

# GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2020

Subject Code:3150614

Date:03/02/2021

Subject Name:Structural analysis-II

Time:10:30 AM TO 12:30 PM

Total Marks: 56

Instructions:

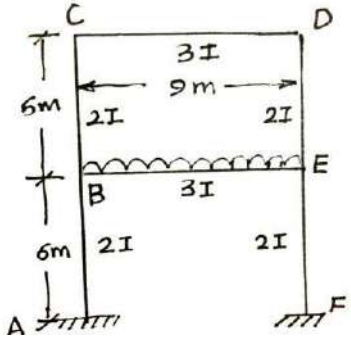
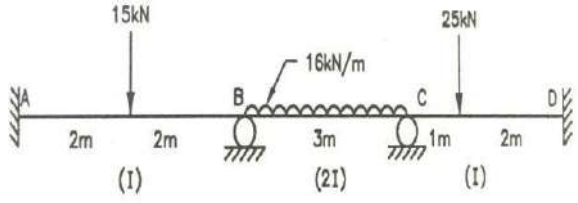
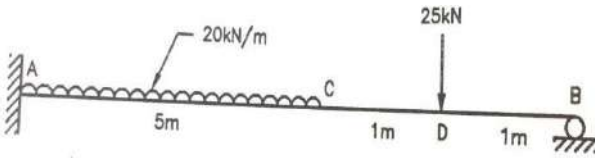
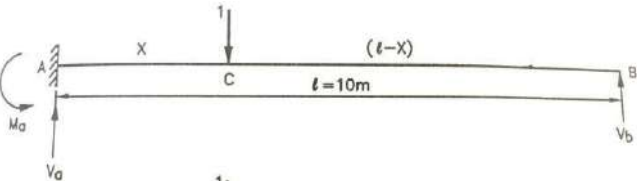
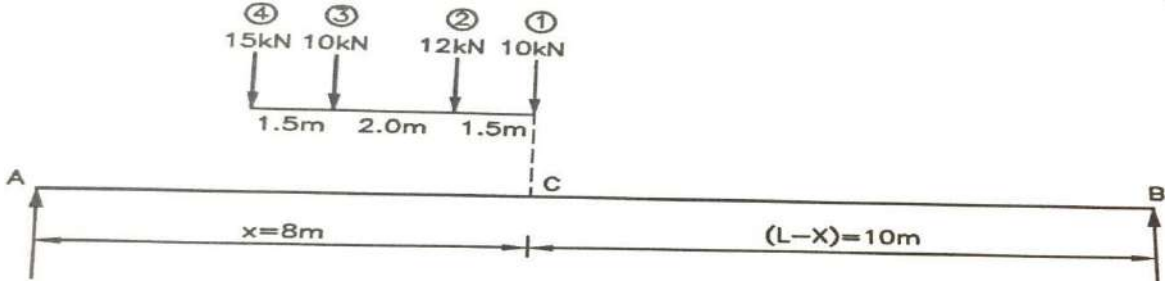
1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

