R13

Code No: 126EE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, April - 2018

FINITE ELEMENT METHODS

(Common to AE, MSNT, ME)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) What boundary conditions are imposed for 1 Dimensional bar element. [2]
b) Discuss the shape functions of one dimensional quadratic element. [3]
c) Write the hermitian shape function of a beam element. [2]
d) How local and global coordinates are related in a truss problem. [3]
e) What are the properties of a triangular coordinates. [2]
f) Write the strain displacement equation of axisymmetric problems using a cylindrical coordinate system. [3]
g) List one requirement which is sufficient for convergence for a plate element. [2]
h) Write governing differential equation for two dimensional heat transfer problem [3]
i) Describe the features of NISA software. [2]
j) Differentiate lumped and consistent mass matrix. [3]

PART - B

(50 Marks)

2. Derive the stiffness matrix and consistent load vector in matrix form for one dimensional quadratic element. [10]

OR

3. Explore the stress strain relation for 2D and 3D elastic problems. [10]

4. Determine the nodal displacement of the following truss as shown in figure 1. [10]

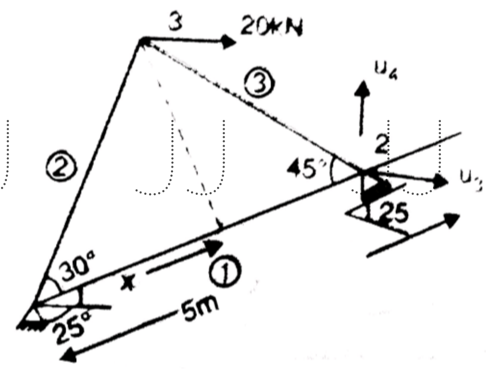

Figure 1

OR

5. Determine the slope and vertical deflection at the centre for the following beam figure 2. [10]

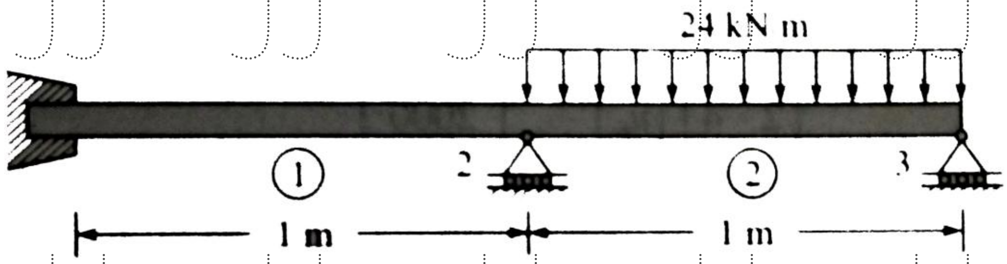

Figure 2

6. Derive the area and strain displacement matrix for the triangular element and thus calculate the same for the triangle as shown in figure 3. [10]

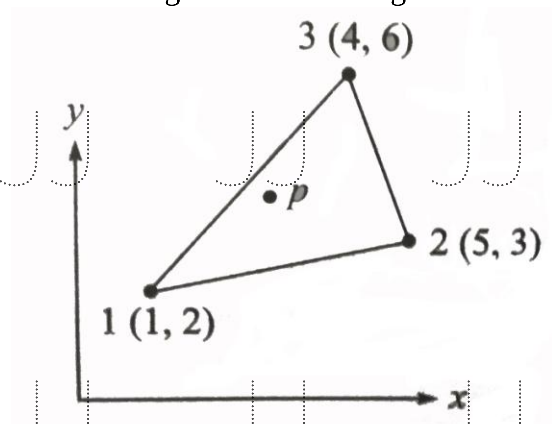

Figure 3

OR

7. Derive the element stiffess matrix for the following figure 4 axisymmetric annular ring element. [10]

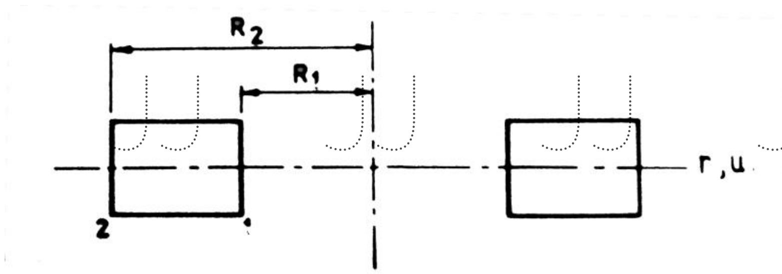

Figure 4

8. Use galerkin's approach to find the stiffness matrix of a torsional triangular element. [10]

OR

9. Determine the temperature distribution in a fin having rectangular cross section and is 8 cm long, 4 cm wide and 1 cm thick. Assume convection heat loss occurs from the free end of the fin. One end is fixed. Take $k=3\ W/cm^{0}C$, $h= 0.1\ W/cm^{2}\ {}^{0}C$ and $T_\infty=20^{0}C$. [10]

10. Find the natural frequency of the following truss bar figure 5. [10]

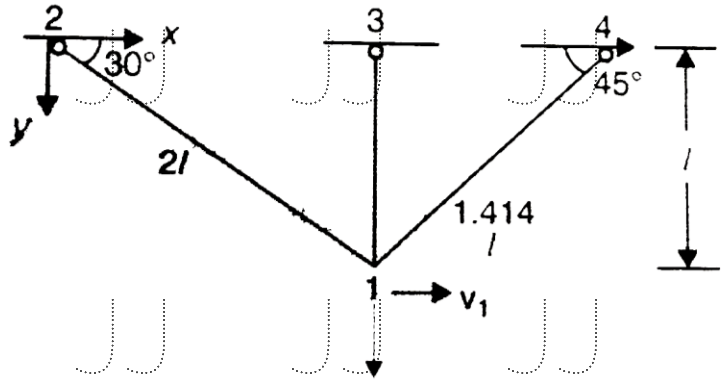

Figure 5

OR

11. Derive the eigen values and eigen vectors of the stepped bar. Assume the required data. [10]

---ooOoo---

Code No: 126EE **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech III Year II Semester Examinations, May - 2016
FINITE ELEMENT METHODS
(Common to ME, AE, MSNT)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A (25 Marks)

