

IV B.Tech II Semester Supplementary Examinations, Apr/May 2006
FINITE ELEMENT METHODS
(Aeronautical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
 All Questions carry equal marks

1. Explain various types of boundary conditions encountered in the finite element analysis of structural problems. [16]
2. Estimate the displacement vector, stresses and reactions for the truss structure as shown in figure 1. [16]

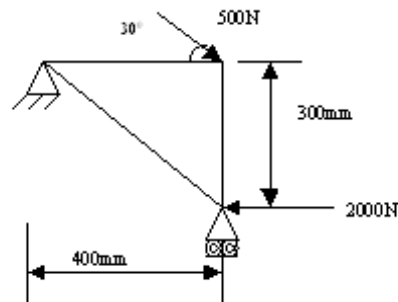


Figure 1:

3. Compute the support reaction at the other end of continuous beam shown in figure 2. use the concept of boundary element $EI=400$ units. [16]

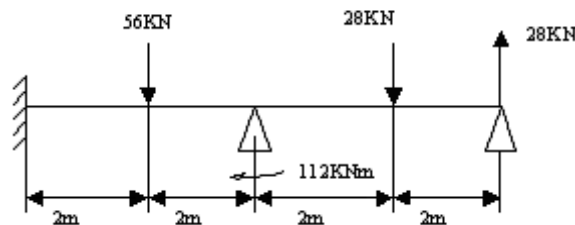


Figure 2:

4. Explain how you derive a stiffness for a triangular plate bending element for a complex structure consisting of plate elements and six degrees freedom at each node how do you proceed to combine the stiffness matrix and in plane stiffness matrices to get 18×18 matrix. [16]
5. (a) What is a Lagrangian? Define the principle involved in arriving it.

- (b) Explain about numerical integration and Gaussian quadrature. [16]
6. A constant strain triangle in a state of plane stress is subjected to a uniform temperature change of ΔT . Assuming that the coefficient of thermal expansion is α , derive the equation for the nodal forces due to temperature change. [16]
7. For the stepped bar shown in the figure 3.
- (a) Develop the global stiffness and mass matrices.
- (b) Determine the natural frequencies and mode shapes using the characteristic polynomial technique. [16]
- Assume $E=200\text{GPa}$ and mass density $= 7850 \text{ kg/m}^3$
 $L_1 = L_2=0.3 \text{ m}$, $A_1=350\text{mm}^2$, $A_2=600\text{mm}^2$

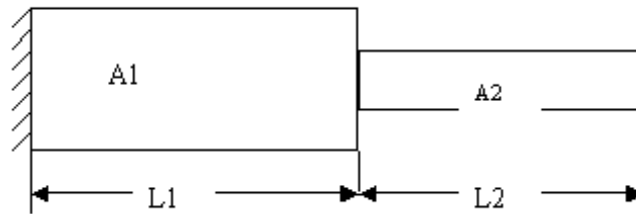


Figure 3:

8. For the simply supported beam, compute the nodal degree of freedom array and column heights of the global stiffness matrix using the mesh 2 for Discretization. The length of the beam is 4 m, height of the beam is 2m ,thickness of the beam is 0.016 m ,Young's modulus $E= 2.1 \times 10^4 \text{ KN/cm}^2$. The load is applied centrally downward i.e., 1000 KN. [16]
