Seat No.: ________ *Enrolment No.___________*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 711501 **Date: 01-12-2014**

Subject Name: Matrix Analysis of Framed Structures

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.**

Q.1	**(a)**	Derive member flexibility matrix for a plane frame member.	**07**
	(b)	Derive the equation $A_M = R\ A_S$ for rotation of axis in two dimension. A_M is a vector consisting of the components of the action A parallel to the x_M, y_M axes. A_S is a vector consisting of the components of the action A parallel to the x_S, y_S axes. R is a rotation matrix.	**07**
Q.2	**(a)**	Formulate S_J matrix for the beam shown in fig. 1.	**07**
	(b)	Considering flexural effects only and reactive moment in anticlockwise direction at support A as redundant, formulate B_{MS} matrix for the plane frame shown in fig. 2.	**07**
		OR	
	(b)	Define: B_{MJ}, F_{QQ}, B_{RQ}, D_Q, S_{MS}, A_E, A_{FC}	**07**
Q.3	**(a)**	Formulate B_{MS} matrix for the plane truss shown in fig. 3(a). For joint displacements & member number and redundant actions refer fig. 3(b) and fig. 3(c) respectively. Consider tensile force positive.	**07**
	(b)	Using flexibility method, determine the redundant actions A_{Q1}, A_{Q2} and A_{Q3} for the plane truss shown in fig. 3(a). For joint displacements & member number and redundant actions refer fig. 3(b) and fig. 3(c) respectively. Take EA = constant for all the members. Consider tensile member force positive.	**07**
		OR	
Q.3	**(a)**	Formulate B_{MS} matrix for the beam shown in fig. 4(a). For joint displacements & member number and redundant actions refer fig. 4(b) and fig. 4(c) respectively.	**07**
	(b)	Using flexibility method, determine the redundant action A_{Q1} for the beam shown in fig. 4(a). For joint displacements & member number and redundant actions refer fig. 4(b) and fig. 4(c) respectively.	**07**
Q.4	**(a)**	Using stiffness method, determine joint displacements for the beam shown in fig. 4(a).	**07**
	(b)	Using stiffness method, determine member end actions for the beam shown in fig. 4(a).	**07**
		OR	
Q.4	**(a)**	Formulate S_{FF} matrix for the grid shown in fig. 5. EI = constant & GJ = constant for both the member. Take GJ = 0.8 EI.	**07**
	(b)	Using stiffness method, determine joint displacements for the grid shown in fig. 5. EI = constant & GJ = constant for both the member. Take GJ = 0.8 EI.	**07**
Q.5	**(a)**	Obtain combined load vector for the plane frame shown in fig. 2, if uniform temperature increase of member AB is 20°. $E = 2 \times 10^5$ N/mm², c/s Area of member AB & BC = 4000 mm² and coefficient of thermal expansion $\alpha = 1.2 \times 10^{-5}$ mm/mm °C.	**07**

(b) Derive S_M matrix for plane frame member or plane grid member. **07**

OR

Q.5 **(a)** Formulate combined load vector for the beam shown in fig. 4(a), if the support B settles by 5mm. $EI = 1.2 \times 10^5\ kNm^2$. **07**

(b) With reference to member oriented flexibility matrix method, write the equation of D_J, A_R and A_M. **07**

****

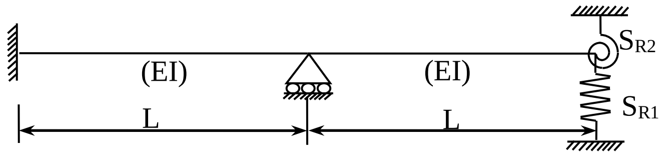

Fig. 1

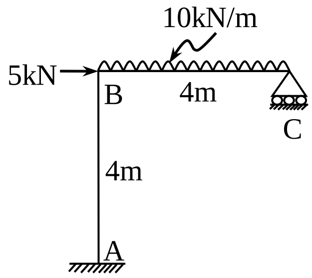

Fig. 2

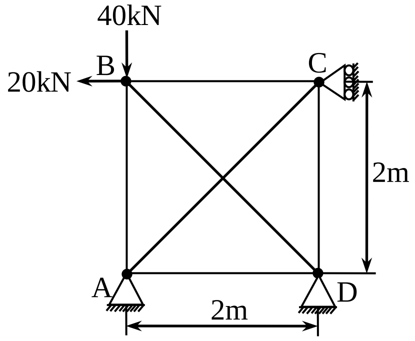

Fig. 3(a)

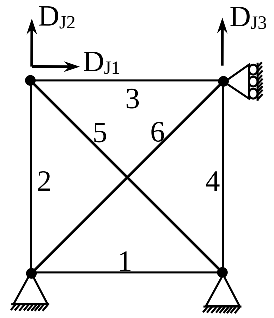

Fig. 3(b)

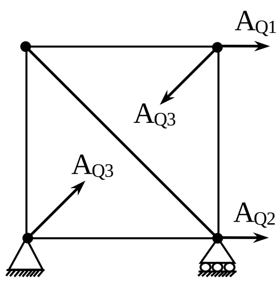

Fig. 3(c)

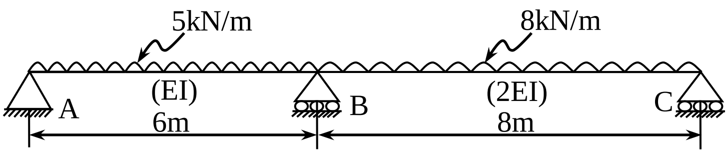

Fig. 4 (a)

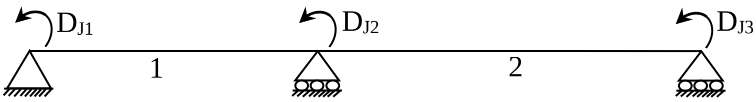

Fig. 4 (b)

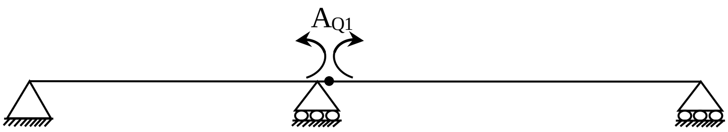

Fig. 4 (c)

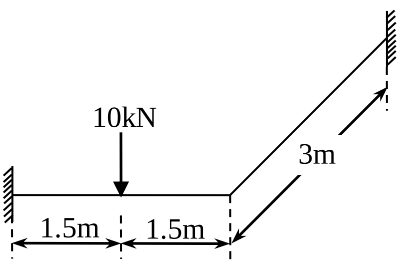

Fig. 5