Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 712001N Date: 08-01-2013

Subject Name: Advanced Structural Analysis

Time: 02.30 pm – 05.00 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)**	Develop Flexibility Matrix for the structure shown in Fig: 1 using Transformation Matrix by using M_A and R_{BA} as Redundant.	**07**
	(b)	Analyze the structure shown in Fig:1 by Flexibility Member Approach.	**07**
Q.2		Develop Flexibility Matrix and Analyze the structure shown in Fig:2 by Flexibility Member Approach.	**14**
		OR	
Q.2		Develop Flexibility Matrix and Analyze the structure shown in Fig:3 by Flexibility Member Approach.	**14**
Q.3	**(a)**	Write Stiffness matrix for a space frame member with respect to its member axis.	**07**
	(b)	In a fixed beam of span 8 m has c/s of 2EI from Left support up to centre of span and has c/s of EI from centre of span to Right Support. The beam is subjected to 25 kN/m u.d.l up to 4m from Left support while a point load , 50 kN downward is acting at 6 m from Left support. 10 kN-m, Anti Clock Wise moment and a point load of 20 kN downward are acting at centre of span. Draw SF and BM diagram by analyzing the beam by stiffness member approach.	**07**
		OR	
Q.3	**(a)**	Draw S.F and B.M diagram for the continuous beam by analyzing it by Stiffness Member Approach. Refer Fig.4. Consider that support B has a downward settlement of 200/EI and support C has downward settlement of 150/EI.	**07**
	(b)	Draw S.F and B.M diagram for the continuous beam by analyzing it by Stiffness Member Approach. Refer Fig.5. Consider that beam has 25 degree C temperature at Top and 10 degree C temperature at bottom. Consider $I_{AB} = 2.5 \times 10^{-4}$ m^4 , $I_{BC} = 4.5 \times 10^{-4}$ m^4 , d_{AB}=0.45 m , d_{BC}=0.3 m , E=200x10^6 kN/m^2 and $\alpha = 1.2 \times 10^{-5}$/ ·C	**07**
Q.4		Find support reactions and member end actions in a plane truss shown in Fig.6 using stiffness member approach. Consider AE= constant	**14**
		OR	
Q.4	**(a)**	Generate Stiffness matrix – S and overall Joint Stiffness – Sj for the plane truss shown in fig.7 , Consider AE=constant	**07**
	(b)	Find out Support reactions for the plane truss of Q-4 (a) Refer Fig.7 . Use Stiffness Member approach.	**07**

Q.5		Find support reactions and draw B.M diagram by analyzing the Plane Frame by Stiffness Member Approach. Refer Fig:8 . Consider E=$200x10^6$ kN/m^2 , Moment of Inertia and c/s Area for member no. 1 & 2 as $0.5x10^{-3}$ m^4 and 0.02 m^2 respectively, while Moment of Inertia and c/s Area for member no. 3 as 1.25 $x10^{-3}$ m^4 and 0.03 m^2 respectively	**14**
		OR	
Q.5	**(a)**	Generate Overall Joint Stiffness matrix- Sj and Stiffness Matrix - S for the Grid shown in Fig:9 . Consider Ixx= $2.9x10^{-3}$ m^4 , G= $4.8x10^6$ kN/ m^2 , Iyy= $3.3x10^{-3}$ m^4 and E= $1.5x10^7$ kN/ m^2	**07**
	(b)	Generate Overall Joint Stiffness matrix- Sj and Stiffness Matrix - S for the Plane Frame shown in Fig:10 . Consider I= $2.9x10^{-3}$ m^4 , A= 0.05 m^2 , and E= $1.5x10^7$ kN/ m^2	**07**

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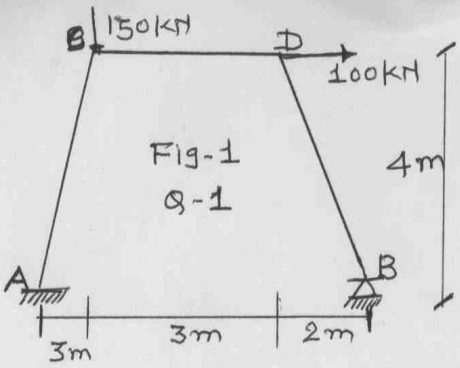


