Code No: RR311403 **RR** **Set No. 2**

III B.Tech I Semester Examinations,May 2011
FINITE ELEMENT METHODS
Mechatronics

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain the significance of node numbering and element numbering during the discretization process.
   (b) Explain the natural and geometric boundary conditions. [8+8]

2. Consider the two bar truss structure shown in the figure5. The elements properties are $E_1 = 20 \times 10^{11}$ N/m^2; $E_2 = 10 \times 10^{11}$ N/m^2; $A_1 = 100$ mm^2; $A_2 = 200$ mm^2. Calculate the displacement at node 2 and stresses in the elements 1 and 2. [16]

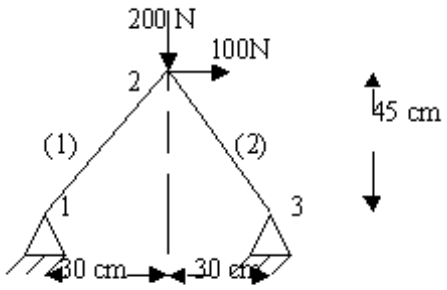

Figure 5

3. A Uniform steel fin of length 25 cm, with a rectangular section 5 cm X 2.5 cm. If the heat transfer takes place by convection from all the sides while the root of the fin is maintained at 300^0C, determine the temperature distribution in the fin. Assume k = 25 W/m K, h = 250 W/m^2 K and T $= 25^0$C. [16]

4. (a) From first principles, derive the general equation for elemental mass matrix?
   (b) Derive the elemental mass matrix for 2-D triangular element? [8+8]

5. (a) What are the limitations of NASTRAN in stress analysis?
   (b) What are the drawbacks of ANSYS in modeling? [8+8]

6. Calculate the deflection at the center of the fixed beam as shown in the figure6. E = 220 GPa, $I_1 = 1000$ mm^4, $I_2 = 2000$ mm^4 [16]

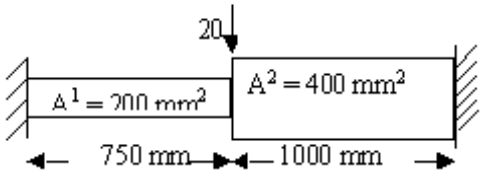

Figure 6

7. An elastic bar is having a uniform cross sectional of area 'A' mm^2 and length 'L' mm. It is fixed at one end and other end is allowed to move along the axis of the elastic bar. A force 'F' KN is acting at the free end and the Youngs Modulus is 'E' N/mm^2. Calculate the displacement at the free end. [16]

8. The nodal coordinates of a four noded quadrilateral element are given below:
   $X_i = 1$, $Y_i = 1$, $X_j = 5$, $Y_j = 1$, $X_k = 6$, $Y_k = 6$, $X_l = 4$, $Y_l = 1$.
   The element displacement vector u is given as
   $[u] = [0, 0, 0.20, 0, 0.15, 0.10, 0, 0.05]^T$
   Find

   (a) The x, y coordinates of a point P whose location in the master elements is given by $\xi = 0.5$, $\eta = 0.5$. and

   (b) The u, v displacements of the point P. [8+8]

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Code No: RR311403 **RR** **Set No. 4**

III B.Tech I Semester Examinations,May 2011
FINITE ELEMENT METHODS
Mechatronics

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Calculate the deflection at the center of the fixed beam as shown in the figure6. E = 220 GPa, $I_1 = 1000$ mm^4, $I_2 = 2000$ mm^4 [16]

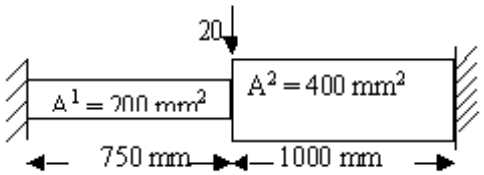

Figure 6

2. A Uniform steel fin of length 25 cm, with a rectangular section 5 cm X 2.5 cm. If the heat transfer takes place by convection from all the sides while the root of the fin is maintained at 300^{0}C, determine the temperature distribution in the fin. Assume k = 25 W/m K, h = 250 W/m^2 K and T $= 25^0$C. [16]

