Code No: R05311402 **R05** **Set No. 2**

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

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. If a displacement field is described as follows,
   u = $(-x^2 + 2y^2 + 6xy)10^{-4}$ and v = $(3x + 6y - y^2)10^{-4}$
   Determine the strain components $\in_{xx}$, $\in_{yy}$, and $\in_{xy}$ at the point x=1 , y = 0. [16]

2. Determine the displacement at node 1 of the truss structure as shown in the figure 2: [16]

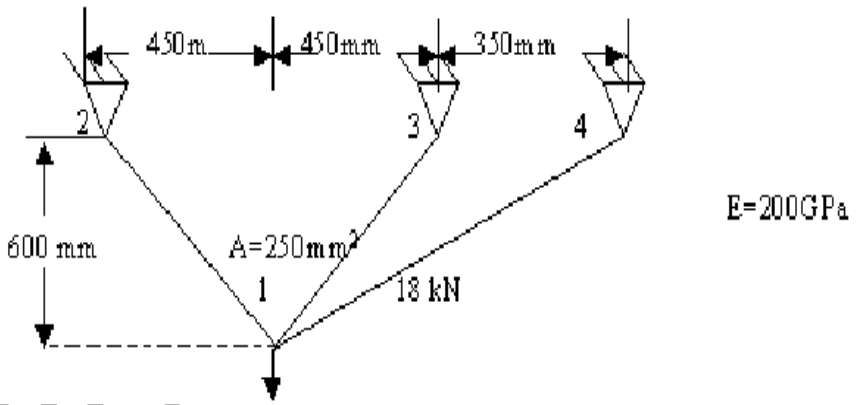

Figure 2

3. Derive the elemental stiffness matrix and load vector for two noded beam element? [16]

4. (a) Derive the shape functions for a Hexahedral element.
   (b) Explain the various convergence requirements. [8+8]

5. find the displacements and reaction forces for the Fig 3 given below. Assume E = 2 x 10^5 N/mm^2. [16]

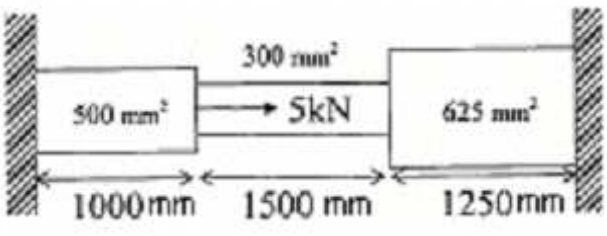

Figure 3

6. A composite wall consists of 4 cm thick wood, 10 cm glass fiber insulation, and 1 cm thick plaster. If the temperature on wood and plaster faces are 20^0C and

-20^{0}C respectively. Determine the temperature distribution in the wall. Assume the thermal conductivity of wood, glass fiber and plaster are 0.17,0.035and 0.5W/m K respectively and colder side heat transfer coefficient is 25 W/m^2 K. [16]

7. Determine the natural frequencies and mode shapes of a stepped bar as shown in figure 8 using the characteristic polynomial technique. Assume E = 250 Gpa and density is 7850 kg/m^3. [16]

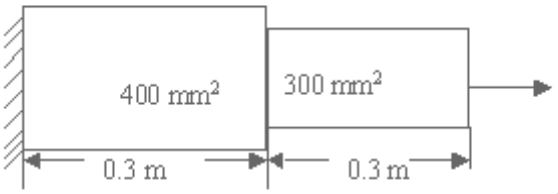

Figure 8

8. The coordinates of the nodes 1, 2 and 3 of a triangular element are (1, 1), (8, 4) and (2, 7) in mm. The displacements at the nodes are u_1 = 1 mm, u_2 = 3 mm, u_3 = -2 mm, v_1 = -4 mm , v_2 = 2 mm and v_3 = 5 mm. Obtain the strain-displacement relations, matrix B and determine the strains $\varepsilon_x, \varepsilon_y$ and γ_{xy}. [16]

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Code No: R05311402 **R05** **Set No. 4**

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

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. A composite wall consists of 4 cm thick wood, 10 cm glass fiber insulation, and 1 cm thick plaster. If the temperature on wood and plaster faces are 20^0C and -20^0C respectively. Determine the temperature distribution in the wall. Assume the thermal conductivity of wood, glass fiber and plaster are 0.17,0.035and 0.5W/m K respectively and colder side heat transfer coefficient is 25 W/m^2 K. [16]

2. If a displacement field is described as follows,
$$u = (-x^2 + 2y^2 + 6xy)10^{-4} \text{ and } v = (3x + 6y - y^2)10^{-4}$$
Determine the strain components $\in_{xx}$, $\in_{yy}$, and $\in_{xy}$ at the point x=1 ; y = 0. [16]