	Marks
<b>Q.1</b> (a) Define portal frame. Discuss the causes of sway in a portal frame.	<b>03</b>
(b) Define: 1) Distribution Factor 2) Relative stiffness	<b>04</b>
(c) Analyse the two storey portal frame shown in figure-1. Consider UDL Value=3 KN/Meter.	<b>07</b>
<b>Q.2</b> (a) Discuss the uses of slope deflection method.	<b>03</b>
(b) Derive shear equation in the case of analyzing the portal frame with side sway.	<b>04</b>
(c) Analyse the beam shown in figure-2 by slope deflection method. Also plot BMD.	<b>07</b>
<b>Q.3</b> (a) Discuss framed structures and enlist the types of framed structures.	<b>03</b>
(b) Discuss actions and displacements.	<b>04</b>
(c) Write the differences between Stiffness Method and Flexibility Method.	<b>07</b>
<b>Q.4</b> (a) State and prove the Castigliano's 1 <sup>st</sup> Theorem.	<b>03</b>
(b) Calculate the central deflection for a simply supported beam of length 'l' subjected to udl 'w' throughout its span using Castigliano's 1 <sup>st</sup> Theorem.	<b>04</b>
(c) Analyse the beam shown in figure-3 by Flexibility Method.	<b>07</b>
<b>Q.5</b> (a) Discuss Castigliano's 2 <sup>nd</sup> Theorem.	<b>03</b>
(b) Determine the reactions at the supports for a propped cantilever beam of length 'l' subjected to a udl 'w' throughout its span using principle of minimum strain energy.	<b>04</b>
(c) For a cantilever beam, show that stiffness and flexibility matrices are reciprocal to each other.	<b>07</b>
<b>Q.6</b> (a) What is influence line diagram? What is the significance of influence line diagram?	<b>03</b>
(b) State Mullar Breslau's principle.	<b>04</b>
(c) Draw the influence line diagrams for support reactions $V_a$ and $V_b$ for a propped cantilever beam shown in figure-4.	<b>07</b>
<b>Q.7</b> (a) Calculate the deflection at the free end of a cantilever beam subjected to udl using Castigliano's 1 <sup>st</sup> Theorem.	<b>03</b>
(b) Discuss Castigliano's 2 <sup>nd</sup> Theorem to solve an indeterminate truss.	<b>04</b>
(c) Draw the Influence line diagram for Reactions at the supports and shear force and bending moments at any section C for a simply supported beam.	<b>07</b>
<b>Q.8</b> (a) Discuss limitations of Castigliano's 1 <sup>st</sup> Theorem.	<b>03</b>
(b) Write the characteristics of ILD for statically indeterminate structures.	<b>04</b>

(c) A train of loads shown in figure-5 crosses a simply supported girder

**07**

of span 18m from left to right. Calculate maximum SF and BM at section 8m from left.

	
<p>Figure-1</p>	<p>Figure-2</p>
	
<p>Figure-3</p>	<p>Figure-4</p>
	
<p>Figure-5</p>	

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2021****Subject Code:3150614****Date:20/12/2021****Subject Name:Structural analysis-II****Time:02:30 PM TO 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.
4. Simple and non-programmable scientific calculators are allowed.

		<b>MARKS</b>
<b>Q.1</b>	(a) Define (a) Distribution Factor (b) Carry over moment (c ) Influence line	<b>03</b>
	(b) Explain (a) Castigliano's first Theorem (b) Flexibility	<b>04</b>
	(c) Derive Slope Deflection Equation using fundamentals with usual notations.	<b>07</b>
<b>Q.2</b>	(a) Explain Muller Breslau principle with appropriate sketches.	<b>03</b>
	(b) Write Characteristics of stiffness matrix.	<b>04</b>
	(c) Using Castigliano's first theorem calculate deflection at free end of cantilever beam shown in Figure.1. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and size of beam as 230x300 mm	<b>07</b>
	<b>OR</b>	
	(c) Determine Reaction $R_A$ and $R_B$ for the propped cantilever beam shown in the Figure. 2 using Castigliano's second theorem.	<b>07</b>
<b>Q.3</b>	(a) Write Slope deflection Equation for the beam shown in figure 3.	<b>03</b>
	(b) Analyze the beam shown in figure 3 using slope deflection method and draw bending moment diagram only.	<b>04</b>
	(c) Analyze the frame shown in the figure 4 using slope deflection method and draw bending moment diagram only.	<b>07</b>
	<b>OR</b>	
<b>Q.3</b>	(a) Differentiate between stiffness and flexibility method	<b>03</b>
	(b) Discuss causes of sidesway in analysis of frame.	<b>04</b>
	(c) Analyze the beam shown in the figure 3 using moment distribution method and draw bending moment diagram.	<b>07</b>
<b>Q.4</b>	(a) Four loads of 30 KN, 40 KN, 30 KN and 20 KN are applied on 9 m mt long beam as shown in figure 5. Draw influence line for shear force at point C located at 5 m from left. Also find maximum positive and negative shear force at point C for given loading.	<b>03</b>
	(b) Draw influence line for bending moment at point C for the beam shown in figure 5 and find maximum bending moment at C for given loading on beam.	<b>04</b>
	(c) Four loads of 20 KN,15 KN,17 KN and 15 KN as shown in Figure 6 are passing from left to right on simply supported beam of span 22 mt with 15 KN load as leading load. Calculate max S.F. and B.M. at point C located at 10 mt from left end.	<b>07</b>
	<b>OR</b>	
<b>Q.4</b>	(a) Draw influence line for 4 m long beam for reaction at B ( $R_B$ ) as shown in figure 7. Calculate ordinates at 1 mt. interval.	<b>07</b>
	(b) Draw influence line for reaction at B ( $R_B$ ) for the 14 mt long two-span beam shown in figure 8. Calulate ordinate at 2 mt interval.	<b>07</b>
<b>Q.5</b>	(a) Find flexibility matrix only for the beam shown in figure 9 considering $M_A$ and $M_B$ as redundant.	<b>07</b>