1.a) What is the principle of finite element method? [2]
b) Write the stress strain relations for 2 D plane stress and plane strain conditions. [3]
c) Differentiate between truss and beam element based on degree of freedom. [2]
d) What is Hermite shape function? [3]
e) Write the formula for the load vector of a triangular element subjected to body force. [2]
f) What is the size of the stiffness matrix for axisymmetric triangular element? [3]
g) What is the degree of freedom for the thermal problems? [2]
h) Where do you apply finite element analysis for thermal problems? [3]
i) Explain convergence requirement. [2]
j) Explain the importance of lumped mass matrix. [3]

PART - B (50 Marks)

2.a) Why polynomial type of interpolation function is preferred over trigonometric functions? Explain.
b) Draw the Pascal's triangle and Pascal's tetrahedron for understanding the interpolations functions. Explain the salient features. [5+5]

OR

3.a) Explain the steps involved in obtaining an approximate solution using finite element method.
b) Explain the equilibrium state of the system, when the system is subjected to different types of loads and explain the stress and equilibrium relations. [5+5]

4. For a two-dimensional truss structure, as shown in the figure 1, determine displacements of the nodes and normal stresses developed in the members using FE. Use $E = 30\times10^6$ N/cm^2 and a diameter of the circular cross-section of 0.25 cm. [10]

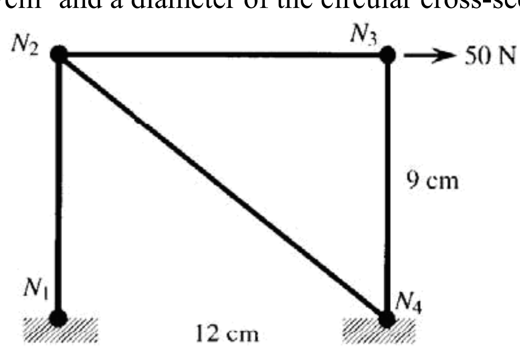

Figure 1

OR

5. A beam is fixed at one end and supported by a roller at the other end, has a 20 kN concentrated load applied at the centre of the span of 10 m. Calculate the deflection and slope and also construct shear force and bending moment diagrams. Take I = 2500 cm^4 and E = 20 × 10^6 N/cm^2. [10]

6.a) Evaluate the axisymmetric stiffness matrix ***K*** of the triangular element shown in the figure 2. Consider the coordinates of nodes as 1 (2, 1), 2 (4, 0), and 3 (3, 2). Also assume E = 2.6 GPa and ν = 0.2.

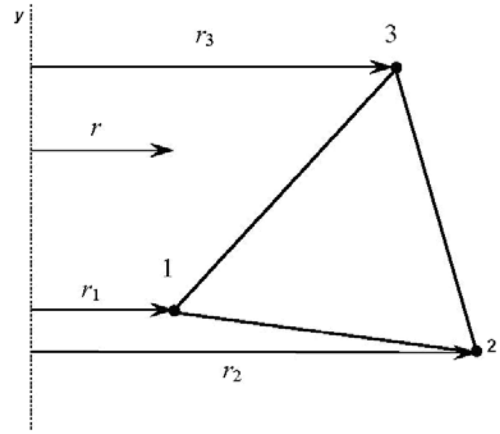

Figure 2

b) Differentiate between CST and LST with respect to the triangular element. [5+5]

OR

7. Derive the stiffness matrix for the four noded quadrilateral element in terms of natural coordinate system. [10]

8. Consider a brick wall of thickness 0.3 m , k=0.7 W/m K . The inner surface is at 28^0C and the outer surface is exposed to cold air at -15^0C. The heat transfer coefficient associated with the outside surface is 40W/m^2 K. Determine the steady state temperature distribution within the wall and also the heat flux through the wall. Use two elements and obtain the solution. [10]

OR

9. Derive the conductivity matrix for two dimensional triangular element subjected to convection on one face of the element. [10]

10. For the stepped bar shown in the figure 3. Develop the global stiffness and mass matrices and also determine the natural frequencies and mode shapes. Assume E = 200 GPa and mass density = 7850 kg/m^3, L_1 = L_2 = 0.3 m, A_1 = 350 mm^2, A_2 = 600 mm^2. [10]

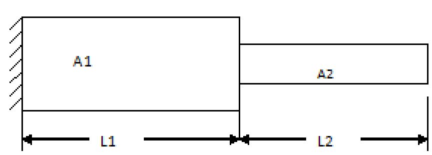

Figure 3

OR

11.a) Derive the shape functions for the four noded tetrahedron element from the first principles.

b) Discuss the importance of semi automatic meshing and auto mesh along with the practical applications. [5+5]

---ooOoo---

R13

Code No: 126EE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, May - 2017
FINITE ELEMENT METHODS
(Common to AE, ME, MSNT)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) List the properties of the shape functions. [2]

b) The nodal displacements of a two noded axial element is (0, 0.075) mm. The length of the element is 0.6 m. Find the stress in the element. Assume the Young's modulus of the element as 200 GPa. [3]

c) How many DOFs does a two-nodal, planar truss element have in its local coordinate system, and in the global coordinate system? [2]

d) Represent the Hermite shape functions graphically. [3]

e) What are the strain displacement relations for axisymmetric element? [2]

f) Differentiate among the Iso-parametric, Sub-parametric and super-parametric formulation. [3]

g) What is Thermal conductivity matrix for 2D heat transfer problems? [2]

h) Derive the governing equation for steady-state, one-dimensional conduction with convection and heat generation? [3]

i) Define Hamilton principle and compare with the principle of minimum potential energy principle. [2]

j) Differentiate between the transient dynamic analysis and eigenvalue analysis. [3]

