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

III B.Tech I Semester Examinations,November 2010
FINITE ELEMENT METHODS
Mechatronics

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. Consider a brick wall (k = 0.7 W/m-K) of thickness 30 cm. The inner surface is at 28^0C and the outer surface is exposed to cold air with heat transfer coefficient of 36 W/m^2 K at -15^{0}C. Determine the steady state temperature distribution and heat flux through the wall. [16]

2. (a) Explain the semi automatic mesh generation technique.

   (b) List any three Finite element analysis software and explain their capabilities. [8+8]

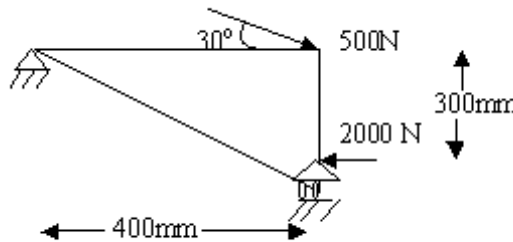3. Estimate the displacement vector, stresses and reactions for the truss structure as shown below Figure8:

Figure 8

   Note: Area A$^{(e)}$ = 1mm^2 and
   E=2×10^5 N/mm^2 [16]

4. A simply supported beam of l m length carries a single point load P at the center of the span. Descritize the span into two elements, find the value of central deflection using FEM? [16]

5. Find the displacement at the free end and the reaction force for the following problem. Assume E = 2 ×10^5 N/mm^2. {As shown in the Figure1} [16]
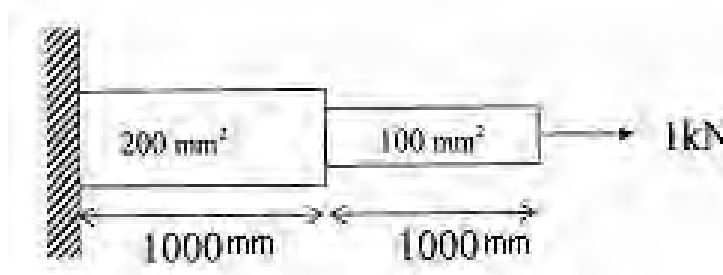

Figure 1

1

6. With a help of a neat block diagram, explain the model based simulation process of finite element method. [4+12]

7. Discuss the methodology to solve the Eigen value problem for the estimation of natural frequencies of a stepped bar? [16]

8. For the linearly varying distributed load on the axisymetric conical surface shown in figure3. Prove that the equivalent point load vector T is given by

T = $[aT_{r1} + bT_{r2}, aT_{z1} + bT_{z2}, bT_{r1} + cT_{r2}, bT_{z1} + cT_{z2}]^T$

Where

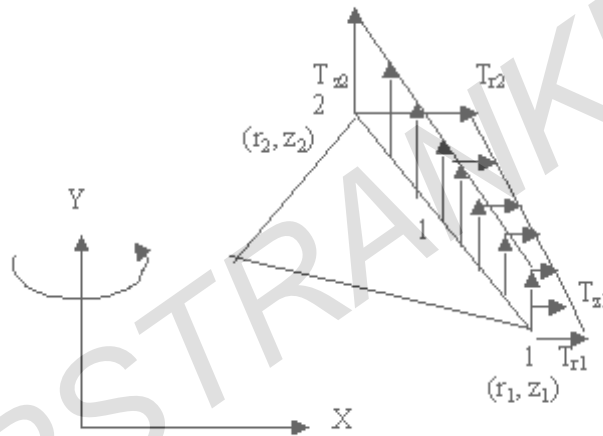a = $2\pi l (3 r_1 + r_2) / 12$, b = $2\pi l (r_1 + r_2) / 12$ and c = $2\pi l (r_1 + 3 r_2) / 12$ [16]

Figure 3

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III B.Tech I Semester Examinations,November 2010
FINITE ELEMENT METHODS
Mechatronics

Time: 3 hours   Max Marks: 80
Answer any FIVE Questions
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1. Find the displacement at the free end and the reaction force for the following problem. Assume $E = 2 \times 10^5$ N/mm^2. {As shown in the Figure1}   [16]
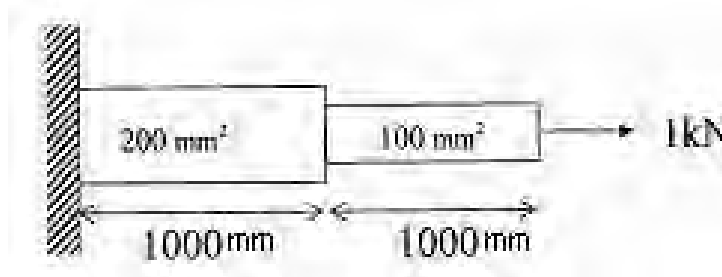

Figure 1

2. (a) Explain the semi automatic mesh generation technique.

