Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2017

Subject Code: 2150608 Date: 13/11/2017

Subject Name: Structural Analysis-II

Time: 10:30 AM TO 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)**	State Castigliano's 1st theorem and using the same find the displacement at the free end of a cantilever beam of 3m span subjected to a uniformly distributed load of 60 kN/m throughout the span.	**03**
	(b)	Define Influence line diagram. Draw the same for (i) support reactions (ii) shear force and bending moment diagrams at a section 2m from left support for a simply supported beam of span 10m.	**04**
	(c)	Draw the shear force and bending moment diagrams for the beam shown in Figure – 1. Use slope deflection OR moment distribution method.	**07**
Q.2	**(a)**	State the theorem of Least work, and using the same, find the support reaction at B, for the beam shown in Figure – 2. Assume EI = Constant.	**03**
	(b)	Using unit load method, find the displacement at Centre, for a simply supported beam of span 4m and subjected to a uniformly distributed load of 60 kN/m at the centre point.	**04**
	(c)	Find the matrices: $[A_D]$, $[A_{DL}]$, [S] and [D] with usual notations for the beam shown in Figure – 3, using Stiffness method.	**07**
		OR	
	(c)	Find the matrices: $[D_Q]$, $[D_{QL}]$, [F] and [Q] with usual notations for the beam shown in Figure – 3. Use Flexibility method assuming vertical support reaction at B (R_B) and vertical support reaction C (R_C) as redundant.	**07**
Q.3	**(a)**	Draw bending moment diagram for the continuous beam ABC shown in Figure – 4, if support B settles down by 10mm. Assume EI = 4000 kN-m^2. Use Slope Deflection Method.	**03**
	(b)	Write only slope deflection equations for the frame shown in Figure – 5.	**04**
	(c)	Analyze the sway frame shown in Figure – 5 and draw the bending moment diagram using Moment Distribution Method.	**07**
		OR	
Q.3	**(a)**	Draw bending moment diagram for the continuous beam ABC shown in Figure – 4, if support B settles down by 10mm. Assume EI = 4000 kN-m^2. Use Moment Distribution Method.	**03**
	(b)	Define: Distribution Factor and find the same at point O shown in Figure – 6.	**04**
	(c)	Analyze the sway frame shown in Figure – 5 and draw the bending moment diagram using Slope Deflection Method.	**07**
Q.4	**(a)**	Explain why Influence Line diagram is important for a structural engineer?	**03**

(b) Draw influence line diagram for a cantilever beam of span 4m for support reactions: Moment (M_A) and Vertical Reaction (V_A). **04**

(c) For a two span continuous beam ABC, having both spans AB and BC = 4m, with all supports as hinged, draw Influence line diagram for vertical reaction at support B (R_B) with ordinates at every 1m interval. **07**

OR

Q.4 **(a)** State and explain the Muller-Breslau's Principle. **03**

(b) Draw qualitative Influence line diagrams for support reactions M_A, R_A and R_B and for a propped cantilever AB with having span "L". **04**

(c) Three point loads 20 kN, 30 kN and 50 kN equally spaced 2m respectively, cross a girder of 30m span from left to right, with the 50 kN load as leading load. Using influence line diagrams, calculate maximum shear force (positive and negative), and bending moment at a section 10m from left end. **07**

Q.5 **(a)** Differentiate between Stiffness and Flexibility matrix. **03**

(b) Analyze the beam shown in Figure – 2 by Stiffness method and draw shear force and bending moment diagrams. **04**

(c) Derive the Flexibility Matrix [F] for the beam shown in Figure –7, assuming vertical reactions at supports B, C and D as redundant. Also show that it satisfies the basic properties of a flexibility matrix. **07**

OR

Q.5 **(a)** Define: Stiffness and Flexibility. Enlist the properties of Flexibility matrix. **03**

(b) Differentiate between "restrained structure" and "released structure". Draw any four possible released structures for the beam shown in Figure – 7. **04**

(c) Derive the Stiffness matrix [S] for the beam shown in Figure – 7. Also show that it satisfies the basic properties of a stiffness matrix. **07**

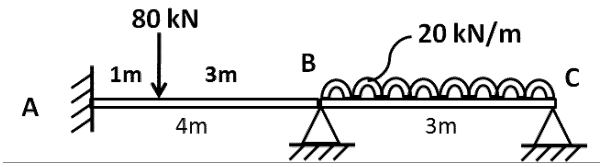

Figure – 1

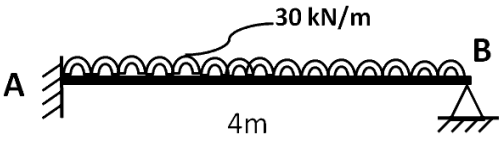

Figure – 2

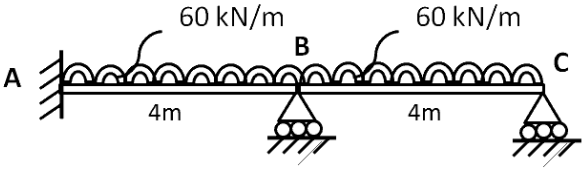

Figure – 3

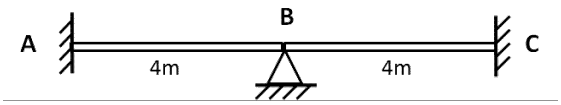

Figure – 4

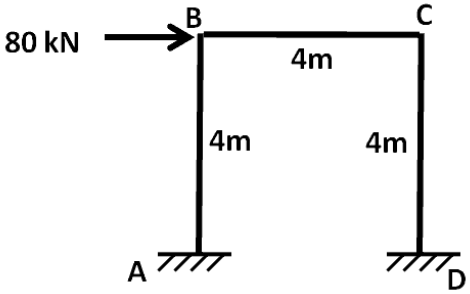

Figure – 5

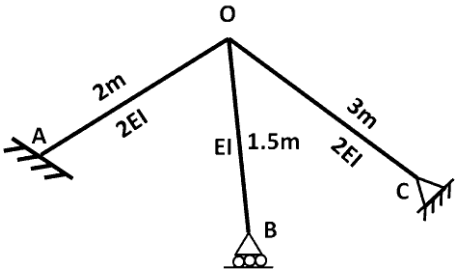

Figure – 6

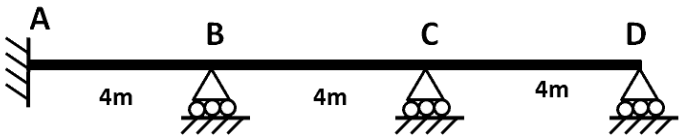

Figure – 7