PART - B

(50 Marks)

2.a) Derive the stress strain relation for a plane stress condition starting from Hook's law.

b) A bar of uniform cross section and length L is fixed at one end and is subjected to an axial load of P. If the body is also subjected to a constant body load of F_b throughout its length, develop the total potential energy expression. [5+5]

OR

3. For the three stepped bar shown in figure 1, determine the displacements at node 2 and 3 and the reactions at the supports. Also find the stresses in each section. [10]

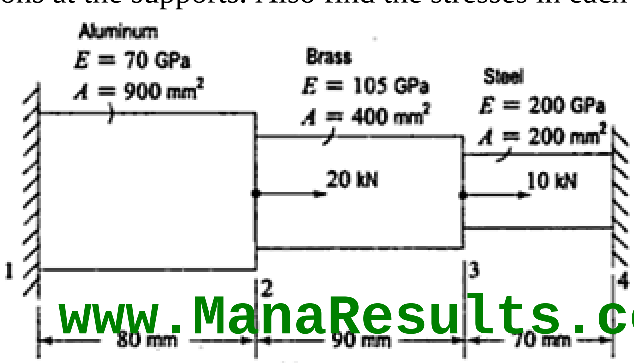

Figure 1

4. The plane truss is loaded with force P as shown in figure 2. Constants E and A for each bar are as shown in the diagram. Determine the nodal displacements, the reaction forces and the stresses in bar elements. [10]

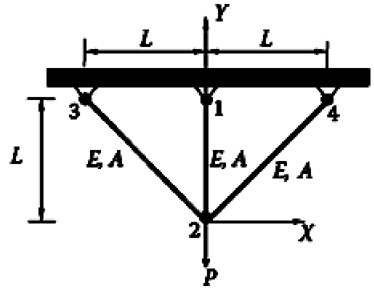

Figure 2

OR

5. A simply supported beam of length of 8 m and uniform cross section of width 300 mm and depth 200 mm is subjected to a uniformly distributed load of 10 kN/m over the entire length. Compute the maximum deflection if the Young's modulus is 200 GPa. Also estimate the slope at the supports. [10]

6. For the four noded quadrilateral element shown in figure 3, find the nodal load vector if p_o is 2MPa. Also find the determinant of the Jacobian for one point gauss quadrature. [10]

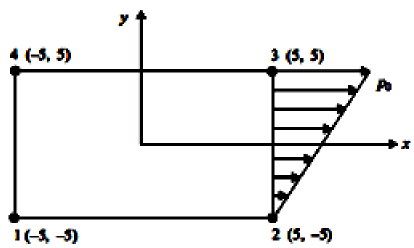

Figure 3

OR

7. An axisymmetric triangular element is described by the following details. Determine the element stresses at the centroid for the Young's Modulus 80 GPa and Poisson's Ratio 0.25. [10]

	Node 1	Node 2	Node 3
Radial Coordinate from the axis (r)	5 mm	1 mm	3 mm
Axial coordinate (z)	5 mm	5 mm	2mm
Deformation in radial direction (u)	0.02 mm	0.06 mm	0.01 mm
Deformation in axial direction (u)	-0.04 mm	0	0.02 mm

8. Estimate the temperature profile in a pin fin of diameter 25 mm, whose length is 500mm. The thermal conductivity of the fin material is 50 W/m K and heat transfer coefficient over the surface of the fin is 40 W/m^2 K at 30^{0}C. The tip is insulated and the base is exposed to a temperature of 150 ^{0}C. Evaluate the temperatures at points separated by 100 mm each. [10]

OR

9. For a two dimensional heat transfer in a square slab shown in figure 4, each element equilibrium equation are given by the same expression. All the edges are maintained at zero degree temperature. What is the final form of equations after assembly and incorporating the boundary conditions? [10]

$$\begin{bmatrix} 25 & -1 & 21 \\ -1 & 18 & -7 \\ 21 & -7 & 41 \end{bmatrix} \begin{Bmatrix} T_i \\ T_j \\ T_k \end{Bmatrix} = \begin{Bmatrix} 300 \\ 500 \\ 800 \end{Bmatrix}$$

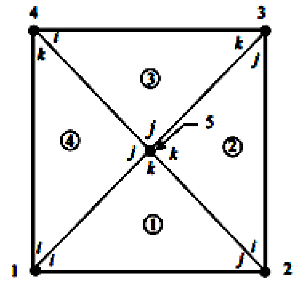

Figure 4

10. Consider a uniform cross section bar of length L made up of a material whose Young's modulus and density are given by E and ρ. Estimate the natural frequencies of axial vibration of the bar using both consistent and lumped mass matrices. [10]

OR

11.a) What are the convergence and compatibility requirements? Discuss in detail.

b) Derive the shape functions for a four noded tetrahedral element using natural coordinate system. [5+5]

---ooOoo---

Code No: 156AZ **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, August/September - 2021
FINITE ELEMENT METHODS
(Common to ME, MCT)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Discuss advantages, limitations and applications of FEM.
b) Explain plane stress and plane strain conditions with suitable examples. [7+8]

2. Derive the stiffness matrix and consistent load vector for one dimensional quadratic element. [15]

3. Find the nodal displacements and stresses in horizontal member and support reactions of truss shown in the below figure 1. [15]