Fig-1
Q-1

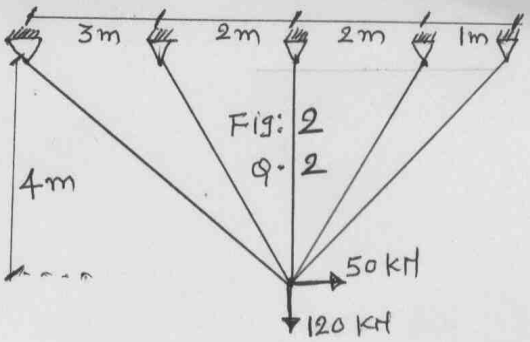


Fig: 2
Q-2

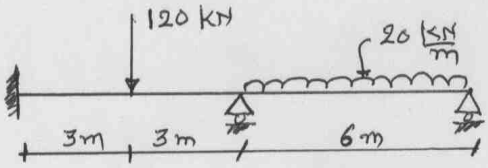
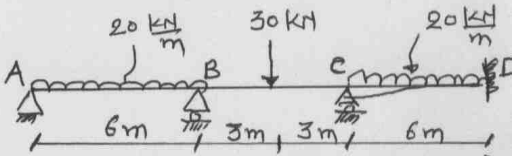


Fig: 3, Q-2



EI = const, Fig: 4, Q-3 (a)

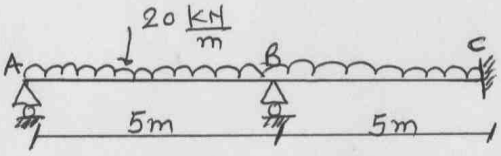


Fig: 5, Q-3 (b)

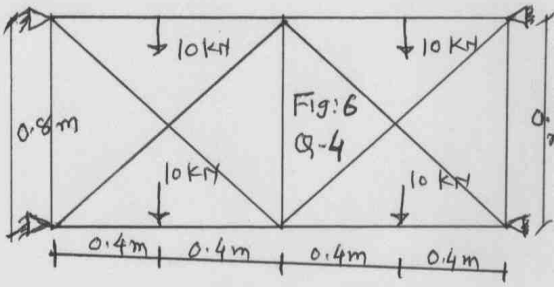


Fig: 6
Q-4

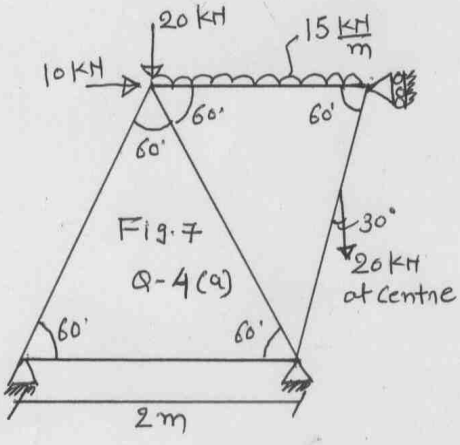


Fig: 7
Q-4 (a)

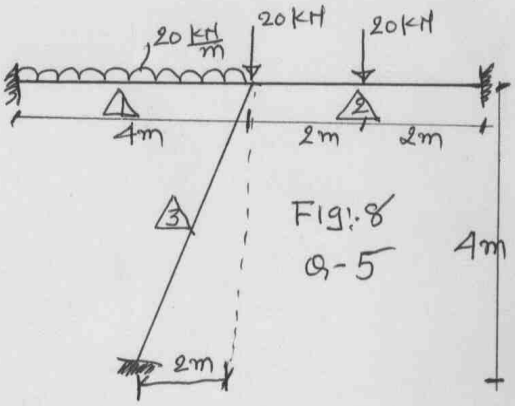


Fig: 8
Q-5

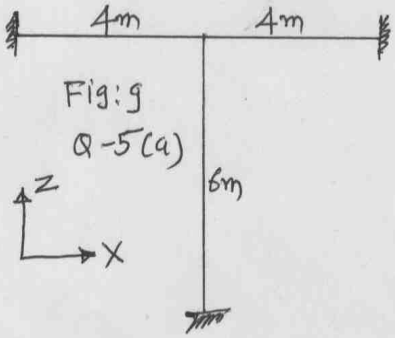


Fig: 9
Q-5 (a)

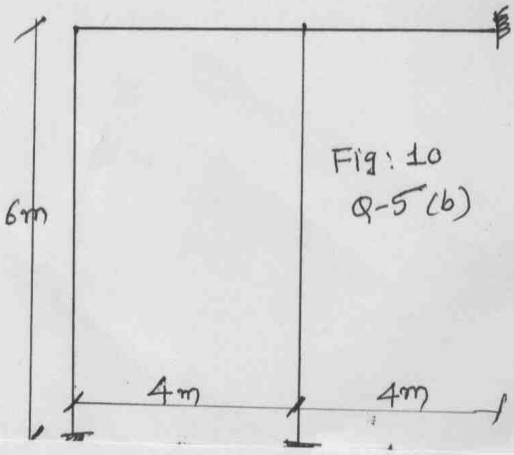


Fig: 10
Q-5 (b)