3. (a) What are the limitations of NASTRAN in stress analysis?
   (b) What are the drawbacks of ANSYS in modeling? [8+8]

4. (a) From first principles, derive the general equation for elemental mass matrix?
   (b) Derive the elemental mass matrix for 2-D triangular element? [8+8]

5. The nodal coordinates of a four noded quadrilateral element are given below:
   $X_i = 1$, $Y_i = 1$, $X_j = 5$, $Y_j = 1$, $X_k = 6$, $Y_k = 6$, $X_l = 4$, $Y_l = 1$.
   The element displacement vector u is given as
   $[u] = [0, 0, 0.20, 0, 0.15, 0.10, 0, 0.05]^T$
   Find
   (a) The x, y coordinates of a point P whose location in the master elements is given by $\xi = 0.5$, $\eta = 0.5$. and
   (b) The u, v displacements of the point P. [8+8]

6. (a) Explain the significance of node numbering and element numbering during the discretization process.
   (b) Explain the natural and geometric boundary conditions. [8+8]

7. An elastic bar is having a uniform cross sectional of area 'A' mm^2 and length 'L' mm. It is fixed at one end and other end is allowed to move along the axis of the

elastic bar. A force 'F' KN is acting at the free end and the Youngs Modulus is 'E' N/mm^2. Calculate the displacement at the free end. [16]

8. Consider the two bar truss structure shown in the figure5. The elements properties are $E_1 = 20 \times 10^{11}$ N/m^2; $E_2 = 10 \times 10^{11}$ N/m^2; $A_1 = 100$ mm^2; $A_2 = 200$ mm^2. Calculate the displacement at node 2 and stresses in the elements 1 and 2. [16]

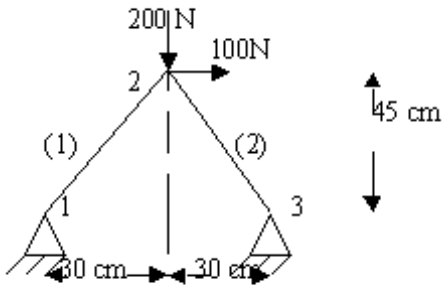

Figure 5

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Code No: RR311403 **RR** **Set No. 1**

III B.Tech I Semester Examinations,May 2011
FINITE ELEMENT METHODS
Mechatronics

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. A Uniform steel fin of length 25 cm, with a rectangular section 5 cm X 2.5 cm. If the heat transfer takes place by convection from all the sides while the root of the fin is maintained at 300^0C, determine the temperature distribution in the fin. Assume k = 25 W/m K, h = 250 W/m^2 K and T $= 25^0$C. [16]

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   The element displacement vector u is given as
   $[u] = [0, 0, 0.20, 0, 0.15, 0.10, 0, 0.05]^T$
   Find
   (a) The x, y coordinates of a point P whose location in the master elements is given by $\xi = 0.5$, $\eta = 0.5$. and
   (b) The u, v displacements of the point P. [8+8]

3. An elastic bar is having a uniform cross sectional of area 'A' mm^2 and length 'L' mm. It is fixed at one end and other end is allowed to move along the axis of the elastic bar. A force 'F' KN is acting at the free end and the Youngs Modulus is 'E' N/mm^2. Calculate the displacement at the free end. [16]

4. Calculate the deflection at the center of the fixed beam as shown in the figure6. E = 220 GPa, $I_1 = 1000$ mm^4, $I_2 = 2000$ mm^4 [16]