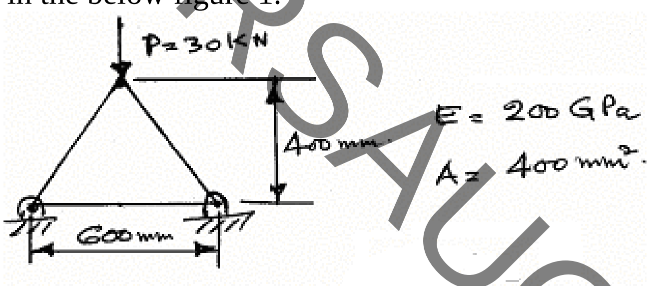

Figure 1

4. Determine the displacement at the midpoint of a fixed beam of length 1 m with uniformly distributed load of 6 kN/m through the span. Use two beam elements. Take E = 200 GPa and El = 2×10^4 N.m^2. [15]

5. Determine the stiffness matrix for the constant strain triangular (CST) element shown in the figure 2. The coordinates are given in units of millimetres. Assume plane stress conditions. Take E = 200 GPa; Poisson's ratio (v) = 0.3; Thickness (t) = 10 mm. [15]

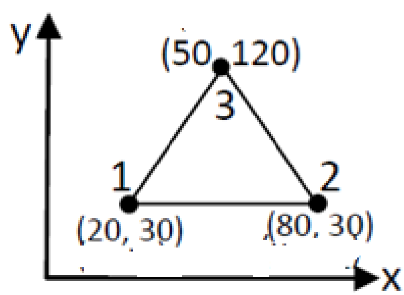

Figure 2

6.a) Derive Shape functions four- node quadrilateral Element and discuss salient points.

b) Evaluate the integral $\int_{-1}^{+1} cos\frac{\pi x}{2}$ by applying one and two-point point Gaussian quadrature. Compare the results with exact results and comment. [9+6]

7. For the composite wall shown in the figure 3 below, compute the interface temperatures considering three elements. Take K_1=5 W/m-K, K_2=0.6 W/m- K, K_3=20 W/m- K, $T_1=100^0C$, $T_4=400^0C$. [15]

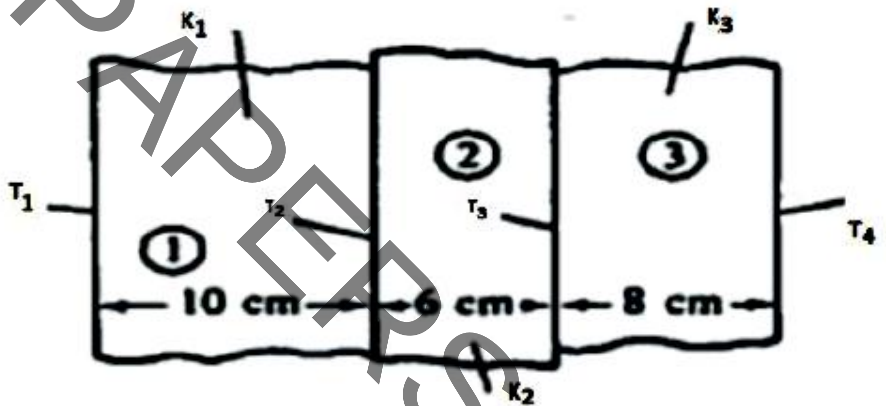

Figure 3

8.a) Derive consistent mass matrix for truss element and also write the lumped mass matrix for the same element.

b) Discuss the importance of semi-automatic meshing and auto mesh along with the practical applications. [7+8]

---ooOoo---

R15

Code No: 126VE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, April - 2018
FINITE ELEMENT METHODS
(Common to AE, MSNT, ME)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) What boundary conditions are imposed for 1 Dimensional bar element. [2]
b) Discuss the shape functions of one dimensional quadratic element. [3]
c) Write the hermitian shape function of a beam element. [2]
d) How local and global coordinates are related in a truss problem. [3]
e) What are the properties of a triangular coordinates. [2]
f) Write the strain displacement equation of axisymmetric problems using a cylindrical coordinate system. [3]
g) List one requirement which is sufficient for convergence for a plate element. [2]
h) Write governing differential equation for two dimensional heat transfer problem [3]
i) Describe the features of NISA software. [2]
j) Differentiate lumped and consistent mass matrix. [3]

PART - B

(50 Marks)

2. Derive the stiffness matrix and consistent load vector in matrix form for one dimensional quadratic element. [10]

OR

3. Explore the stress strain relation for 2D and 3D elastic problems. [10]

4. Determine the nodal displacement of the following truss as shown in figure 1. [10]

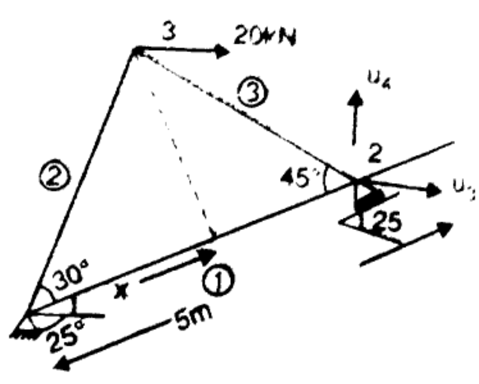

Figure 1

OR

5. Determine the slope and vertical deflection at the centre for the following beam figure 2. [10]

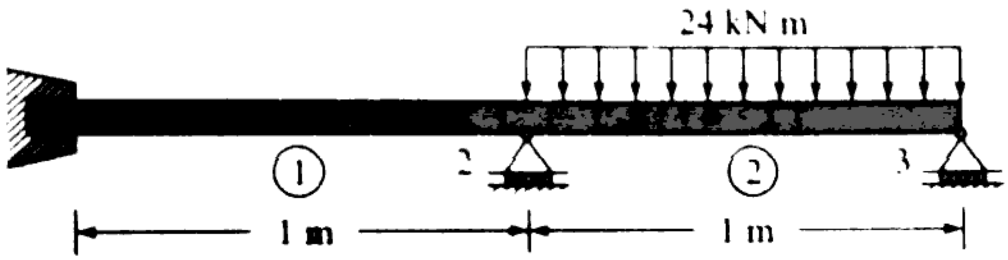

Figure 2

6. Derive the area and strain displacement matrix for the triangular element and thus calculate the same for the triangle as shown in figure 3. [10]

