

B.Tech IV Year I Semester (R13) Supplementary Examinations June 2017

FINITE ELEMENT METHODS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

PART – A
(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- Give the advantages and disadvantages of Ritz vectors.
 - What is the significance of node numbering?
 - Explain Hermite shape function.
 - What is the difference between explicit and implicit solution of assembled matrix.
 - List any four commonly used axisymmetric elements.
 - What are Serendipity elements?
 - What are modes of heat transfer?
 - Write down the general Helmholtz equation.
 - What are the advantages of lumped mass over consistent matrix?
 - Write down the finite element equation for 1D heat conduction with free end convection.

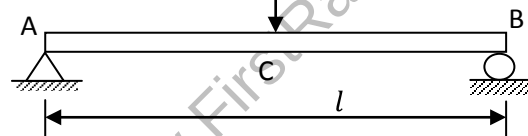
PART – B
(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

- 2 (a) Write short notes on the following: (i) Weighted residual method. (ii) Initial and boundary value problems.
(b) Determine the circumference of a circle of radius 'r' using basic principles of FEM.

OR

- 3 A beam AB of span 'l' simply supported at the ends and carrying a concentrated loads 'w' at the centre 'c' as shown in figure below. Determine the deflection at the mid-span by using Rayleigh-Ritz method. Use a suitable trigonometric trial function.

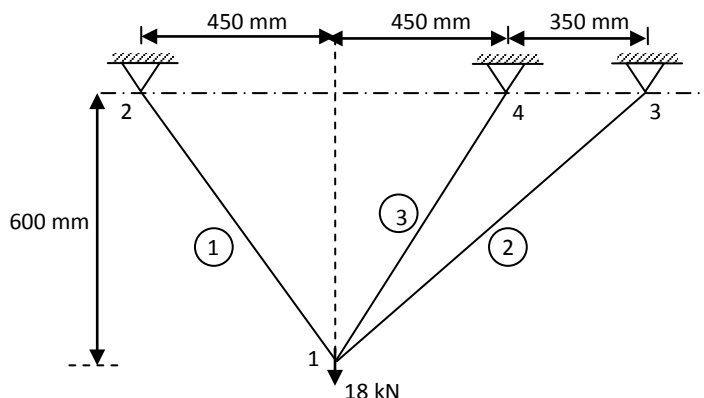


UNIT – II

- 4 For a cantilever beam of length of 'l' subjected to free end load P. Determine the maximum deflection and reactions using FEM. Let 'EI' be the constant value throughout the beam.

OR

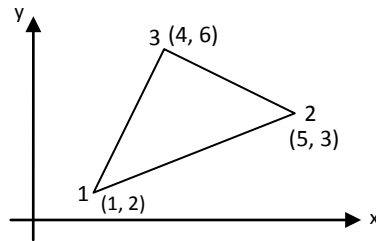
- 5 For the three bar truss shown in figure below, determine the displacements in node 1 and the stress in element 3. Take $A = 250 \text{ mm}^2$, $E = 200 \text{ GPa}$.



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UNIT – III

- 6 The nodal coordinates of the triangular element are shown in figure below. At the interior point P. The x coordinate is 3.3 and shape function at nod 1 is N_1 is 0.3. Determine shape functions at nodes 2 & 3 and also y coordinate of the point P.



OR

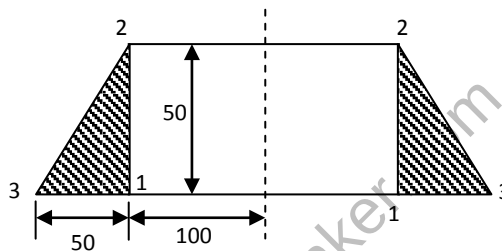
- 7 Derive the strain displacement matrix for a Tetrahedron element. List some disadvantages of using 3D isoparametric elements.

UNIT – IV

- 8 (a) Explain isoparametric, subparametric and super-parametric elements.
(b) Using 3 point Gaussian quadrature, evaluate the following integral: $\int_{-1}^1 (4\xi + \xi^3) d\xi$

OR

- 9 An axisymmetric element is shown in figure below. Derive the matrices $[B]$ and $[D]$. Take $E = 2 \times 10^5 \text{ N/mm}^2$, $\mu = 0.33$.



UNIT – V

- 10 A metallic fin, with thermal conductivity of 360 W/mK , 0.1 cm thick and 10 cm long extends from a plane wall whose temperature is 235°C . Determine temperature distribution and amount of heat transfer from the air at 20°C with a heat transfer coefficient of $9 \text{ W/m}^2\text{K}$. Take width of the fin is 1 m .

OR

- 11 A composite wall consists of three materials. The outer temperature is $T = 20^\circ\text{C}$. Convection heat transfer takes place on the inner surface of the wall with $T_\infty = 800^\circ\text{C}$ and $h = 25 \text{ W/m}^2\text{C}$. Determine the temperature distribution in the wall. $K_1 = 20 \text{ W/m}^\circ\text{C}$, $K_2 = 30 \text{ W/m}^\circ\text{C}$, $K_3 = 50 \text{ W/m}^\circ\text{C}$, $L_1 = 30 \text{ m}$, $L_2 = 0.15 \text{ m}$, $L_3 = 0.15 \text{ m}$.