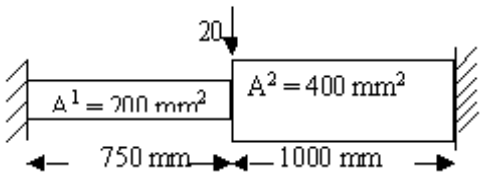

Figure 6

5. (a) Explain the significance of node numbering and element numbering during the discretization process.
   (b) Explain the natural and geometric boundary conditions. [8+8]

6. (a) What are the limitations of NASTRAN in stress analysis?
   (b) What are the drawbacks of ANSYS in modeling? [8+8]

7. Consider the two bar truss structure shown in the figure5. The elements properties are $E_1 = 20 \times 10^{11}$ N/m^2; $E_2 = 10 \times 10^{11}$ N/m^2; $A_1 = 100$ mm^2; $A_2 = 200$ mm^2. Calculate the displacement at node 2 and stresses in the elements 1 and 2. [16]

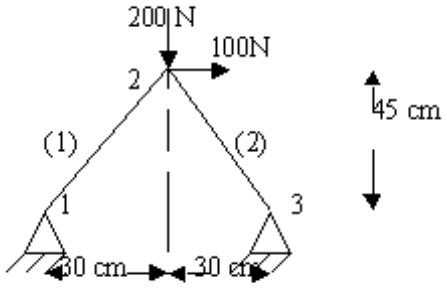

Figure 5

8. (a) From first principles, derive the general equation for elemental mass matrix?
   (b) Derive the elemental mass matrix for 2-D triangular element? [8+8]

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Code No: RR311403 **RR** **Set No. 3**

III B.Tech I Semester Examinations,May 2011
FINITE ELEMENT METHODS
Mechatronics

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) What are the limitations of NASTRAN in stress analysis?
   (b) What are the drawbacks of ANSYS in modeling? [8+8]

2. A Uniform steel fin of length 25 cm, with a rectangular section 5 cm X 2.5 cm. If the heat transfer takes place by convection from all the sides while the root of the fin is maintained at 300^0C, determine the temperature distribution in the fin. Assume k = 25 W/m K, h = 250 W/m^2 K and T $= 25^0$C. [16]

3. (a) Explain the significance of node numbering and element numbering during the discretization process.
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4. The nodal coordinates of a four noded quadrilateral element are given below:
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   $[u] = [0, 0, 0.20, 0, 0.15, 0.10, 0, 0.05]^T$
   Find
   (a) The x, y coordinates of a point P whose location in the master elements is given by $\xi = 0.5$, $\eta = 0.5$. and
   (b) The u, v displacements of the point P. [8+8]

5. Consider the two bar truss structure shown in the figure5. The elements properties are $E_1 = 20 \times 10^{11}$ N/m^2; $E_2 = 10 \times 10^{11}$ N/m^2; $A_1 = 100$ mm^2; $A_2 = 200$ mm^2.
   Calculate the displacement at node 2 and stresses in the elements 1 and 2. [16]

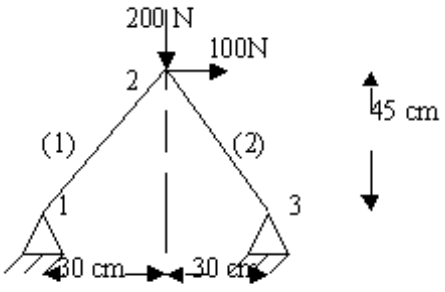

Figure 5

6. Calculate the deflection at the center of the fixed beam as shown in the figure6. E = 220 GPa, I_1 = 1000 mm^4, I_2 = 2000 mm^4 [16]

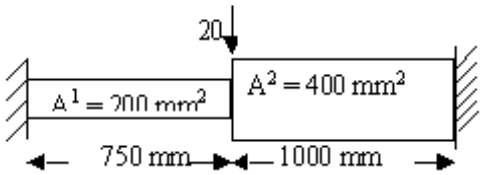

Figure 6

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8. (a) From first principles, derive the general equation for elemental mass matrix?
   (b) Derive the elemental mass matrix for 2-D triangular element? [8+8]

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