Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –I Examination Feb. - 2012

Subject code: 712001 **Date: 11/02/2012**

Subject Name: Advanced Structural Analysis

Time: 10.30 am – 01.00 pm **Total Marks: 60**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Take $E = 2 \times 10^8$ kN/m^2, $I_Z = 0.001$ m^4, $A_X = 0.01$ m^2, $I_X = 0.002$ m^4 and $G = 8 \times 10^7$ kN/m^2 unless and otherwise given.**

Q.1 **(a)** For the truss shown in Figure 1, obtain rearranged joint stiffness matrix. Advantage of symmetry may be taken. **06**

(b) Determine free joint displacements, support reactions and member end-actions for the truss shown in Figure 1 using stiffness member approach. Tabulate the member forces. **06**

Q.2 **(a)** Obtain assembled flexibility matrix for the whole truss shown in Figure 2. **06**

(b) Calculate joint displacements, support reactions and member end-actions for the truss shown in Figure 2 using flexibility member approach. Tabulate the member forces. **06**

OR

(b) Define the types of non-linearity, list the methods of non-linear analysis and explain any one of them in detail. **06**

Q.3 **(a)** Obtain the rearranged joint stiffness matrix of a composite structure shown in Figure 3. Beam AC is made of concrete (E = 20GPa) with rectangular cross-section of 150 mm x 230 mm, while cable BC is made of steel (E = 200 GPa) with 12 mm diameter. **06**

(b) Derive rotation transformation matrix for a space truss member. **06**

OR

Q.3 **(a)** Construct the rearranged joint stiffness matrix for the plane frame shown in Figure 4. **06**

(b) Determine free joint displacements, support reactions and member end-actions for the plane frame shown in Figure 4 using stiffness member approach. Also draw free body diagrams. **06**

Q.4 **(a)** Explain substructure technique of analysis giving example of a plane truss. **06**

(b) Derive stiffness matrix for a beam member considering shear deformation. **06**

OR

Q.4 **(a)** Obtain assembled flexibility matrix for the whole plane frame shown in Figure 5. **06**

(b) Calculate joint displacements, support reactions and member end-actions for the plane frame shown in Figure 5 using flexibility member approach. **06**

Q.5 **(a)** Explain method to solve simultaneous equations giving computer program. **06**

(b) Obtain load vector for the continuous beam shown in Figure 7, if (i) support A sinks by 5 mm (ii) support C rotates counterclockwise by 0.05 radian and (iii) temperature of BC member is increased so that the top and bottom fibers are at 40 ^{0}C and 50 ^{0}C, respectively. Assume depth of members as 300 mm and coefficient of thermal expansion as 1.2 x 10^{-6} per ^{0}C. Omit the external loads. **06**

OR

Q.5 **(a)** Obtain the rearranged joint stiffness matrix and load vector for the grid shown in Figure 6. **06**

(b) Obtain the rearranged joint stiffness matrix and load vector for the continuous beam shown in Figure 7. **06**

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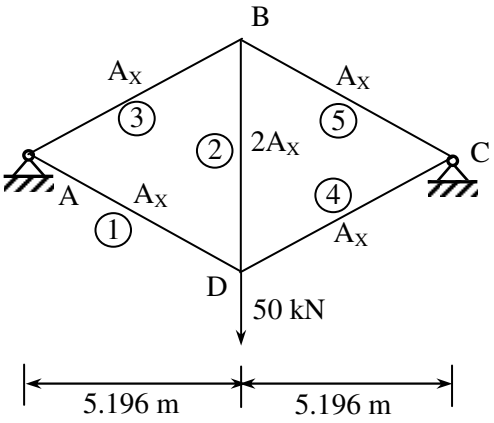

