Code: 9A21701

R09

B.Tech IV Year I Semester (R09) Regular & Supplementary Examinations December 2015

FINITE ELEMENT & MODELING METHODS

(Aeronautical Engineering)

Time: 3 hours Max. Marks: 70

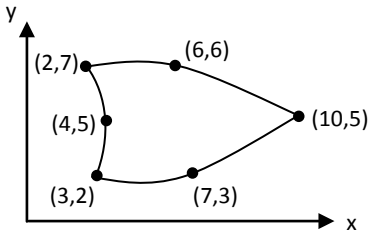
Answer any FIVE questions

All questions carry equal marks

*****

1 (a) State the principle of minimum potential energy.

(b) Determine the jacobian matrix for the quadratic isoparametric triangular element shown below.



2 (a) Describe general steps of finite element method.

(b) Explain variational approach and weighted residual methods.

3 (a) What is the basic in finite element method?

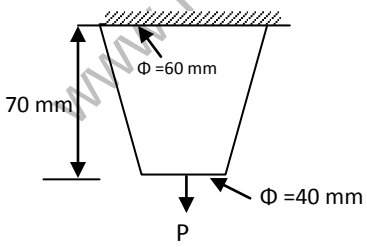
(b) Derive the stiffness matrix for a plane stress triangular element using:

(i) Principle of minimum potential energy.

(ii) Galerkin method.

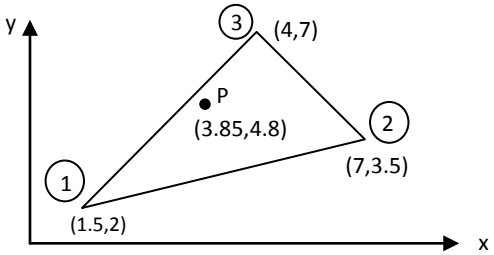
4 (a) Why Gauss quadrature method is preferred in FEM?

(b) Find the displacement of a truncated cone bar subjected to axial load as shown in figure below, using FE technique. Take P = 50 kN, E = 210 GPa and ρ = 7800 kg/m^3.



5 (a) What are the advantages of lumped matrix over consistent matrix?

(b) Evaluate the shape functions N_1, N_2 and N_3 at the interior point P for the triangular element shown in below.

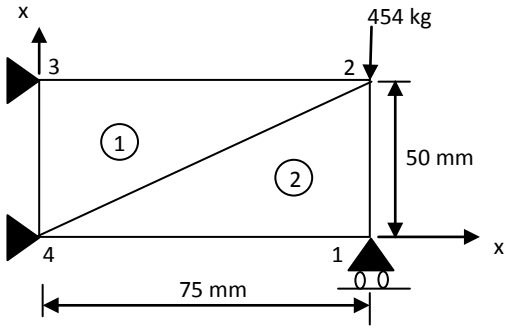


Contd. in page 2

Code: 9A21701

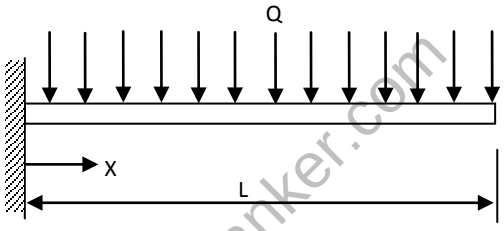
R09

6 For two dimensional loaded plate shown below, determine the displacement of nodes 1 & 2 and the element stresses using plane stress conditions. Body forces may be neglected in comparison with external forces.

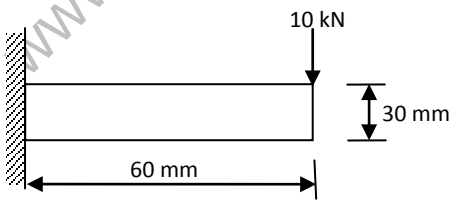


Thickness = 12.5 mm
Young's modulus = 70 GPa
Poisson's ratio = 0.25

7 (a) Write the properties of shape functions.
(b) Develop the expression for the maximum deflection of a cantilever beam shown in figure using the following methods: (i) Point collocation method. (ii) Least square method. (iii) Galerkin method.



8 (a) What are the ways in which 3D problem can be reduced to a 2D approach.
(b) Solve the plane stress problem using two different mesh divisions. Compare the deformation and stresses with values obtained from elementary beam theory.



E = 70 GPa
$\gamma = 0.3$
Thickness = 10 mm

*****