   (b) List any three Finite element analysis software and explain their capabilities.
                                                                          [8+8]

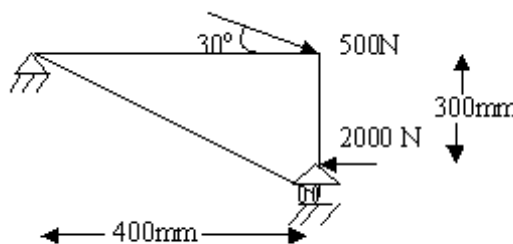3. Estimate the displacement vector, stresses and reactions for the truss structure as shown below Figure8:

Figure 8

   Note: $A^{(e)} = 1$mm^2 and
      E=2×10^5 N/mm^2 [16]

4. Consider a brick wall (k = 0.7 W/m-K) of thickness 30 cm. The inner surface is at 28^0C and the outer surface is exposed to cold air with heat transfer coefficient of 36 W/m^2 K at -15^{0}C. Determine the steady state temperature distribution and heat flux through the wall.   [16]

5. With a help of a neat block diagram, explain the model based simulation process of finite element method.   [4+12]

3

6. Discuss the methodology to solve the Eigen value problem for the estimation of natural frequencies of a stepped bar? [16]

7. A simply supported beam of l m length carries a single point load P at the center of the span. Descritize the span into two elements, find the value of central deflection using FEM? [16]

8. For the linearly varying distributed load on the axisymetric conical surface shown in figure3. Prove that the equivalent point load vector T is given by

$T = [aT_{r1} + bT_{r2}, aT_{z1} + bT_{z2}, bT_{r1} + cT_{r2}, bT_{z1} + cT_{z2}]^T$

Where

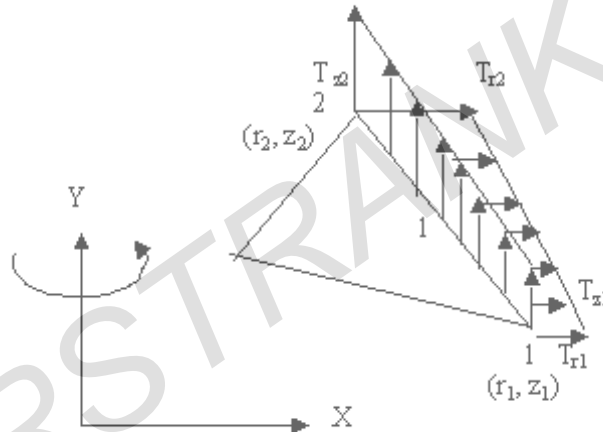$a = 2\pi l (3 r_1 + r_2) / 12$, $b = 2\pi l (r_1 + r_2) / 12$ and $c = 2\pi l (r_1 + 3 r_2) / 12$ [16]

Figure 3

⋆ ⋆ ⋆ ⋆ ⋆

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

III B.Tech I Semester Examinations,November 2010
FINITE ELEMENT METHODS
Mechatronics

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. A simply supported beam of l m length carries a single point load P at the center of the span. Descritize the span into two elements, find the value of central deflection using FEM? [16]

2. With a help of a neat block diagram, explain the model based simulation process of finite element method. [4+12]

3. Consider a brick wall (k = 0.7 W/m-K) of thickness 30 cm. The inner surface is at 28^0C and the outer surface is exposed to cold air with heat transfer coefficient of 36 W/m^2 K at -15^{0}C. Determine the steady state temperature distribution and heat flux through the wall. [16]

4. For the linearly varying distributed load on the axisymetric conical surface shown in figure3. Prove that the equivalent point load vector T is given by

   $T = [aT_{r1} + bT_{r2}, aT_{z1} + bT_{z2}, bT_{r1} + cT_{r2}, bT_{z1} + cT_{z2}]^T$

   Where

   $a = 2\pi l (3 r_1 + r_2) / 12$, $b = 2\pi l (r_1 + r_2) / 12$ and $c = 2\pi l (r_1 + 3 r_2) / 12$ [16]
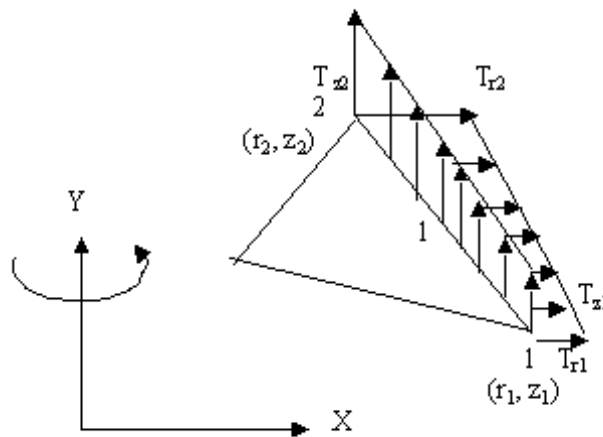

Figure 3

5. (a) Explain the semi automatic mesh generation technique.
   (b) List any three Finite element analysis software and explain their capabilities.
   [8+8]