Figure 1

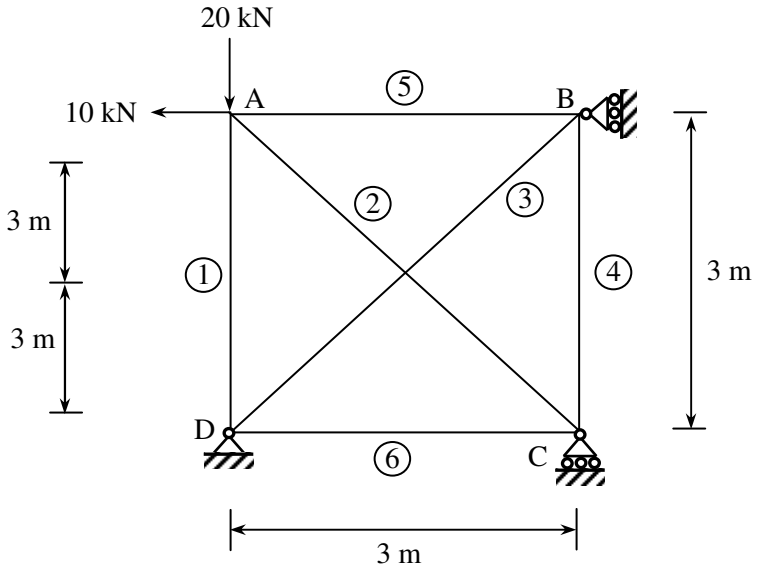

Figure 2

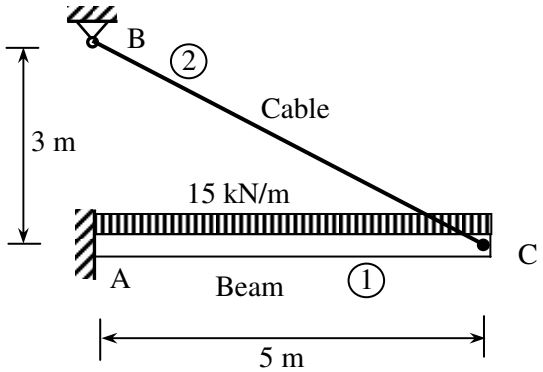

Figure 3

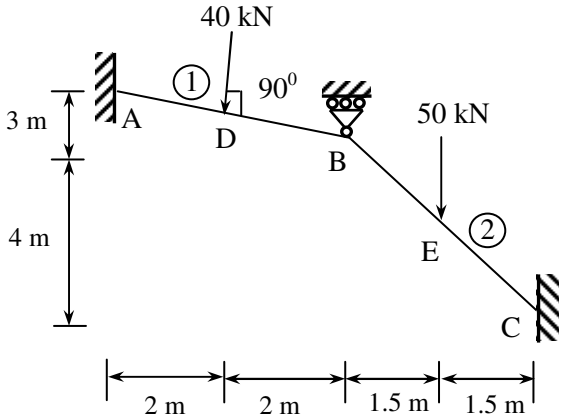

Figure 4

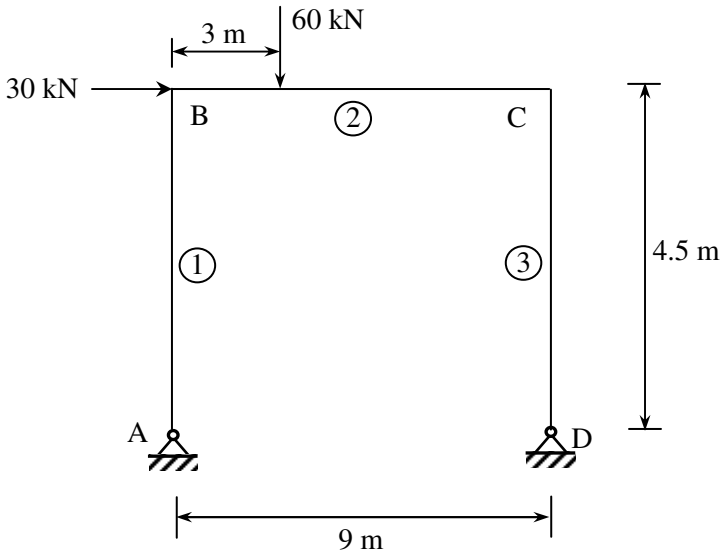

Figure 5

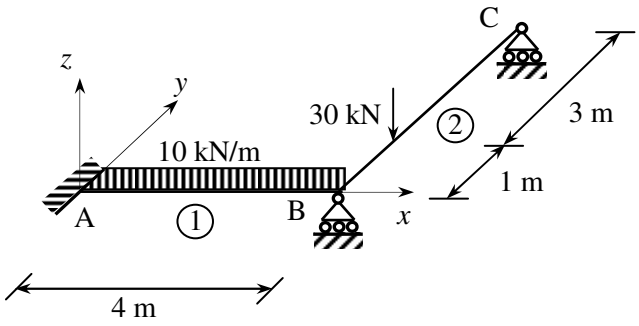

Figure 6

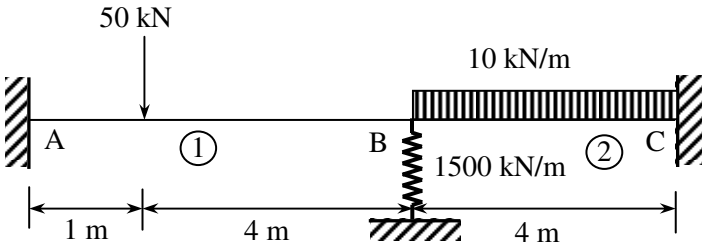

Figure 7