Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M.E Sem-I Examination January 2010**

**Subject code: 712001 Subject Name: Advanced Structural Analysis**

**Date: 20 / 01 / 2010 Time: 12.00 – 2.30 pm**

**Total Marks: 60**

## Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** Find out reactions at support D for the frame shown in **Fig.1** by Flexibility Method member approach. **06**

**(b)** Determine forces in all members of truss shown in **Fig 2** by Flexibility Method member approach. EA is same for all members. **06**

**Q.2** **(a)** The top and bottom surfaces of the continuous beam shown in **Fig.3** are heated to $20^0$C & $10^0$C respectively. Analyse the beam by stiffness method and draw bending moment diagram. $I_{AB}=2\times10^{-4}m^4$ ,$I_{BC}=5\times10^{-5}m^4$ , $d_{AB}=0.4m$ ,$d_{BC}=0.2m$ $E=200\times10^6$ kN/ $m^2$,$\alpha=1.2\times10^{-5}/^0C$ **06**

**(b)** Analyse the continuous beam shown in **Fig.4** by Flexibility Method member approach and draw Bending Moment diagram. **06**

**OR**

**(b)** What are the different methods used in non linear analysis of structures? Explain any one in detail. **06**

**Q.3** Calculate axial forces in all members for the plane truss shown in **Fig.5** by stiffness method member approach. All members have same axial rigidity EAx. Use the numbering system for the members and joints given. **12**

**OR**

**Q.3** **(a)** Obtain the rearranged joint stiffness matrix $S_J$ for the plane truss shown in **Fig.6**.Assume that the horizontal and vertical members have cross sectional area $A_x$ & that the diagonal members have 2Ax. **10**

**(b)** Explain the concept of rotation of axes in two dimensions. **02**

**Q.4** For the plane frame shown in **Fig.7** Determine member end actions by stiffness method member approach. Use given numbering system for joints and members. **12**

$E=200\times10^6$ kN/ $m^2$, $Iz=1\times10^{-3}m^4$, $A_x=0.02$ $m^2$ for both members.

**OR**

**Q.4** **(a)** Explain Gauss Elimination Method to solve simultaneous equations and write a computer program for the method. **06**

**(b)** Develop Global stiffness matrix for the members AB and BC of the Grid shown in **Fig.8**. **06**

$J=2.7945\times10^{-3}m^4$,$G=4.783\times10^6$ kN/ $m^2$, $Iy=3.125\times10^{-3}m^4$ $E=1.1\times10^7$ kN/ $m^2$

**Q.5** Determine forces in all members of the pin jointed space truss shown in **Fig .9**. $E=200\times10^6$ kN/ $m^2$, $A_1=0.05$ $m^2$, $A_2=0.02$ $m^2$, $A_3=0.06$ $m^2$ **12**

**OR**

**Q.5** **(a)** Explain substructure technique of analysis giving example. **06**

**(b)** Analyse the continuous beam on elastic support as shown in **Fig.10** by stiffness method and draw bending moment diagram. $E=200\times10^6$ kN/ $m^2$, $I_{AB}=2\times10^{-4}m^4$ ,$I_{BC}=5\times10^{-5}m^4$ **06**

