

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Remedial Examination April 2010

Subject code: 711501**Subject Name: Matrix Analysis of Framed Structure****Date: 06 / 04 /2010****Time: 12.00 noon – 03.00 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, $G=80$ GPa, $EI=200 \times 10^3$ kN.m² and $GJ=0.8EI$, if not specified in any problem.

Q.1 (a) For the beam shown in **fig.-1**, the rotation at joint 'B' and joint 'C' is found to be $36.16/EI$ (anticlockwise) & $-4.02/EI$ (clockwise) respectively for the given loading. Find out internal forces in the member using Stiffness method and plot diagrams. **06**

(b) Derive assembled flexibility matrix for the beam shown in fig.-1 considering moment at A and B are redundant. **06**

Q.2 (a) Find out displacement of a plane truss shown in fig.-2 considering symmetry of structure by Stiffness method. **06**

(b) Derive load vector of the plane frame shown in fig.-3(a) & 3(b) **06**

OR

(b) Derive the relation to transfer actions/displacement from member axes to structure axes or vice versa. Using same relation, find out axial, transverse & bending deformation of the member BC for fig.-3(a), if displacement found at rigid joint is $\delta x = 4.146/EI$, $\delta y = -1.762/EI$ & $\theta z = -3.011/EI$ (clockwise). Take $I/A=1/100$. **06**

Q.3 (a) For the plane frame shown in fig.-3(b), derive complete joint stiffness matrix showing partitioning and load vector. Take $I/A=1/100$. **06**

(b) Compute displacements and member end actions for the plane frame shown in fig.-3(b). Plot deflected shape and member end actions diagrams also. **06**

OR

Q.3 (a) For the plane frame shown in fig.-4 has constant EI for all members. Find out necessary matrices to derive assembled flexibility matrix. You may choose your own sets of redundant. **06**

(b) Calculate displacements at joints, reactions and member end actions for the plane frame shown in fig.-4 using Flexibility member approach. Plot all necessary diagrams. **06**

Q.4 (a) Derive joint stiffness matrix and load vector for the Grid shown in fig.-5 considering symmetry of the structure. **06**

(b) Compute displacements and member end actions for the Grid shown in fig.-5. Plot deflected shape and member end actions diagrams also. **06**

OR

- Q.4 (a)** Explain the derivation of flexibility matrix F_M , B_{MS} matrix, B_{RS} matrix and assembled flexibility matrix F_S with partitioning for the plane truss structure. Also explain how to find out displacements, reactions and member end actions. **06**
- (b)** Compute displacements and member end actions for the space truss shown in fig.-6 considering symmetry of the structure. Take axial rigidity of member AD is 30 MN and for member AB and AC is 20 MN. **06**
- Q.5 (a)** A composite structure shown in fig.-7 consist of a beam ABC made of a concrete of grade M20 and having size of 250 mm x 450 mm, which supported by a steel rod of 20 mm diameter at centre of its length. Take $E_{concrete} = 5000(fck)^{1/2}$ and $E_{steel}=200$ GPa. Determine joint stiffness matrix and load vector of the structure considering symmetry of the structure. **06**
- (b)** Compute displacement, reactions and member end actions of the composite structure shown in fig.-7. Plot structural response neatly. **06**
- OR**
- Q.5 (a)** In a plane truss shown in fig.-2, member CD is found to be 5 mm shorter than its original length. How this effect can be incorporated in the analysis by Stiffness method? Show necessary calculations. **06**
- (b)** Find the load vector of the beam shown in fig.-1, if **06**
- (i) support B sinks by 10 mm and
- (ii) it is subjected to temperature variation of 40° at top and 15° at bottom of the beam
- in addition to the load given on it.

