**Code: 13A03703** **R13**

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)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Give the advantages and disadvantages of Ritz vectors.
(b) What is the significance of node numbering?
(c) Explain Hermite shape function.
(d) What is the difference between explicit and implicit solution of assembled matrix.
(e) List any four commonly used axisymmetric elements.
(f) What are Serendipity elements?
(g) What are modes of heat transfer?
(h) Write down the general Helmholtz equation.
(i) What are the advantages of lumped mass over consistent matrix?
(j) Write down the finite element equation for 1D heat conduction with free end convection.

**PART – B**

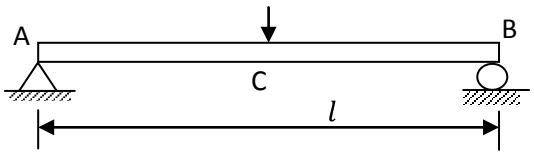
(Answer all five units, 5 X 10 = 50 Marks)

**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 trail function.

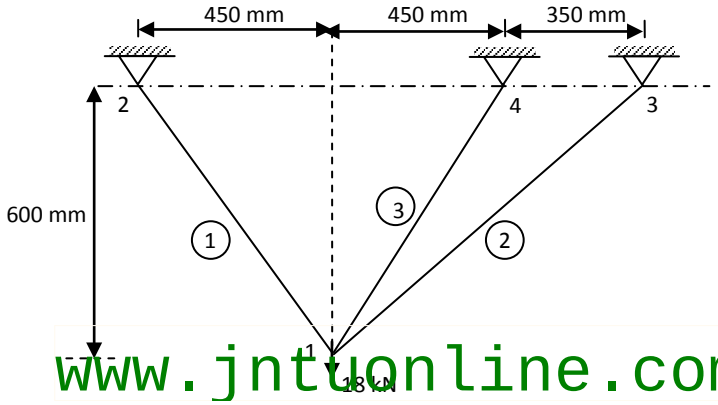



**UNIT – II**

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 mm$^2$, E = 200 GPa.



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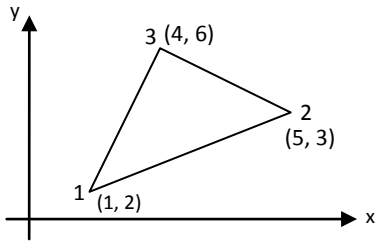
**UNIT – III**

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.

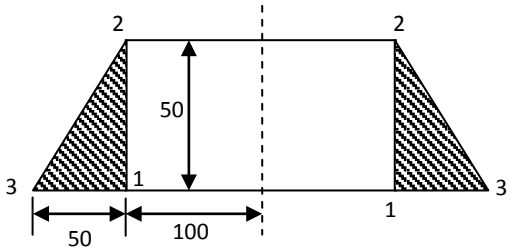
**UNIT – IV**

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 x $10^5$ 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℃. Determine temperature distribution and amount of heat transfer from the air at 20℃ with a heat transfer coefficient of 9 W/m$^2$K. Take width of the fin is 1 m.

**OR**

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

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