# FIGURES

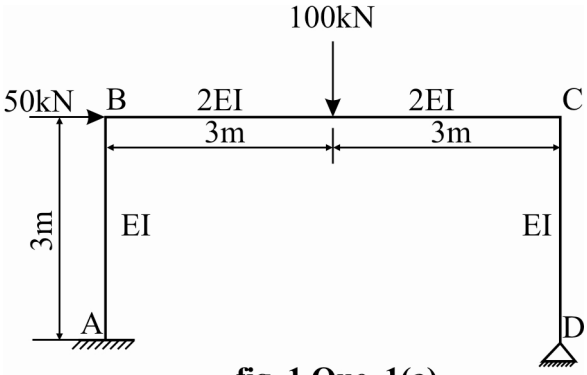


**fig. 1 Que. 1(a)**

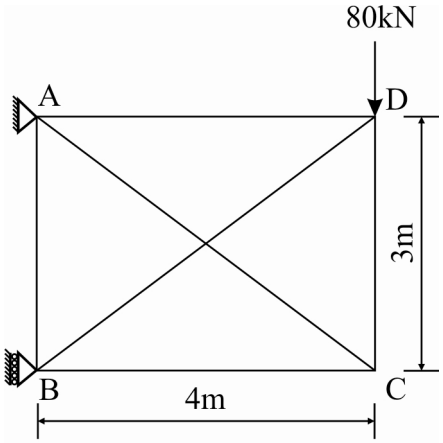


**fig. 2 Que. 1(b)**

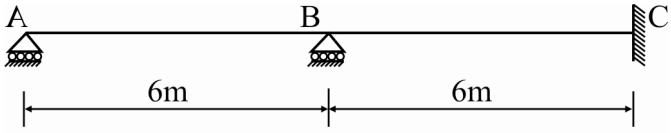


**fig. 3 Que. 2(a)**

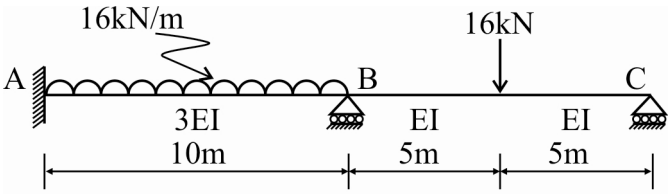


**fig. 4 Que. 2(b)**

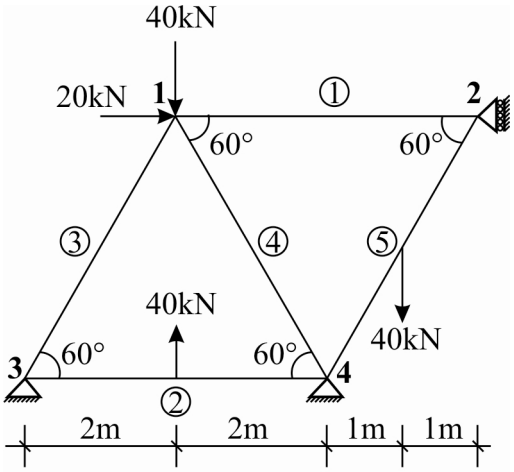


**fig. 5 Que. 3**

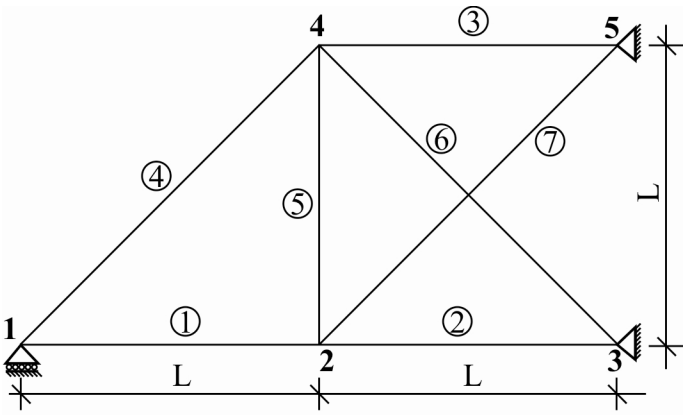


