Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2022

Subject Code:2150608   **Date:21-01-2023**
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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	(a)	State and explain Castigliano's second theorem with example.	**03**
	(b)	Derive slope-deflection equations from first principles.	**04**
	(c)	Using Castigliano's 1st theorem, calculate the deflection at point C for the beam shown in Figure - 1. Take $EI = 10 \times 10^{13}$ N mm^2	**07**
Q.2	(a)	Explain causes of side-sway in plane frame with illustrations.	**03**
	(b)	Calculate deflection at free end C for a cantilever beam ABC having length 6m shown in figure - 2 using energy principle. $EI = 10 \times 10^{13}$ N mm^2	**04**
	(c)	Draw the bending moment diagrams for the beam shown in figure 3. Use Slope Deflection Method.	**07**

OR

	(c)	Find the matrices: [DQ], [DQL], [F] and [Q] with usual notations for the beam shown in figure 4. Use Flexibility method assuming vertical support reaction at B (RB) and vertical support reaction C (RC) as redundant.	**07**

Q.3	(a)	Define: Stiffness, Distribution factor, Carry over factor	**03**
	(b)	Analyze the beam shown in Figure – 3 by Moment Distribution method. Also draw the Bending Moment Diagram.	**04**
	(c)	Analyze the portal frame shown in Figure – 5 by Moment Distribution method. Also draw the Shear force and Bending Moment Diagram.	**07**

OR

Q.3	(a)	State and explain the Muller-Breslau's Principle.	**03**
	(b)	For cantilever of span L draw ILD for support reactions and shear force and bending moment at center.	**04**
	(c)	For a propped cantilever beam AB, fixed at A and having roller support at B, of span 7m, draw ILD for RB. Calculate ordinates of ILD at every 1m interval.	**07**

Q.4	(a)	Calculate slope-deflection equations for the portal frame as shown in figure – 6.	**03**
	(b)	Find the fixed end moment and distribution factors for the beam shown in figure – 4.	**04**
	(c)	Figure-7 shows the beam AB having varying moment of inertia. It is subjected to an eccentric load. Calculate the moment under the load using Castigliano's 2nd theorem.	**07**

OR

Q.4	(a)	Enlist the properties of Stiffness matrix.	**03**

(b) Write only the Stiffness matrix [S] for the beam shown in Figure – 4. (Take AE and EI = Constant). **04**

(c) Analysis the beam shown in Figure – 8 by Flexibility method. Take EI=constant. (Take MB as Q1 and MC as Q2 as redundant). **07**

Q.5 (a) Explain with illustrations the characteristics of flexibility matrices. **03**

(b) For a 5 m span propped cantilever beam AB, fixed at A and having roller support at B, Draw ILD for RB showing ordinates of ILD at every 1m interval. **04**

(c) Draw bending moment diagram for the frame shown in fig. 6 using Slope Deflection Method. **07**

<center>OR</center>

Q.5 (a) For two span continuous beam having span AB = 3m and BC = 3m, draw qualitative ILD for support reactions. (all supports are simply support) **03**

(b) Differentiate the influence line diagram for BM at any section and normal BM diagram. Explain this with taking simple example. **04**

(c) Find the matrices: [AD], [ADL], [S] and [D] with usual notations for the beam shown in figure - 8, using Stiffness method. **07**

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Fig-1

Fig-2

Fig-3

Fig-4

Fig-5

Fig-6

Fig-7

Fig-8