- (c) Analyze the beam shown in figure 3 by matrix method and draw bending moment diagram only. 07

**OR**

- Q.5** (a) Write assumptions made in cantilever method of approximate analysis. 03  
 (b) Draw only Qualitative influence line diagram for following functions of 2 span continuous beam having support reaction  $R_A$ ,  $R_B$  and  $R_C$ . The point D is located at center of right span BC 04  
     (a) Influence line for  $R_C$   
     (b) Influence line for  $R_A$   
     (c) Influence line for shear at D  
     (d) Influence line for bending moment at D.  
 (c) Analyze the frame shown in figure 10 by portal method and draw shear force and axial force diagram only. 07

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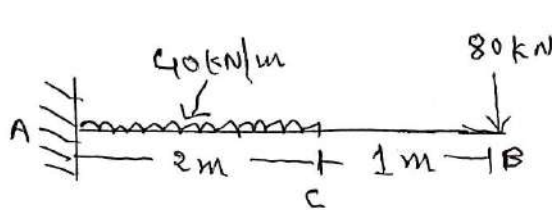


Fig-1 Q-2(c)

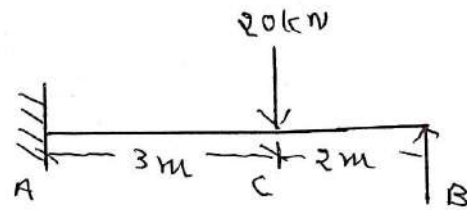


Fig-2 Q-2(c) OR

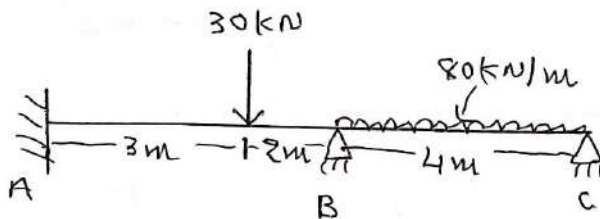


Fig-3

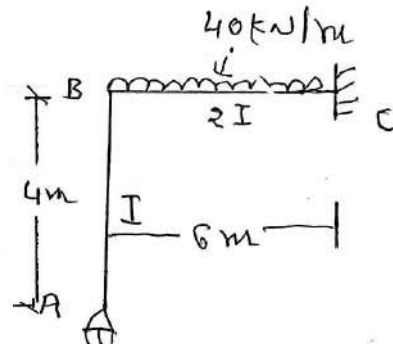


Fig-4 Q-3(c)

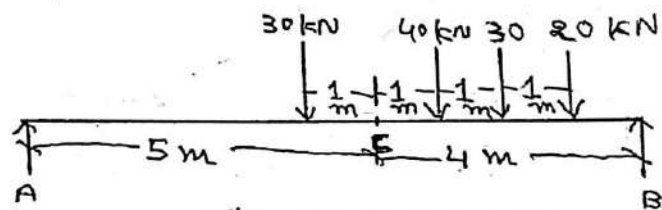


fig-5 Q-4(c)(b)

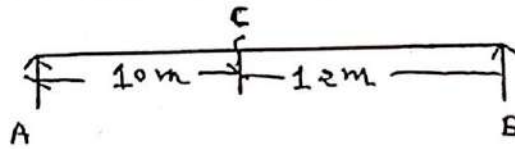
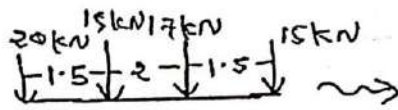


fig-6 Q-4(c)