**fig. 6 Que. 3(a) OR**

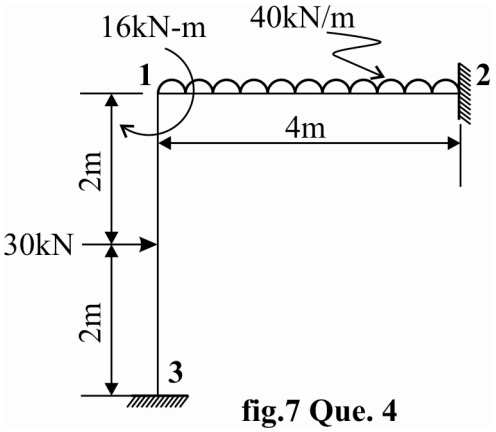


**fig.7 Que. 4**

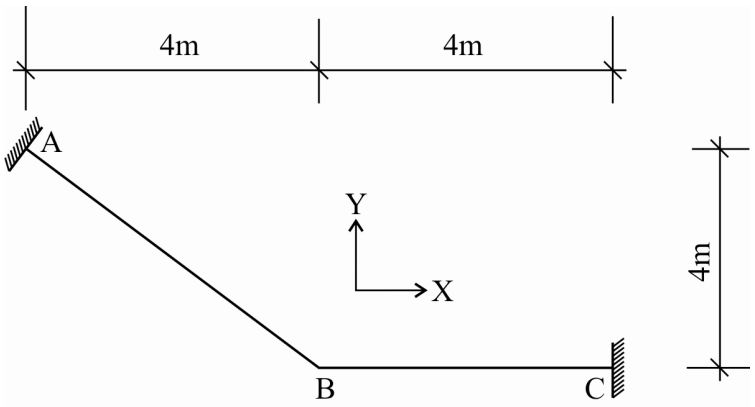


**fig.8 Que. 4(b) OR**

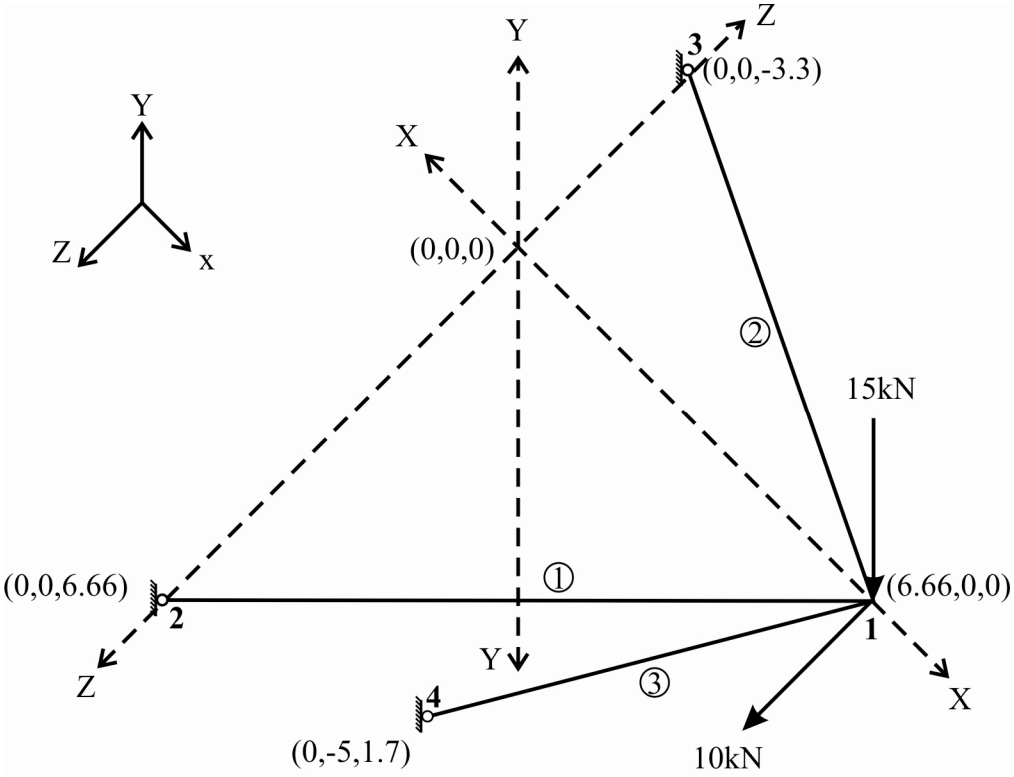


**fig.9 Que. 5**

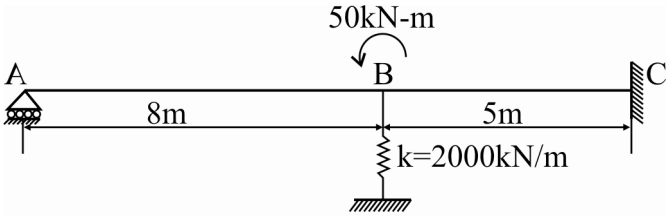


**fig.10 Que. 5(b) OR**

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