Seat No.: _____ Enrolment No.______

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. IST Semester–Remedial Examination – July- 2011

Subject code:711501N
Subject Name: Matrix Analysis of Framed Structures

Date:07/07/2011 **Time: 10:30 am – 01:00 pm**
Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Take E=200 GPa and G=80 GPa in the absence of data.**

Q.1 **(a)** For a plane truss shown in fig.-1, calculate displacement at joint 'D' and member forces using Stiffness method. Take area of the members, A=800 mm^2. **07**

(b) Determine displacements at joints D of the plane truss shown in fig.-1 using flexibility method. Take reaction at D (R_D) and force in member AD (P_{AD}) as redundant, whose value is 69.065 kN (upward) and 124.51 kN (tension) respectively. **07**

Q.2 **(a)** Describe various types of secondary effects. Explain in detail with appropriate example, the effect of temperature change in the analysis by matrix method. **07**

(b) For the plane truss shown in fig.-2, the displacement at joint C and D is found to be 1.2 mm and 0.8 mm downward respectively. Determine member forces of the truss. Area of the members, A=800 mm^2. You may consider symmetry of structure. **07**

OR

(b) Derive flexibility matrix showing partitioning for the plane truss shown in fig.-2 considering symmetry of structure. **07**

Q.3 **(a)** List steps or draw flow chart for the process of stiffness method-member approach for analysis of plane frame structure. Also give description of various matrices to be used in it. **05**

(b) Determine the displacements of the plane frame shown in fig.-3 using stiffness method-member approach. The frame consists of a steel tubular pipe of 100 mm outside diameter and 2.5 mm thickness. Take $E_{steel}=2x10^5$ N/mm^2. **09**

OR

Q.3 **(a)** Derive the load vector for the plane frame shown in fig.-3 for the self weight only. Do not consider the load shown in fig.-3. Other data are same as mentioned in Q.3(b). Take density of steel, ρ=77 kN/m^3. **05**

(b) For the plane frame shown in fig.-4, determine displacements and reactions by stiffness method. **Neglect axial deformations.** Take beam and columns are of concrete and having 300 mm x 600 mm cross section. $E_{concrete}$=25000 N/mm^2. **09**

Q.4 **(a)** For the grid structure shown in fig.-5, an elastic support having stiffness 'K' is provided in the vertical direction at point D. Explain the process of incorporating its effect in stiffness method. **05**

(b) The displacements at joint D in the Grid structure shown in fig.-5 are found to be δ=-21.33 cm (downward), θ=-0.094 (clockwise) radian. Determine member end actions in member AB only and plot diagrams. All members of grid consist of steel tubular section of 125x125x4.5, whose properties are: A=21.17 cm^2, I=505.83 cm^4 and J=787.36 cm^4. **09**

OR

Q.4 **(a)** Explain the use of nonlinear analysis in the structural analysis. **05**

(b) For the plane frame shown in fig.-4, fixed supports at the base are replaced by hinge support. Analyse the frame using flexibility method-member approach. Take Horizontal reaction at D (R_{DH}) as redundant. **09**

Q.5 **(a)** Derive relation for action or displacement along member axis and structure axis for a space truss member. **05**

(b) Analyse the space truss shown in fig.-6 using stiffness method-member approach. You may solve the problem using cyclo-symmetry. All members are having same area. **09**

OR

Q.5 Analyse the composite structure consisting of wooden beam and steel cable, subjected to loading as shown in fig.-7. The cross section of wooden beam is 150 mm x 200 mm (BxD) and steel cable having diameter of 8 mm. E_{wood}=10 GPa and E_{steel}=200 GPa. Draw necessary diagrams. **14**

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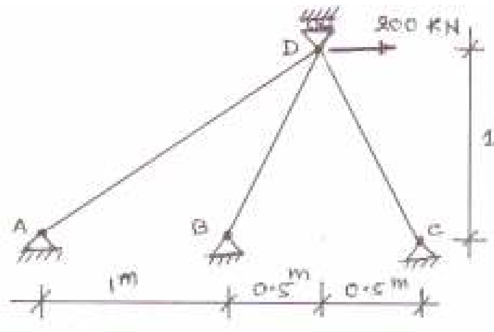