3. Determine the natural frequencies and mode shapes of a stepped bar as shown in figure 8 using the characteristic polynomial technique. Assume E = 250 Gpa and density is 7850 kg/m^3. [16]

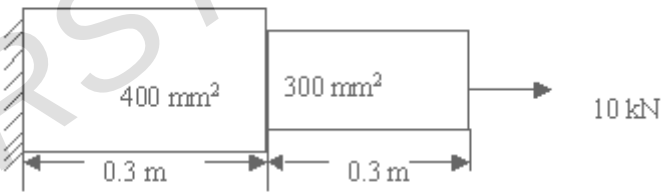

Figure 8

4. The coordinates of the nodes 1, 2 and 3 of a triangular element are (1, 1), (8, 4) and (2, 7) in mm. The displacements at the nodes are u_1 = 1 mm, u_2 = 3 mm, u_3 = -2 mm, v_1 = -4 mm , v_2 = 2 mm and v_3 = 5 mm. Obtain the strain-displacement relations, matrix B and determine the strains $\varepsilon_x, \varepsilon_y$ and γ_{xy}. [16]

5. Determine the displacement at node 1 of the truss structure as shown in the figure 2: [16]

Code No: R05311402 **R05** **Set No. 4**

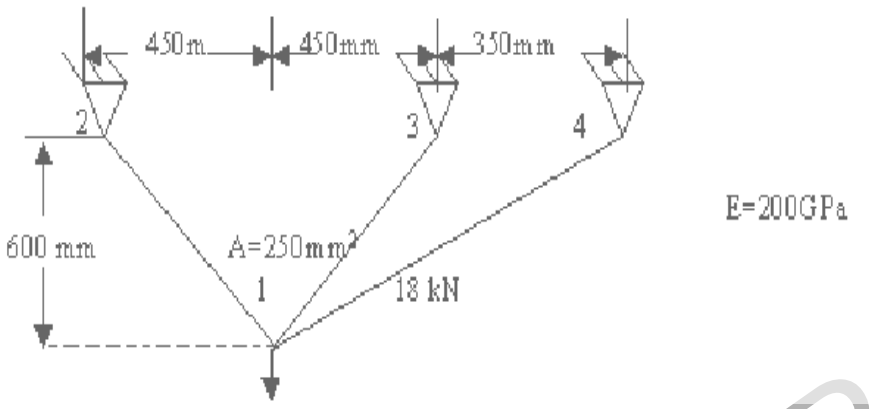

Figure 2

6. (a) Derive the shape functions for a Hexahedral element.
   (b) Explain the various convergence requirements. [8+8]

7. Derive the elemental stiffness matrix and load vector for two noded beam element? [16]

8. find the displacements and reaction forces for the fig given below. 3. Assume E = 2 x 10^5 N/mm^2. [16]

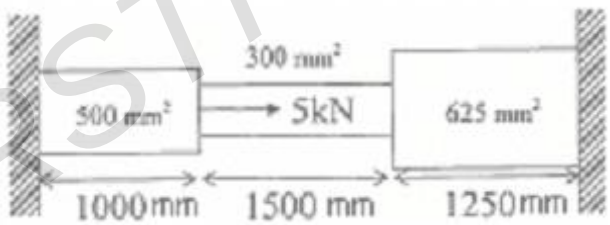

Figure 3

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Code No: R05311402 **R05** **Set No. 1**

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

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Derive the elemental stiffness matrix and load vector for two noded beam element? [16]

2. The coordinates of the nodes 1, 2 and 3 of a triangular element are (1, 1), (8, 4) and (2, 7) in mm. The displacements at the nodes are u_1 = 1 mm, u_2 = 3 mm, u_3 = -2 mm, v_1 = -4 mm , v_2 = 2 mm and v_3 = 5 mm. Obtain the strain-displacement relations, matrix B and determine the strains $\varepsilon_x, \varepsilon_y$ and γ_{xy}. [16]

3. find the displacements and reaction forces for the fig given below. 3. Assume E = 2 x 10^5 N/mm^2. [16]

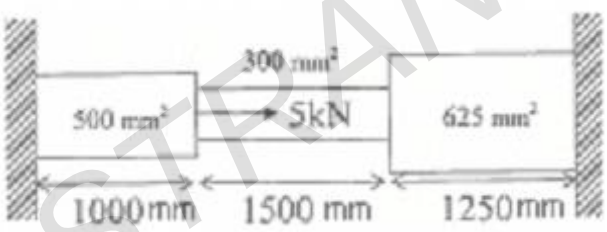

Figure 3

4. (a) Derive the shape functions for a Hexahedral element.
   (b) Explain the various convergence requirements. [8+8]