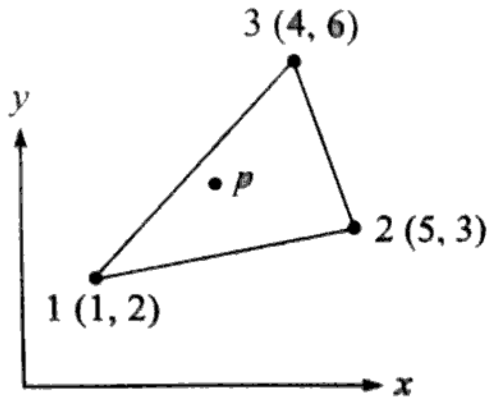

Figure 3

OR

7. Derive the element stiffess matrix for the following figure 4 axisymmetric annular ring element. [10]

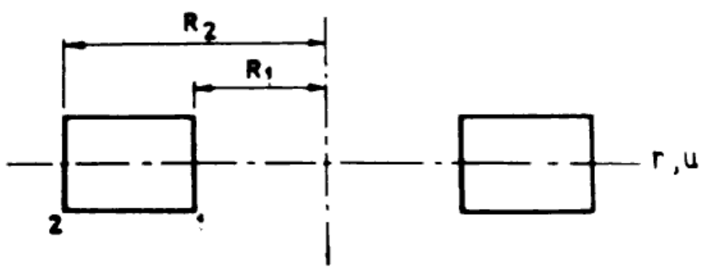

Figure 4

8. Use galerkin's approach to find the stiffness matrix of a torsional triangular element. [10]

OR

9. Determine the temperature distribution in a fin having rectangular cross section and is 8 cm long, 4 cm wide and 1 cm thick. Assume convection heat loss occurs from the free end of the fin. One end is fixed. Take k=3 W/cm^0C, h= 0.1 $W/cm^2\,^0C$ and $T\infty=20^0C$. [10]

10. Find the natural frequency of the following truss bar figure 5. [10]

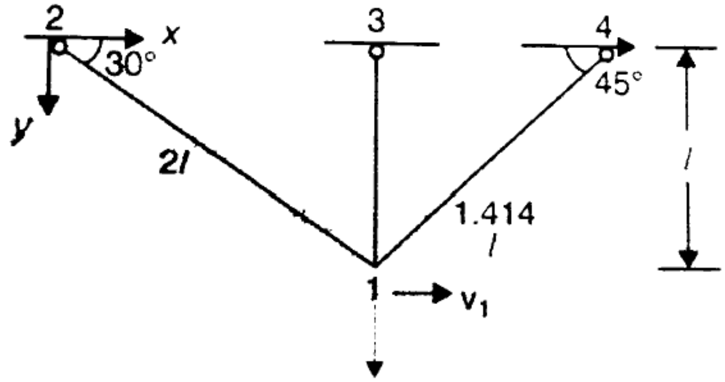

Figure 5

OR

11. Derive the eigen values and eigen vectors of the stepped bar. Assume the required data. [10]

---ooOoo---

Code No: 156AZ **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, February/March - 2022
FINITE ELEMENT METHODS
(Common to ME, MCT)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

1.a) Explain the step by step procedure for formulating the equations for finite element methods.
b) Draw the Pascal's triangle and Pascal's tetrahedron for the formulation of interpolations functions. Explain the salient features. [7+8]

2.a) What do you understand by the assembly of 1 D bar elements and formulate global stiffness matrix and global load vector.
b) Calculate the nodal displacements and forces for the stepped bar with the stiffness values are 12 kN/m and 8 kN/m and a load of 6 kN is subjected at the end of the stepped bar and other end of the bar is fixed. [7+8]

3.a) Derive the stiffness matrix and load vector for two noded 2 DOF truss element and explain the importance.
b) Calculate the deflection at the center and slopes at the ends of a fixed beam of 2 m length subjected to a UDL of 50 kN/m throughout the length and a point load of 50 kN at the centre. Take EI = 700×10^5 N-m^2. [7+8]

4.a) The coordinates of the plane truss element is given as 1(0,0) and 2(20,35) mm has the displacement values $\{-0.03\ -0.01\ -0.03\ 0.02\}^T$ mm with the material had Young's modulus of 200 GPa. Calculate the stiffness matrix, load vector and strain energy if the cross sectional area of the truss is 100 mm^2.
b) Derive the load vector for two noded beam element subjected to a uniformly distributed load. [7+8]

5.a) Calculate the strain displacement matrix for element with the coordinates 1(4,5), 2(9,2) and 3(6,8) mm. And also calculate load vector, stresses, strains and strain energy for (i) plane stress and (ii) plane strain of triangle whose nodal displacement values are u_1=0.3 mm, v_1 = 0.3 mm, u_2 = 0.2 mm, v_2 = -0.4 mm, u_3 = 0.3 mm, v_3 = 0.5 mm. Take E = 200 GPa, poisons ratio = 0.3 and thickness=2 mm.
b) Derive the stiffness matrix for three noded axisymmetric triangular element from the first principles. [7+8]

6.a) How to make use of Gaussian quadrature method for solving two dimensional integral equations with a suitable example?
b) Explain the finite element formulation for four noded quadrilateral element using isporametric condition. [7+8]

