[03 – 3119]

III/IV B.E. DEGREE EXAMINATION.

First Semester

Mechanical Engineering

Elective I — FINITE ELEMENT ANALYSIS

(Common with Marine and Naval Architecture Engineering)

(w.e.f. admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Answer FIVE questions including questions No. 1 which is compulsory.

1. (a) Explain saint Venant's principle.

   (b) State the stress-strain relations for an isotropic material using Lame's constant λ and μ.

   (c) Distinguish between bar, beam and frame elements.

   (d) What is isoprametric formulation?

   (e) What is shape function?

   (f) Write short notes on modelling of beams on elastic supports.

   (g) What is CST? Why is it called so?

2. (a) Explain with neat sketches plane stress, plane strain and axi-symmetric problems.

(b) For the functions :

$u = 8x + 5xy + 7x^2y$, $v = 6y + 3xy + 10xy^2$.

Find the values ϵ_x, ϵ_y and γ_{xy} at a point $(1, -1)$.

3. Use the Galerkin's method to find the displacement of the mix point of the linear elastic rod with body force neglected as shown in fig. 1.

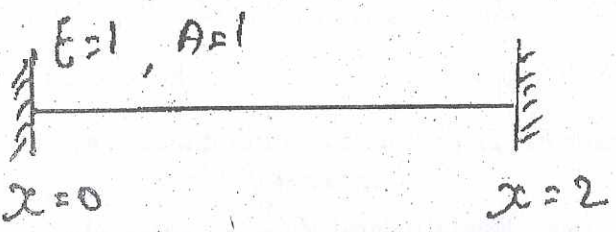


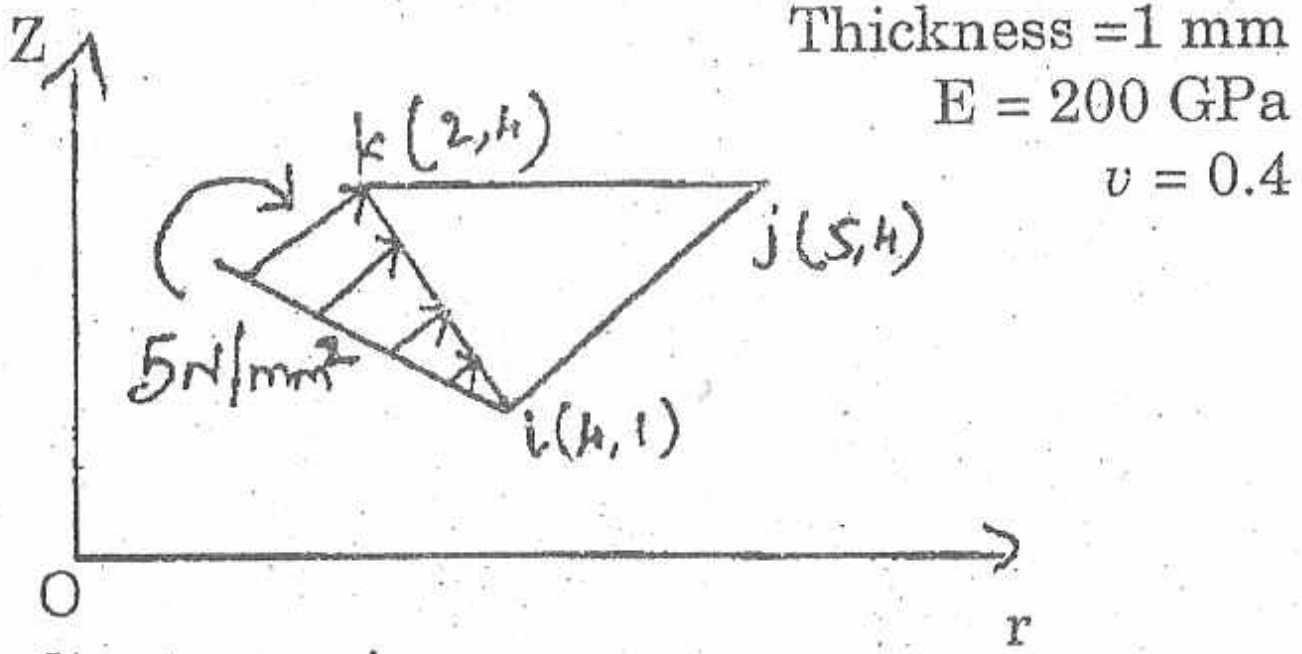
Fig. 1

4. Derive the stiffness matrix for a 3-noded bar element using quadratic shape functions.

5. For a triangle element under implane loading derive the relation between shear strain and nodal displacements.

6. Form the finite element equation for the axisymmetric element show in fig. 2

Thickness = 1 mm E = 200 GPa $\gamma = 0.4$.



Coordinates are in mm.

Fig 2

7. Explain the Gaussian integration method in F.E. applications by considering suitable examples.

8. (a) Establish interpolation functions for an 8-noded quadrilateral element.

(b) Establish the Jacobian for a 4-noded quadrilateral element.