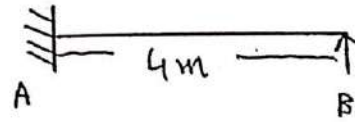


fig-7 Q-4(c) or

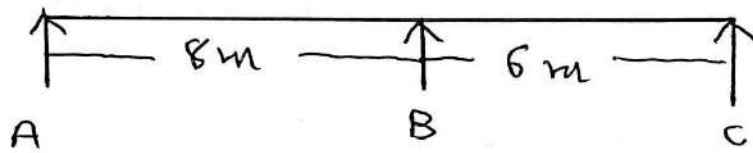


fig-8 Q-4(b) 08

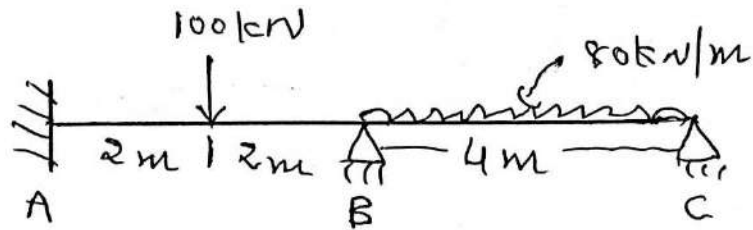


fig-9 Q-5(a)

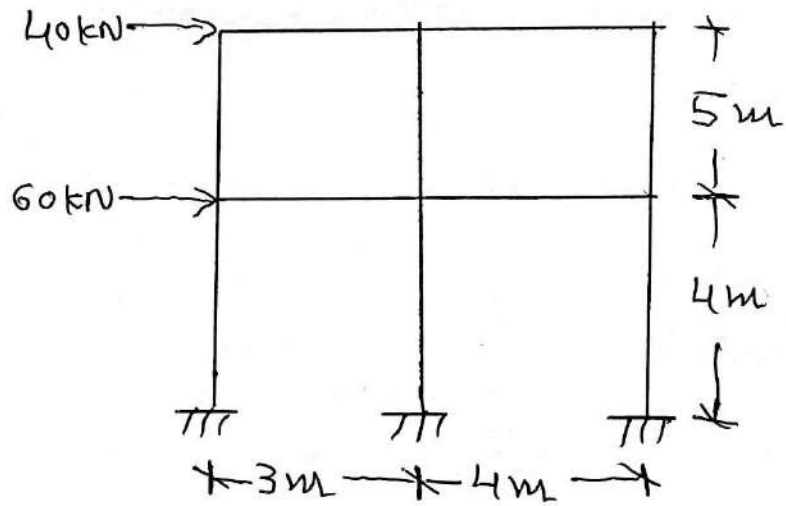


fig-10 Q-5(c) 08

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2021****Subject Code:3150614****Date:17/09/2021****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 Castigliano's first theorem and its usefulness in analysis of structures.                                       | <b>03</b> |
| (b) | Explain following terms: Stiffness, Distribution factor, Carry over factor, Carry over moment.                        | <b>04</b> |
| (c) | Draw the shear force and bending moment diagrams for the beam shown in <b>Fig.1</b> . Use Moment Distribution Method. | <b>07</b> |

- Q.2**
- |     |  |           |
|-----|--|-----------|
| (a) | Find out Distribution factor for the frame shown in <b>Fig. 2</b>                              | <b>03</b> |
| (b) | Write only slope deflection equations for the frame shown in <b>Fig. 3</b> .                   | <b>04</b> |
| (c) | Analyze and Draw the SFD & BMD for the beam shown in <b>Fig. 4</b> by slope deflection method. | <b>07</b> |

**OR**

- |     |   |           |
|-----|---|-----------|
| (c) | Analyze and Draw the SFD & BMD for the beam shown in <b>Fig. 4</b> by Moment distribution method. | <b>07</b> |
|-----|---|-----------|
- Q.3**
- |     |   |           |
|-----|---|-----------|
| (a) | State and explain Castigliano's second theorem with example.  | <b>03</b> |
| (b) | Using Castigliano's first theorem, calculate vertical displacement at free end C for the cantilever beam as shown in <b>Fig. 5</b> Take $E = 2 \times 10^5 \text{ N/mm}^2$ and $I = 7 \times 10^8 \text{ mm}^4$       | <b>04</b> |
| (c) | A propped cantilever beam of span 8 m has fixed support at left end and roller support at right end. It is loaded by a UDL of 15 kN/m up to 4 m from left support. Analyze the beam by Energy principle and draw BMD. | <b>07</b> |