Fig. 1

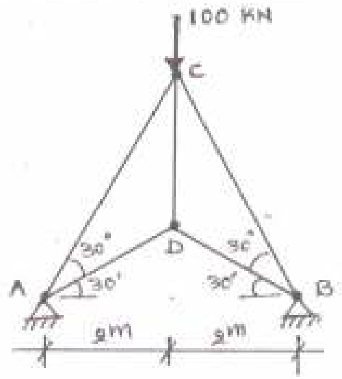

Fig. 2

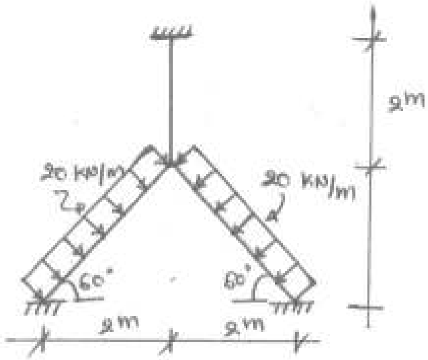

Fig. 3

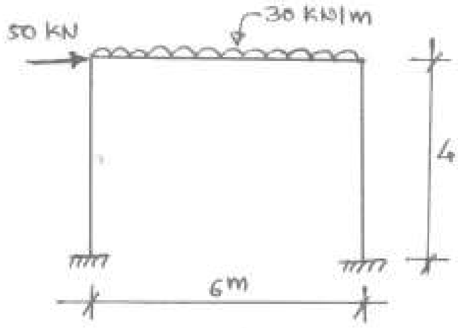

Fig.4

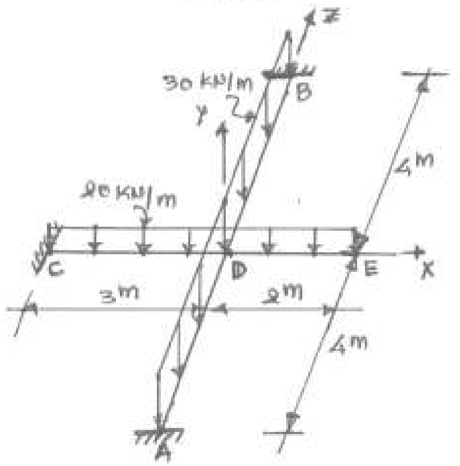

Fig.5

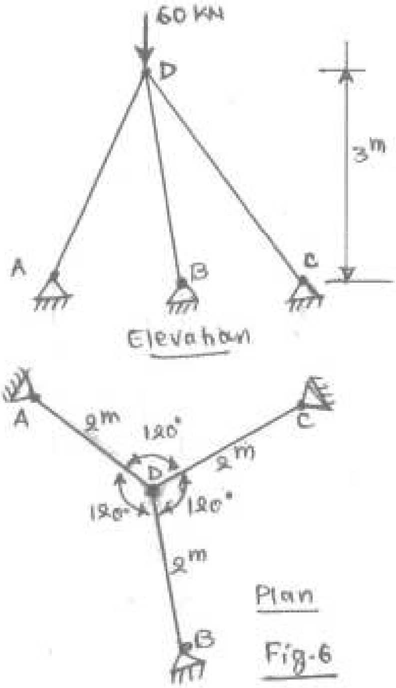

Fig.6

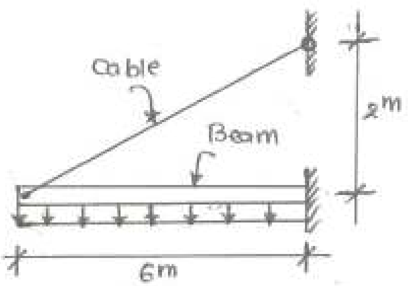

Fig.7