEERING

FINITE ELEMENT ANALYSIS

QUESTION BANK

Prepared by:

M.Yugender
Associate Professor
Department of ANE
yugender@mrcet.ac.in

Code No: R18A2114

R18

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

III B.Tech II Semester Regular Examinations, July 2021

Finite Element Analysis

(AE)

Roll No										

Time: 3 hours **Max. Marks: 70**

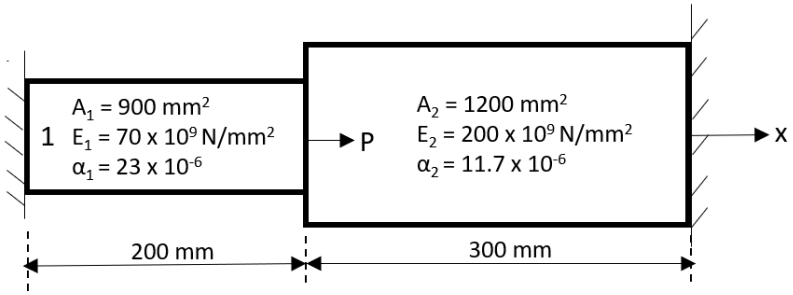
Answer Any **Five** Questions
All Questions carries equal marks.

***

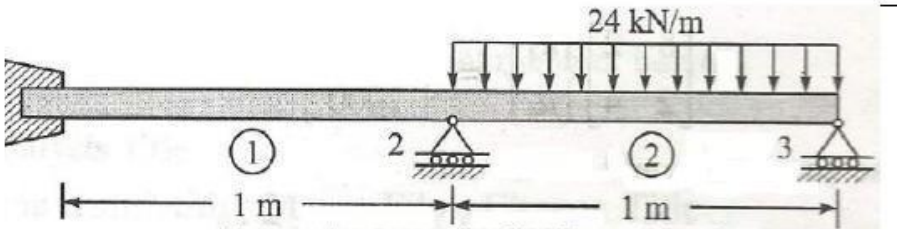
1 (i) Derive the equations of equilibrium in case of a three-dimensional stress system. **[7M]**
(ii) Write the Strain displacement equations for three-dimensional system **[7M]**

2 An axial load P =300 x 10^3N is applied at 20^0C to the rod as shown in Figure below. The temperature is the raised to 60^0 C. **[14M]**

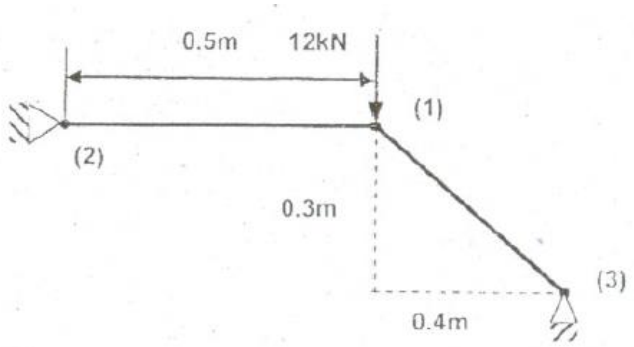
a) Assemble the K and F matrices
b) Determine the nodal displacements and stresses



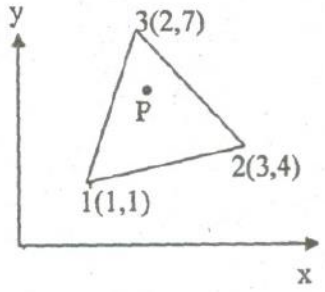
3 For the beam shown in Figure below, determine the following: **[14M]**
(a) Slopes at nodes 2 and 3
(b) Vertical deflection at the mid-point of the distributed load.
Consider all the elements have E=200GPa, and I=5 X 10^6mm^4 .



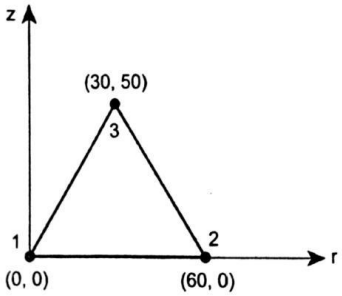
4 For the two-bar truss shown in Figure determine the displacements of node 1and the stress in element 1-3. Take Young's Modulus as 80 GPa and cross section of the truss members as 175 mm^2. **[14M]**



5 Consider the triangular element shown in Figure. Find the temperature at point P(2,5) inside the element. The temperature at nodes are $T_1 = 80^0$ C, $T_2 = 100^0$ C and $T_3 = 150^0$ C. Also determine the temperature gradient inside the element. **[14M]**

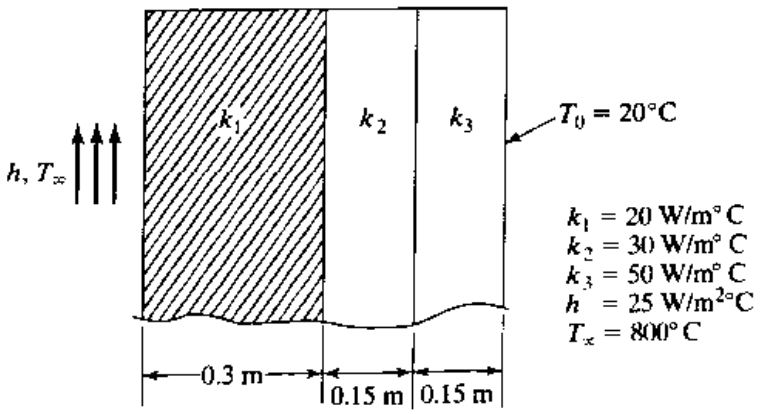


6 For the axisymmetric element shown in fig. determine the element stresses. Take E= 2.1 x 10^5 N/ co-ordinates are in mm. The nodal displacements are: **[14M]**



u_1 = 0.05mm; w_1 = 0.03mm
u_2 = 0.02mm; w_2 = 0.02mm
u_3 = 0 mm; w_3 = 0 mm

7 A composite wall consists of three materials, as shown in fig. The outer temperature is 20^0C. Convection heat transfer takes place on the inner surface of the wall with 800^0C. Determine the temperature distribution in the wall. **[14M]**



