Seat No.: _____ Enrolment No.______

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=200x10^3 kN.m^2 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 δx = 4.146/EI, δy = -1.762/EI & θz =-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.

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Figures

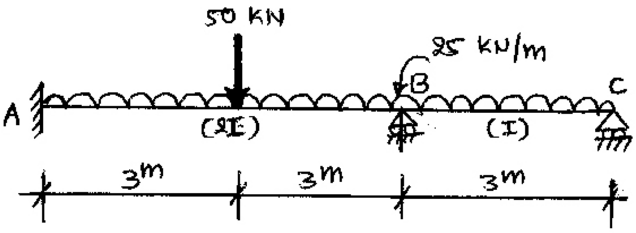

Fig. 1

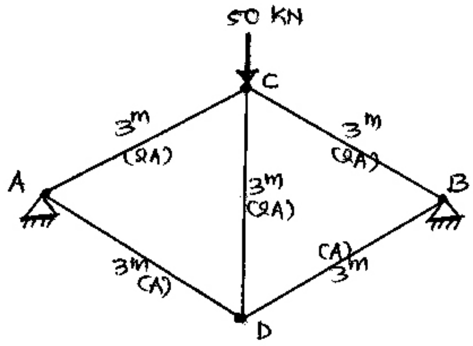

Fig. 2

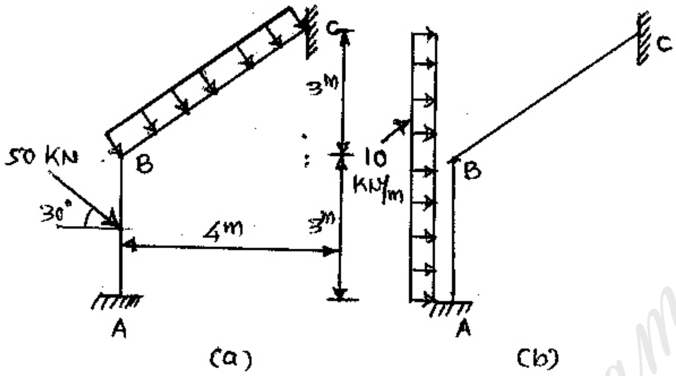

Fig. 3

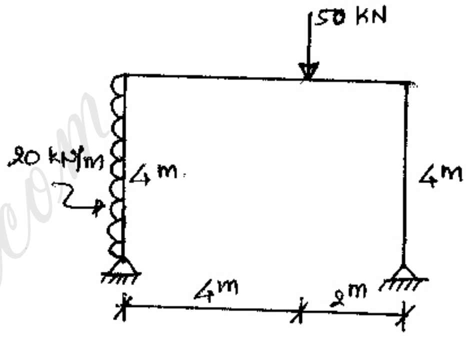

Fig. 4

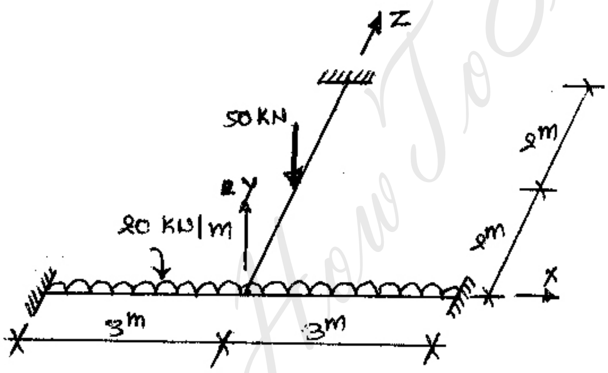

Fig. 5

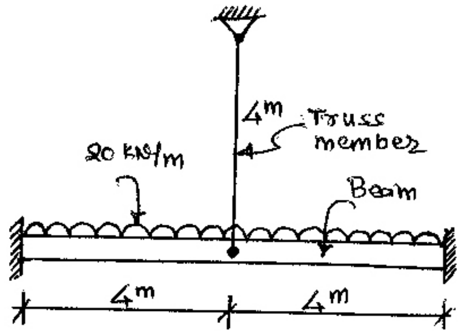

Fig. 7

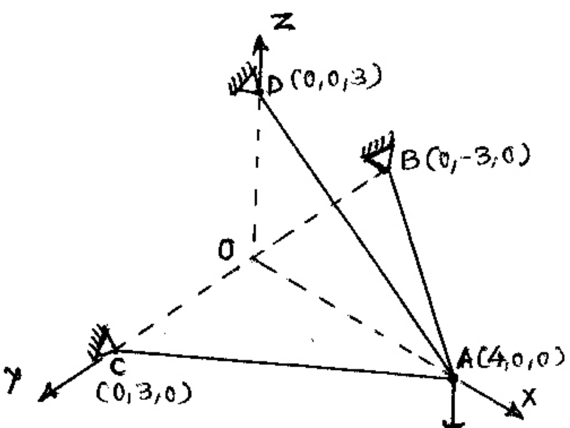

Fig. 6