**OR**

- Q.3**
- |     |  |           |
|-----|--|-----------|
| (a) | Calculate Slope and Deflection at free end of a cantilever beam as shown in <b>Fig. 6</b> using unit load method. Take $EI = \text{constant}$        | <b>03</b> |
| (b) | Determine the reaction at B for the propped cantilever beam shown in <b>Fig. 7</b> Use Castigliano's second theorem.                                 | <b>04</b> |
| (c) | Determine deflection at B and slope at C for a cantilever beam shown in <b>Fig. 8</b> take $EI = 10 \times 10^4 \text{ kN.m}^2$ Use unit load method | <b>07</b> |
- Q.4**
- |     |  |           |
|-----|--|-----------|
| (a) | For cantilever of span 'l' draw ILD for support reaction and shear force and bending moment at center.   | <b>03</b> |
| (b) | Two wheel loads 14 kN and 22 kN with fixed distance 2 m between them and 14 kN load leading, crosses a beam of span 8 m from left to right. Draw ILD for SF and BM for a point 3 m from left support and find maximum values of SF and BM. | <b>04</b> |
| (c) | A propped cantilever beam is having 10 m span. Draw ILD for SF at section 4 m from the fixed end.  | <b>07</b> |

**OR**

- Q.4**
- |     |  |           |
|-----|--|-----------|
| (a) | State and explain Muller Breslau principle for influence line.   | <b>03</b> |
| (b) | A simply supported beam AB has span 6m. Draw influence lines for | <b>04</b> |



$R_A$ ,  $R_B$ ,  $V_x$  and  $M_x$  for a section X at 2m from left hand support.

- (c) Draw ILD for SF and BM at section D, 4 m from A, for a two span continuous beam as shown in Fig. 9 07

Q.5 (a) State the characteristics of stiffness matrix. 03

(b) Differentiate between Flexibility method and Stiffness method. 04

(c) Analyze the beam ABC fixed at A and supported on rollers at B and C as shown in Fig. 10. Use flexibility method. 07

OR

Q.5 (a) State the characteristics of flexibility matrix. 03

(b) Formulate flexibility matrix for the actions for a beam shown in Fig. 11. 04

(c) Calculate the stiffness matrix and load vector for the structure as shown in Fig. 12 Take  $EI = \text{constant}$ . Also calculate joint displacements and draw BMD. 07

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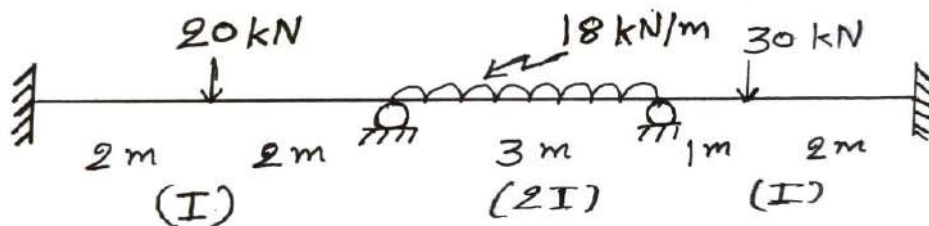