7.a) A composite slab consists of three materials having different thermal conductivities i.e 100 W/m K, 125 W/m K , 75 W/m K of thickness 0.35 m, 0.25 m and 0.5 m respectively. The outer surface is 25^0C and the inner surface is exposed to the convective heat transfer coefficient of 90 W/m^2 K, 850^0C. Determine the temperature distribution in the wall.

b) Derive the conductivity matrix for the fin element based on convective boundary condition over the entire surface. [7+8]

8.a) Derive the equilibrium equations by considering the mechanical vibration varying by following sine curve and discuss the salient points.

b) What are the advantages and limitations of ANSYS commercial software over other available finite element software? Explain. [7+8]

---ooOoo---

Code No: 136BW **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, February/March - 2022
FINITE ELEMENT METHODS
(Common to ME, AE, MSNT)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Discuss in detail about the applications and limitations of FEM.
b) What do you understand by plane stress and plane strain body? Give an example.[7+8]

2. For the beam and loading shown in figure 1 calculate the nodal displacements at centre of beam. Take E =210 GPa, I = 6×10^{-6} m^4. [15]

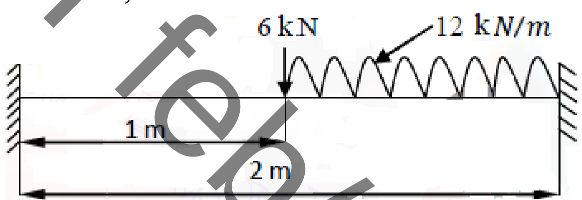

Figure 1

3. Derive the strain displacement relation matrix for axi-symmetric triangular element from the first principle. [15]

4. Determine the force in the members of the truss as shown in figure 2. Take E=200GPa. [15]

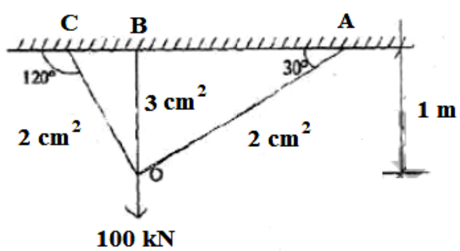

Figure 2

5. A triangular element with the coordinates 1(10, 10), 2(55, 75) and 3(25, 45) mm has the nodal diagram of freedom {0.01 0.02 -0.02 -0.04 -0.03 0.04}^{T} mm. Calculate the displacements on the triangle sides intersected by a line 25x+32y=8 [15]

6. Derive the shape functions for four noded quadrilateral element using isoparametric condition. [15]

7. Derive the conductivity matrix for three noded triangular thin plate having thermal conductivity 'K'. [15]

8. Determine the Eigen values and Eigen vectors for the stepped bar shown in the figure 3. Given E = 100 GPa and Specific weight=0.025 kg/mm^3. [15]

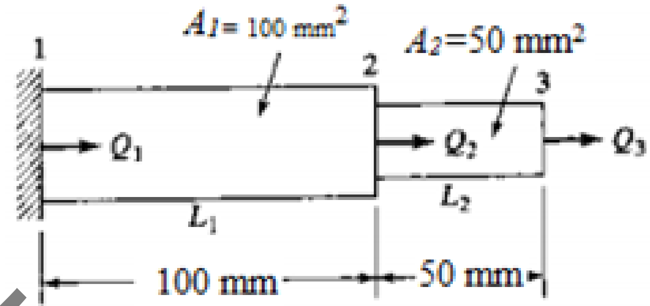

Figure 3

---ooOoo---

R16

Code No: 136BW

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, May - 2019
FINITE ELEMENT METHODS
(Common to ME, AE, MSNT)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) Write the temperature load vector in the matrix form of a one dimensional bar element. [2]
b) How the order of the assembled global stiffness matrix is decided? [3]
c) What is force transformation matrix in a truss element? [2]
d) What assumptions are made in classical beam theory? [3]
e) Differentiate LST and CST Element. [2]
f) What are non zero stress components of axisymmetric element. [3]
g) Write the governing equation and the functions used into determine the shearing stresses. [2]
h) What are the various boundary conditions of heat convection to take place? [3]
i) Describe the features of NASTRAN software. [2]
j) What are the convergence requirements of a finite element model? [3]

PART - B

(50 Marks)

2. Derive finite element equation using galerkins method for one dimensional bar element. [10]

OR

3. Derive the element stiffness matrix for a one dimensional quadratic element. [10]

4. Determine the nodal displacement of the following figure 1. [10]

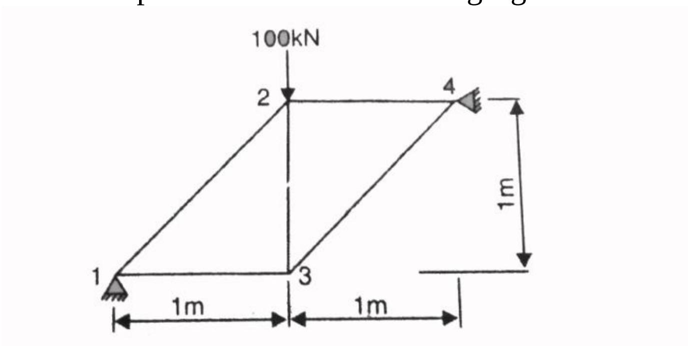

Figure 1

OR

5. Determine the shear forces and bending moments for the cantilever beam having length '*l*'. [10]

6. Derive the element stiffness matrix for triangular element and thus find the matrix element for the triangular element as shown in figure 2. [10]