Figures

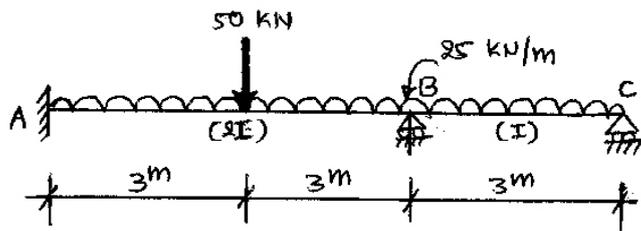


Fig. 1

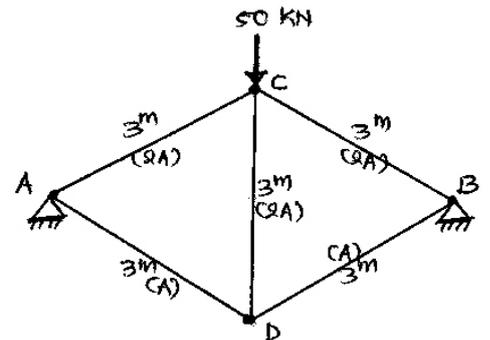


Fig. 2

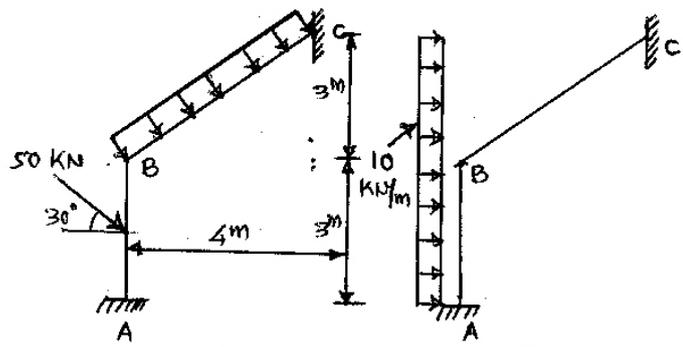


Fig. 3

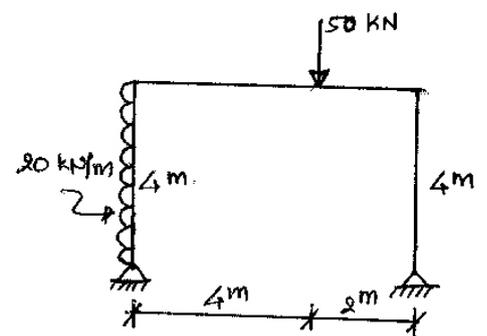


Fig. 4

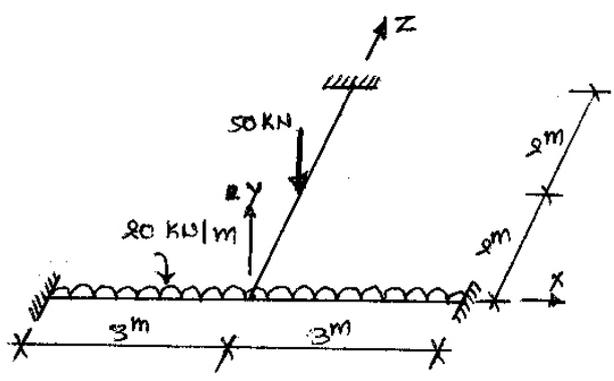


Fig. 5

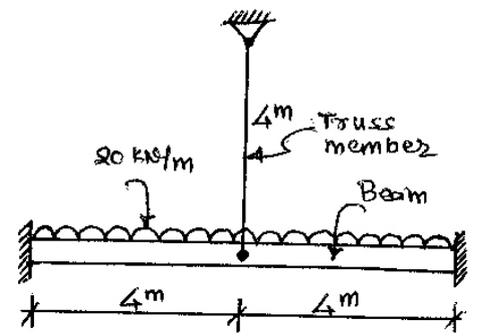


Fig. 6

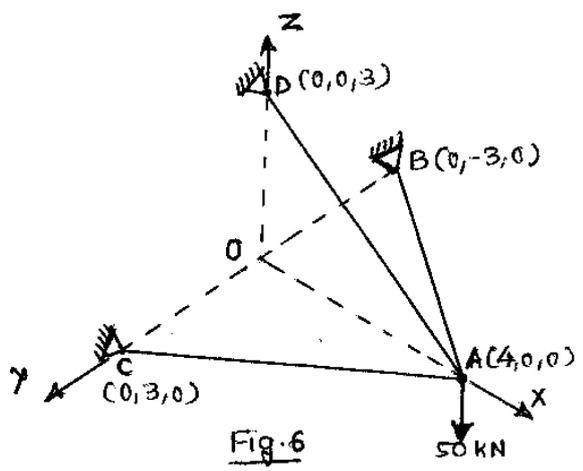


Fig. 7