Fig-1

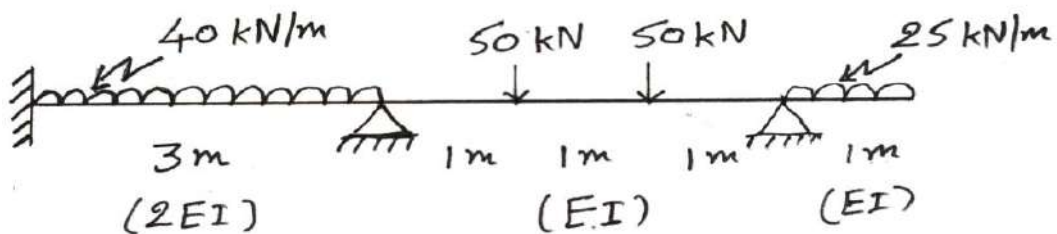


Fig-2

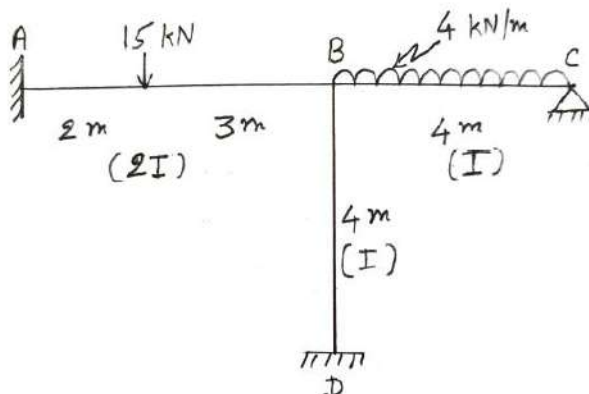


Fig-3

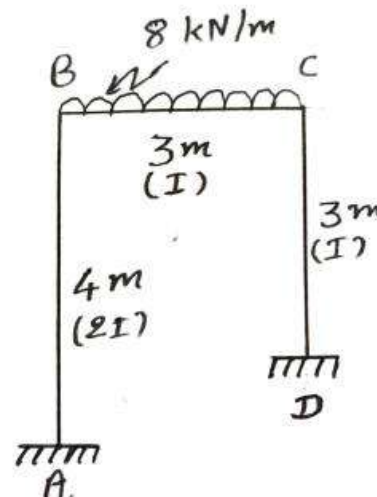


Fig-4

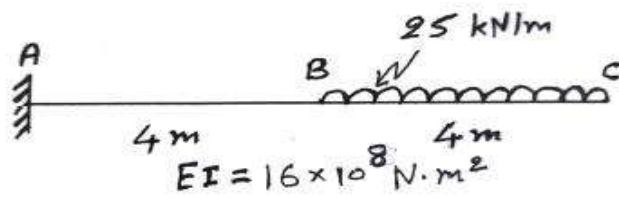


Fig-5

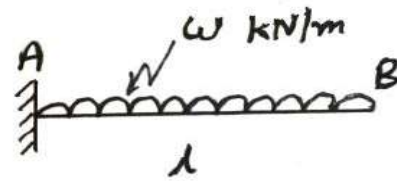


Fig-6

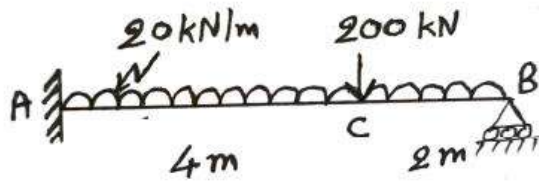


Fig-7

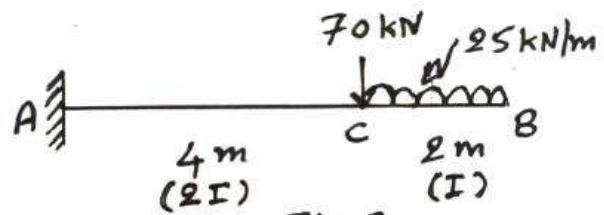


Fig-8

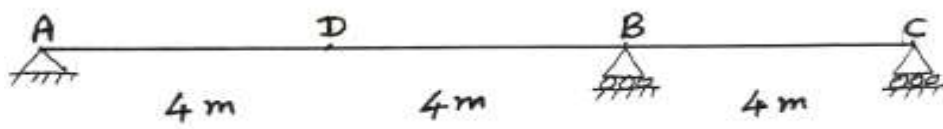


Fig-9

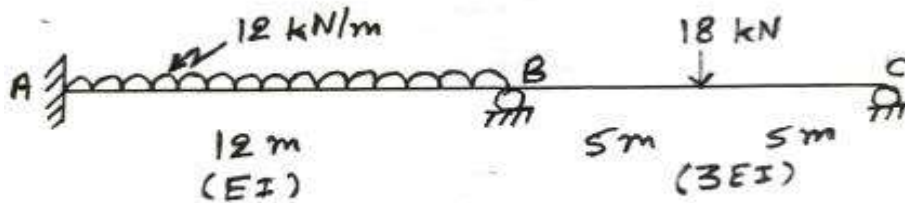


Fig-10

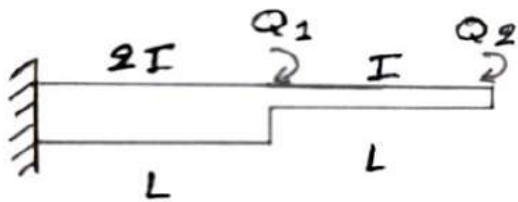


Fig-11

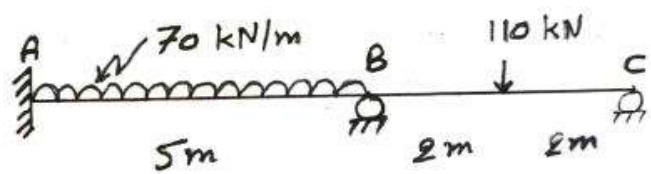


Fig-12

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-V(NEW) EXAMINATION – SUMMER 2022****Subject Code:3150614****Date:13/06/2022****Subject Name:Structural analysis-II****Time:02:30 PM TO 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.
4. Simple and non-programmable scientific calculators are allowed.

		<b>MARKS</b>
<b>Q.1</b>	(a) Define thinfluence line diagram and give statement of Muller Breslau principle.	<b>03</b>
	(b) Derive slope and deflection method equations from first fundamentals.	<b>04</b>
	(c) Determine reactions at the support and draw S.F. and B.M. diagram for a beam shown in Fig.1. Use Castigliano's theorem.	<b>07</b>
<b>Q.2</b>	(a) Write assumptions made in slope deflection method.	<b>03</b>
	(b) Define: Carry over moment, Distribution factor, Carryover factor,	<b>04</b>
	(c) Draw B.M. and S.F. diagram for a beam shown in Fig.2 using Slope and deflection method.	<b>07</b>
	<b>OR</b>	
	(c) Draw B.M. and S.F. diagram for a beam shown in Fig.2 using the Moment distribution method.	<b>07</b>
<b>Q.3</b>	(a) Define: Sway. What are the causes for Sway in portal frames?	<b>03</b>