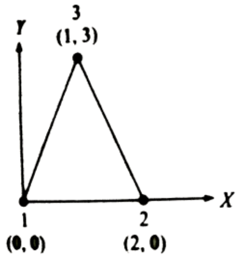

Figure 2

OR

7. Derive the element stiffness matrix for the following axisymmetric ring of triangular cross section (figure 3). [10]

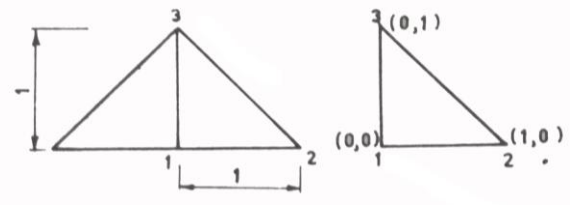

Figure 3

8. Derive the element stiffness matrix of a thin plate. [10]

OR

9. Derive the stiffness matrix for heat flow in a rectangular fin, where k, h and P denotes thermal conductivity, convective heat coefficient and perimeter of fin and A is area of cross section of fin. [10]

10. Find the natural frequency of the following truss bar (figure 4). [10]

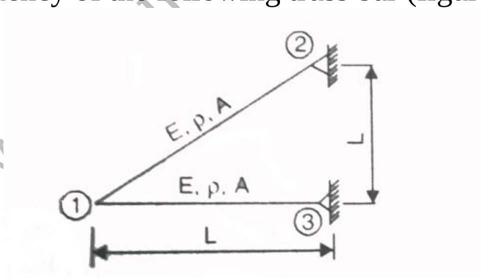

Figure 4

OR

11. Draw the mode shapes of the following stepped bar. Take E= 200 GPa, specific weight 7850 kg/m^3. Take A_1 = 400 mm^2, and A_2=200 mm^2 (figure 5). [10]

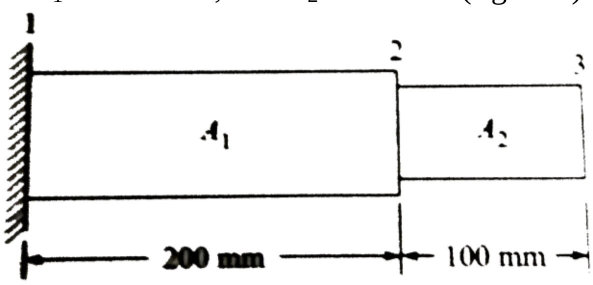

Figure 5

---ooOoo---

Code No: 136BW

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, May - 2019
FINITE ELEMENT METHODS
(Common to ME, AE, MSNT)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) Write the temperature load vector in the matrix form of a one dimensional bar element. [2]
b) How the order of the assembled global stiffness matrix is decided? [3]
c) What is force transformation matrix in a truss element? [2]
d) What assumptions are made in classical beam theory? [3]
e) Differentiate LST and CST Element. [2]
f) What are non zero stress components of axisymmetric element. [3]
g) Write the governing equation and the functions used into determine the shearing stresses. [2]
h) What are the various boundary conditions of heat convection to take place? [3]
i) Describe the features of NASTRAN software. [2]
j) What are the convergence requirements of a finite element model? [3]

PART - B

(50 Marks)

2. Derive finite element equation using galerkins method for one dimensional bar element. [10]

OR

3. Derive the element stiffness matrix for a one dimensional quadratic element. [10]

4. Determine the nodal displacement of the following figure 1. [10]

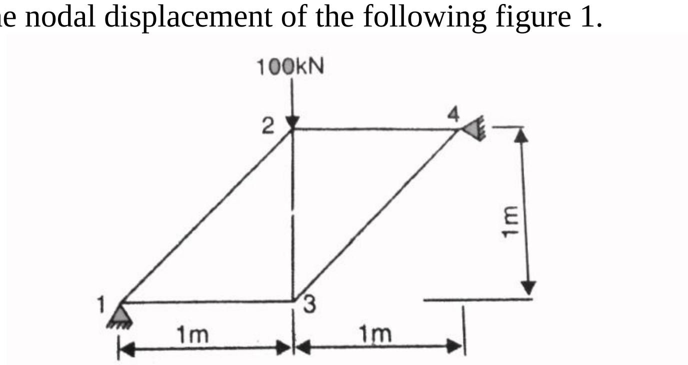

Figure 1

OR

5. Determine the shear forces and bending moments for the cantilever beam having length '*l*'. [10]

6. Derive the element stiffness matrix for triangular element and thus find the matrix element for the triangular element as shown in figure 2. [10]

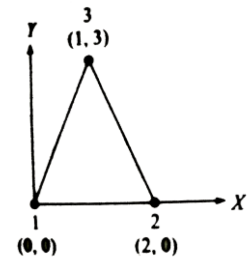

Figure 2

OR

7. Derive the element stiffness matrix for the following axisymmetric ring of triangular cross section (figure 3). [10]

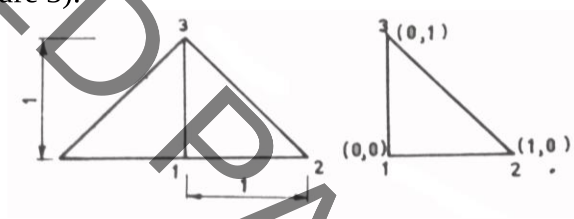

Figure 3

8. Derive the element stiffness matrix of a thin plate. [10]

OR

9. Derive the stiffness matrix for heat flow in a rectangular fin, where k, h and P denotes thermal conductivity, convective heat coefficient and perimeter of fin and A is area of cross section of fin. [10]

