

[03 - 3119]

III/IV B.E. DEGREE EXAMINATION.

First Semester

Elective - Mechanical Engineering

FINITE ELEMENT ANALYSIS

(Common with Marine and Naval Architecture
Engineering)

(Effective from the admitted batch of 2006-2007)

Time : Three hours

Maximum : 70 marks

First question is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) Define shape function.
- (b) Explain the isoperimetric concept in element analysis.
- (c) What are the different types of boundary conditions?
- (d) A displacement field is described by
 $u = -x^2 + 2y^2 + 6xy$; $v = 3x + 6y - y^2$
Determine : y_{xy} at $x = 1, y = 0$.

- (e) Explain the principle of minimum potential energy.
 - (f) What do you understand by modeling of beams on elastic supports?
 - (g) Explain planes strain problem.
2. (a) Establish the hermite shape functions for a beam element.
- (b) Derive the equivalent nodal point loads for u.d.l. acting on the beam element in the transverse direction.
3. (a) Define Linear and Quadratic shape functions bar element and its properties Establish the interpolation functions in Natural coordinate system for 2 noded truss element and derive the stiffness matrix for truss using intrinsic coordinates.

- (b) Consider axial vibration of the Aluminium bar shown in Figure 1, (i) develop the global stiffness and (ii) determine the nodal displacements and stresses using elimination approach and with help of linear and quadratic shape function concept. Assume Young's modulus $E = 210 \text{ GPa}$.

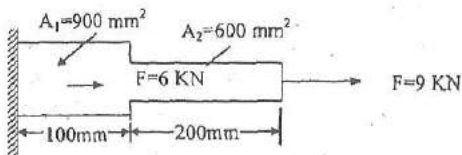


Figure 1

4. (a) Distinguish between local, natural and global coordinates.
- (b) For the pin jointed configuration shown in Figure 2, determine;
- Element stiffness matrices
 - Global stiffness matrix
 - Stress in the element 1