5. Determine the displacement at node 1 of the truss structure as shown in the figure 2: [16]

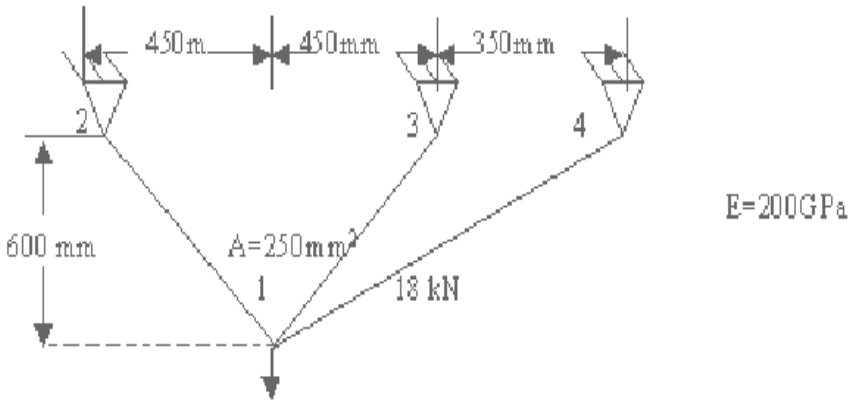

Figure 2

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8. Determine the natural frequencies and mode shapes of a stepped bar as shown in figure 8 using the characteristic polynomial technique. Assume E = 250 Gpa and density is 7850 kg/m^3. [16]

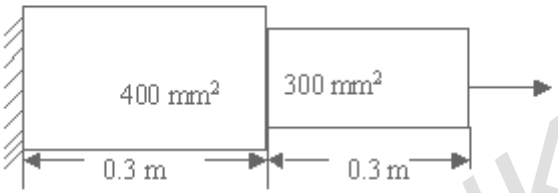

Figure 8

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Code No: R05311402 **R05** **Set No. 3**

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

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

Answer any FIVE Questions
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⋆ ⋆ ⋆ ⋆ ⋆

1. If a displacement field is described as follows,
   u = (-$x^2 + 2y^2 + 6xy$)10^{-4} and v = (3x + 6y - y^2)10^{-4}
   Determine the strain components $\in_{xx}$, $\in_{yy}$, and $\in_{xy}$ at the point x=1 ; y = 0. [16]

2. Determine the displacement at node 1 of the truss structure as shown in the figure 2: [16]

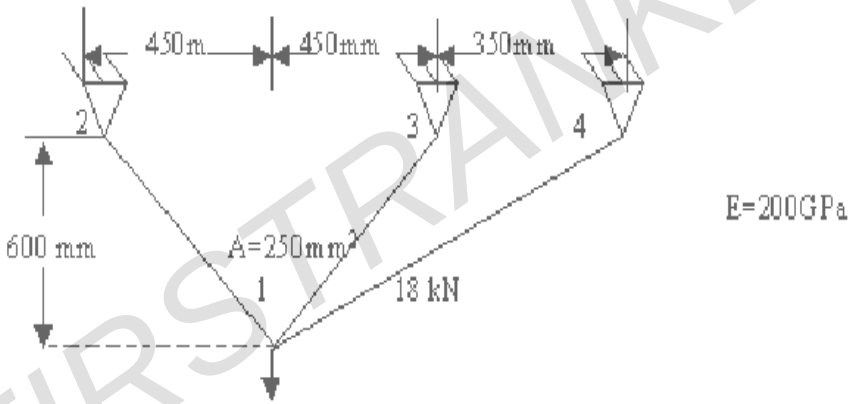

Figure 2

3. find the displacements and reaction forces for the fig given below. 3. Assume E = 2 x 10^5 N/mm^2. [16]

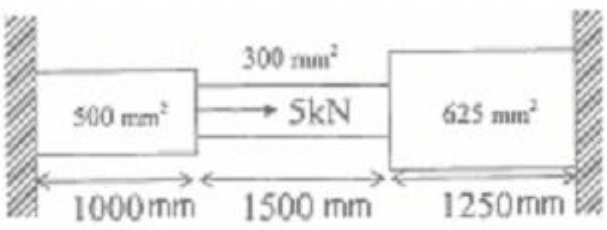

Figure 3

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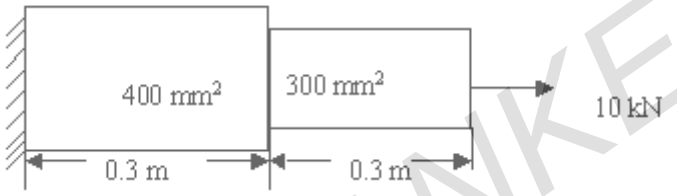

Figure 8

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