10. Find the natural frequency of the following truss bar (figure 4). [10]

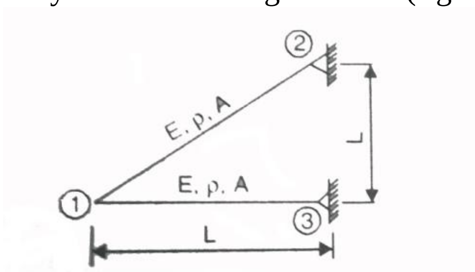

Figure 4

OR

11. Draw the mode shapes of the following stepped bar. Take E= 200 GPa, specific weight 7850 kg/m^3. Take A_1 = 400 mm^2, and A_2=200 mm^2 (figure 5). [10]

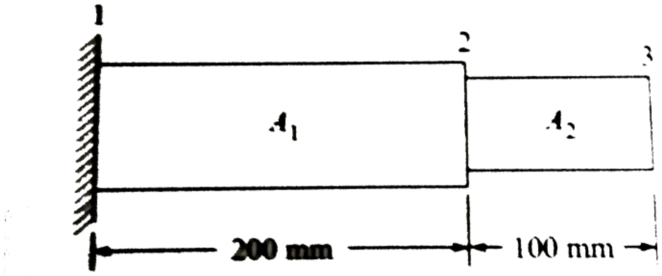

Figure 5

---ooOoo---

R16

Code No: 136BW

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, November/December - 2020

FINITE ELEMENT METHODS

(Common to ME, AE, MSNT)

Time: 2 Hours **Max. Marks: 75**

Answer any five questions

All questions carry equal marks

- - -

1. What category and applications fall under Plane strain and Plane stress problems? Illustrate the same. [15]

2. Derive the Quadratic shape function for a bar element. [15]

3. Determine the stresses and reaction for the following truss element. Given (figure 1) E=70GPa and A = 500 mm^2. [15]

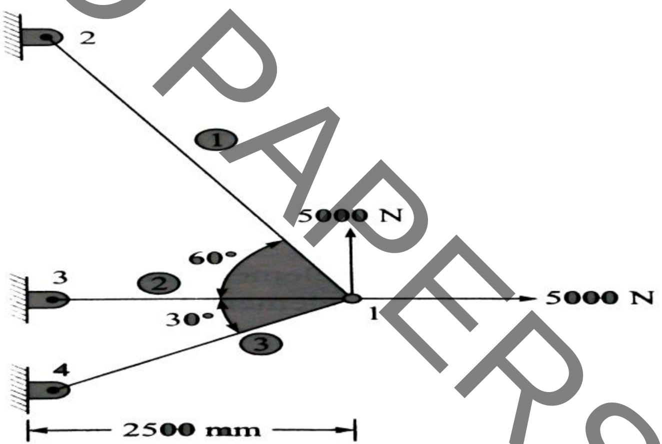

Figure 1

4. Determine the end reactions and deflection at mid span (Figure 2). [15]

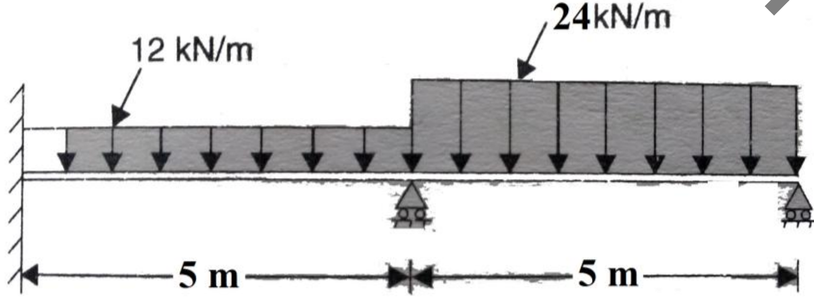

Figure 2

Assume E=200 GPa.

5. For the axisymmetric body rotating with constant angular velocity ω=200 rpm, determine the body force vector. Specific density is 7800 kg/m^3. [15]

6. Derive the jacobian matrix of two dimensional four noded isoparametric element (figure 3). [15]

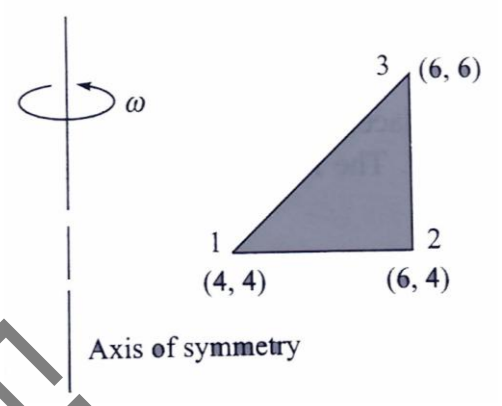

Figure 3

7. A square cross section of a steel shaft is as shown in Figure 4. Evaluate nodal values, if shaft is 8 mm square. Given G= 8×10^6N/cm^2, and $\phi = 0.005$ degree/cm. Use only one fourth of the cross section. [15]

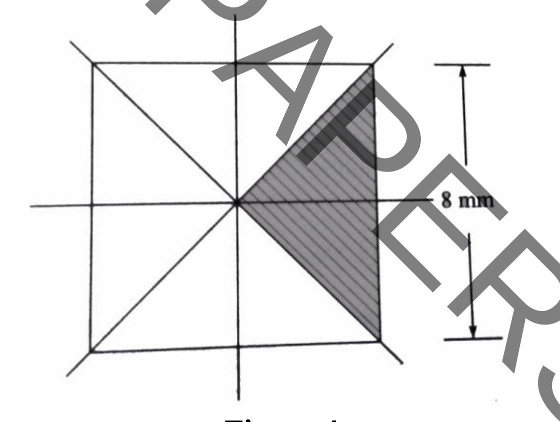

Figure 4

8. Evaluate eigen values and eigen vectors for a cantilever beam of length 1 m free at the other end. Take E= 200GPa, I=40×10^{-10} m^4, A = 2×10^{-4} m^2 and weight density = 7850 kg/m^3. Use one element method. [15]

---ooOoo---