5

6. Find the displacement at the free end and the reaction force for the following problem. Assume E = 2 ×10^5 N/mm². {As shown in the Figure1} [16]
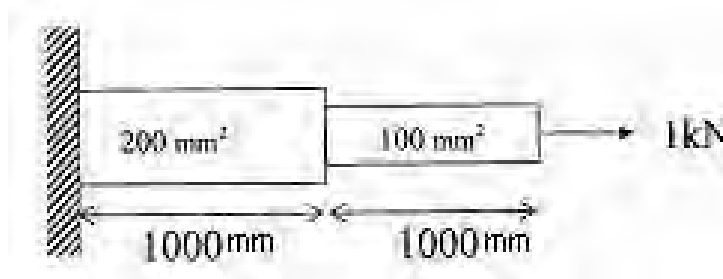

Figure 1

7. Discuss the methodology to solve the Eigen value problem for the estimation of natural frequencies of a stepped bar? [16]

8. Estimate the displacement vector, stresses and reactions for the truss structure as shown below Figure8:
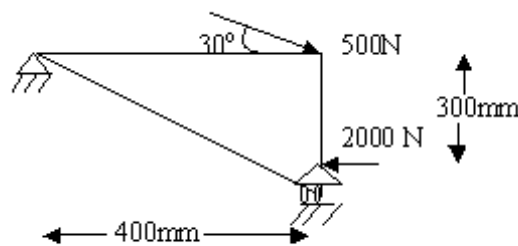

Figure 8

Note: A$^{(e)}$ = 1mm² and
E=2×10^5 N/mm² [16]

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

III B.Tech I Semester Examinations,November 2010
FINITE ELEMENT METHODS
Mechatronics

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. Find the displacement at the free end and the reaction force for the following problem. Assume $E = 2 \times 10^5$ N/mm^2. {As shown in the Figure1}   [16]
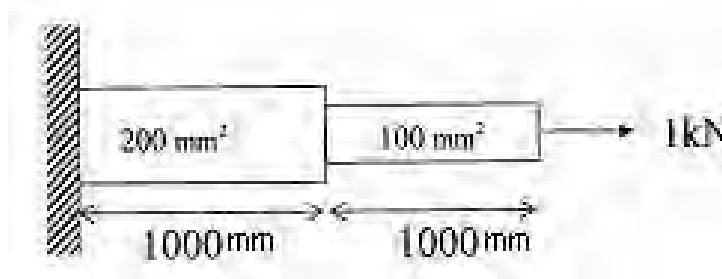

Figure 1

2. (a) Explain the semi automatic mesh generation technique.

   (b) List any three Finite element analysis software and explain their capabilities.
   [8+8]

3. For the linearly varying distributed load on the axisymetric conical surface shown in figure3. Prove that the equivalent point load vector T is given by

   $T = [aT_{r1} + bT_{r2}, aT_{z1} + bT_{z2}, bT_{r1} + cT_{r2} , bT_{z1} + cT_{z2}]^T$

   Where

   $a = 2\pi l (3 r_1 + r_2) / 12$, $b = 2\pi l (r_1 + r_2) / 12$ and $c = 2\pi l (r_1 + 3 r_2) / 12$ [16]
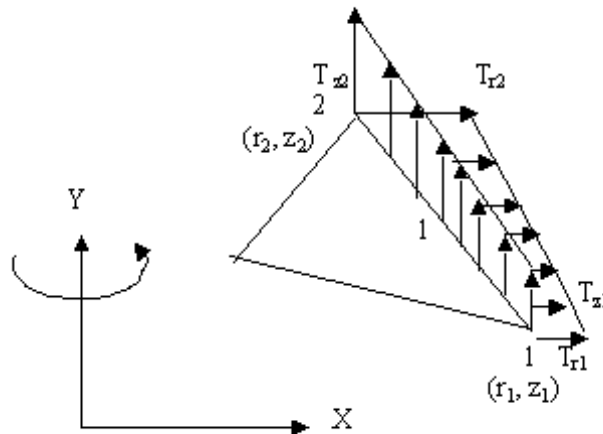

Figure 3

4. Consider a brick wall (k = 0.7 W/m-K) of thickness 30 cm. The inner surface is at 28^0C and the outer surface is exposed to cold air with heat transfer coefficient of 36 W/m^2 K at -15^{0}C. Determine the steady state temperature distribution and heat flux through the wall. [16]

5. A simply supported beam of l m length carries a single point load P at the center of the span. Descritize the span into two elements, find the value of central deflection using FEM? [16]

6. Discuss the methodology to solve the Eigen value problem for the estimation of natural frequencies of a stepped bar? [16]

7. With a help of a neat block diagram, explain the model based simulation process of finite element method. [4+12]

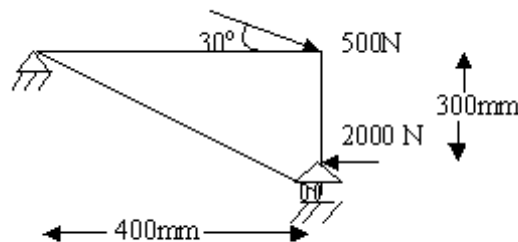8. Estimate the displacement vector, stresses and reactions for the truss structure as shown below Figure8:

Figure 8

Note: A$^{(e)}$ = 1mm^2 and
E=2$\times$10^5 N/mm^2 [16]

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