8 Determine the eigen values and the associated Eigen vectors of the matrix [A] given by **[14M]**

$$A = \begin{bmatrix} 3 & 4 \\ 4 & -3 \end{bmatrix}$$

****

Code No: **R17A2112**

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

III B.Tech II Semester Supplementary Examinations, February 2021

Finite Element Analysis

(AE)

Roll No										

Time: 2 hours 30 min **Max. Marks: 70**

Answer Any **Five** Questions

All Questions carries equal marks.

***

1 Explain the general procedure of Finite Element Analysis. **[14M]**

2 Consider a bar as shown in Figure 1. Young's Modulus E = 2 x 10^5 N/mm^2. A_1 = 2cm^2, A_2 = 1cm^2 and force of 100N. Determine the nodal displacement. **[14M]**

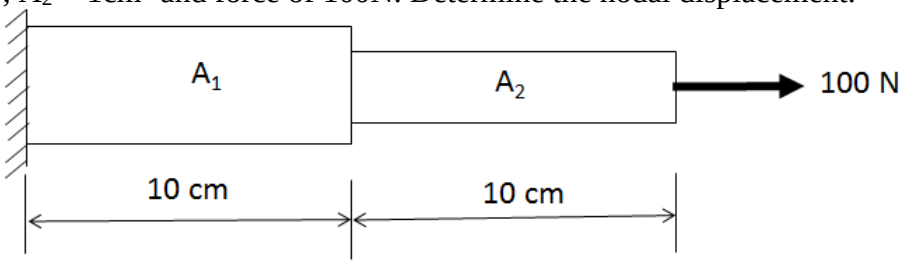


Figure 1

3 The plane truss shown in Figure 2 is subjected to a downward vertical load at node 2. Determine the deflection of node 2 in the global coordinate. For both elements, A = 100mm^2, E = 200 GPa and nodal coordinates are in cm. **[14M]**

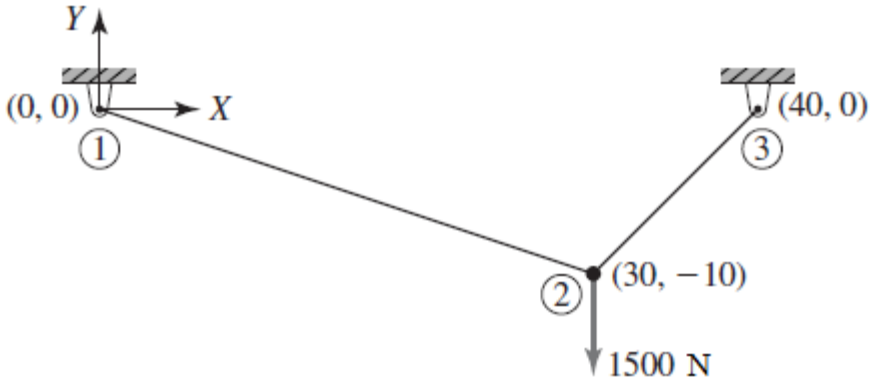


Figure 2

4 Find the global stiffness matrix and load vector for the steel shaft shown in Figure 3. Consider the shaft to be simply supported at bearings A and B . **[14M]**

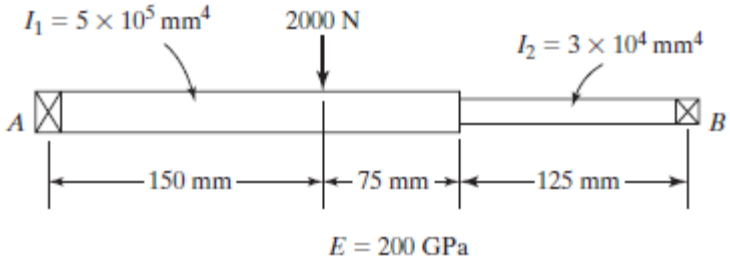


Figure 3

5 Derive the strain displacement matrix for constant strain triangle (CST) element. **[14M]**

6 Develop the shape functions for a four-noded Isoparametric quadrilateral element. **[14M]**

7 A furnace wall is made up of three layers, inside layer with thermal conductivity 8.5 W/m K, the middle layer with conductivity 0.25 W/m K, the outer layer with conductivity 0.08 W/m K. The respective thicknesses of the inner, middle and outer layer are 25 cm, 5 cm and 3 cm respectively. The inside temperature of the wall is 600^0C and outside of the wall is exposed to atmospheric air at 30^0C with heat transfer coefficient of 45 W/m^{2}K. Determine the nodal temperatures. **[14M]**

8 Develop the global stiffness and mass matrices of the stepped copper bar as shown in Figure 4. **[14M]**

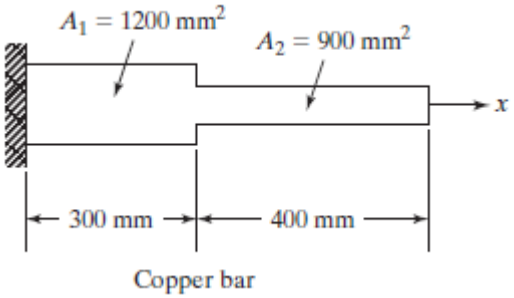


Figure 4

****