	(b) Enlist steps of unit load method to analyse indeterminate structures.	<b>04</b>
	(c) Analyse the frame shown in Fig.3 using the moment distribution method.	<b>07</b>
	<b>OR</b>	
<b>Q.3</b>	(a) Explain Castigliano's both theorems.	<b>03</b>
	(b) Draw qualitative shapes of influence lines for reactions in two bay- two storeyed fixed based portal frame.	<b>04</b>
	(c) Determine the horizontal deflection at A of truss as shown in Fig.4. Use unit load method.	<b>07</b>
<b>Q.4</b>	(a) Draw "Restrained Structure" and "Released structure" for a propped cantilever beam.	<b>03</b>
	(b) Explain characteristics of influence line diagram for statically indeterminate structures.	<b>04</b>
	(c) Draw the influence line for reactions $V_a$ , $V_b$ , and $V_c$ for the two span continuous beam having span $AB = 8\text{m}$ and $BC = 4\text{m}$ . Compute ordinates at 2 m interval.	<b>07</b>
	<b>OR</b>	
<b>Q.4</b>	(a) Explain various types of skeletal Structures.	<b>03</b>
	(b) Explain essential features of stiffness method.	<b>04</b>
	(c) Analyse L-bent shown in Fig.5 using flexibility method.	<b>07</b>
<b>Q.5</b>	(a) Define Stiffness. Derive relation between stiffness and flexibility.	<b>03</b>
	(b) A simply supported beam AB has span 8 m. Draw influence line for $R_a$ , $R_b$ , $V_x$ and $M_x$ for a section at 3m from left hand support.	<b>04</b>
	(c) Analyse the beam shown in Fig.6 by flexibility method.	<b>07</b>

OR

- Q.5 (a) Differentiate: Stiffness method and Flexibility method. Which method is suitable for general computer programming? Why? 03
- (b) What is Qualitative influence line and Quantitative influence line? 04
- (c) Analyse the beam shown in Fig.6 by stiffness method. 07

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