

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. IST Semester–Remedial Examination – July- 2011****Subject code:711501****Subject Name: Matrix Analysis of Framed Structures****Date:07/07/2011****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 $E=200$ 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, $A=800 \text{ mm}^2$. **06**
- (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. **06**

- 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. **06**
- (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, $A=800 \text{ mm}^2$. You may consider symmetry of structure. **06**

OR

- (b) Derive flexibility matrix showing partitioning for the plane truss shown in fig.-2 considering symmetry of structure. **06**

- 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. **04**
- (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 $E_{\text{steel}}=2 \times 10^5 \text{ N/mm}^2$. **08**

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, $\rho=77 \text{ kN/m}^3$. **04**
- (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. $E_{\text{concrete}}=25000 \text{ N/mm}^2$. **08**

- 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. **04**

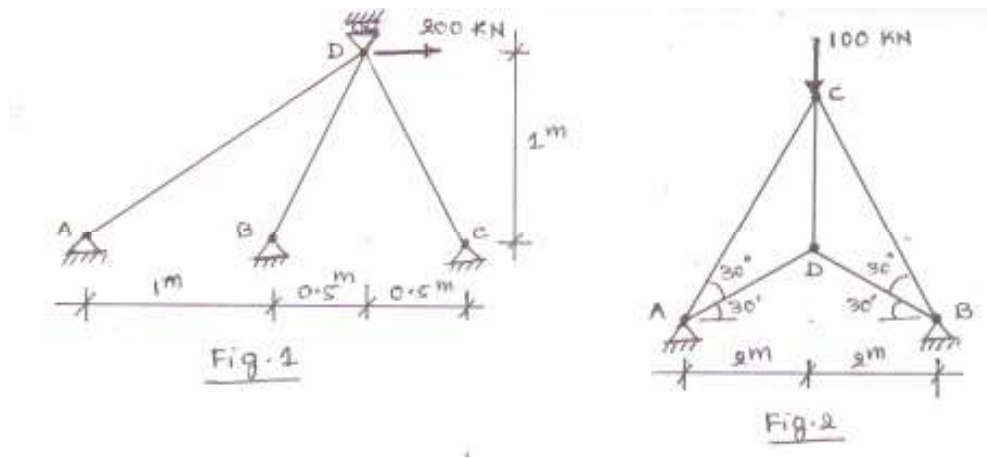
- (b) The displacements at joint D in the Grid structure shown in fig.-5 are found to be $\delta = -21.33$ cm (downward), $\theta = -0.094$ (clockwise) radian. Determine member end actions in member AB only and plot diagrams. All members of grid consist of steel tubular section of $125 \times 125 \times 4.5$, whose properties are: $A = 21.17 \text{ cm}^2$, $I = 505.83 \text{ cm}^4$ and $J = 787.36 \text{ cm}^4$. **08**

OR

- Q.4** (a) Explain the use of nonlinear analysis in the structural analysis. **04**
 (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. **08**
- Q.5** (a) Derive relation for action or displacement along member axis and structure axis for a space truss member. **04**
 (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. **08**

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 $150 \text{ mm} \times 200 \text{ mm}$ (BxD) and steel cable having diameter of 8 mm. $E_{\text{wood}} = 10 \text{ GPa}$ and $E_{\text{steel}} = 200 \text{ GPa}$. Draw necessary diagrams. **12**



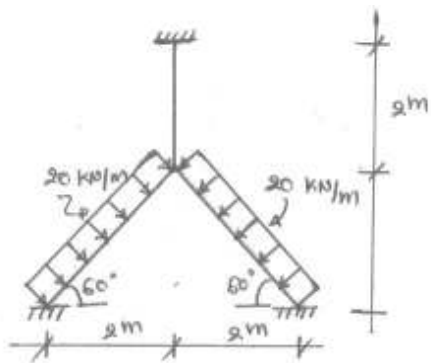


Fig. 3

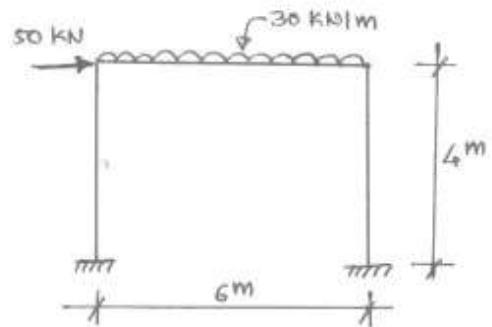


Fig. 4

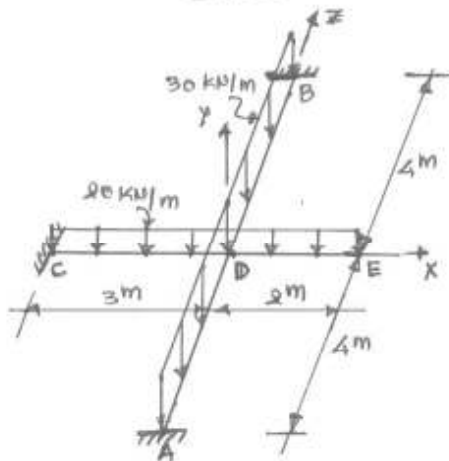
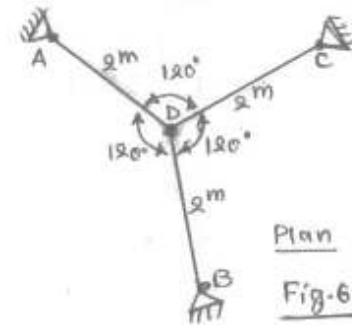
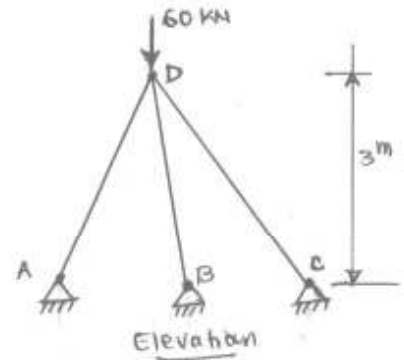


Fig. 5



Plan

Fig. 6

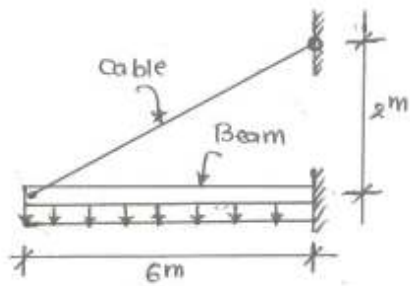


Fig. 7