Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - V EXAMINATION - WINTER 2025

Subject Code: 3150614 **Date: 25-11-2025**

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)**	Define the influence line diagram and give statement of Muller Breslau principle.	**03**
	(b)	Explain following terms with suitable example: Stiffness, Distribution factor, Carry over factor, Carry over moment.	**04**
	(c)	Differentiate the methodology for Stiffness and Flexibility method. Also suggest the suitability of method in case of high degree of indeterminacy.	**07**
Q.2	**(a)**	State and explain Castigliano's second theorem with example.	**03**
	(b)	Draw qualitative shapes of influence lines for reactions in two bay- two storeyed fixed based portal frame.	**04**
	(c)	Determine the deflection at the mid span of the beam given in the figure 1 below. E = 200 GPa and I = 8 x 10^6 mm^4 using Castigliano or Unit load method.	**07**

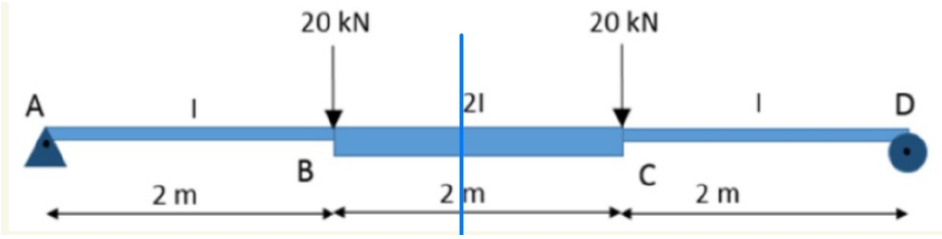


Fig. 1

OR

	(c)	Determine the Influence line diagram of Reaction at B i.e. R_B using the Muller Breslau's Principal for following Fig 2. Also find the ordinate of ILD at E and F.	**07**

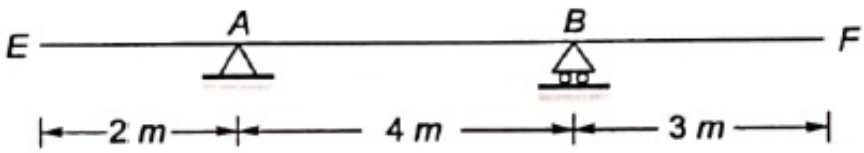
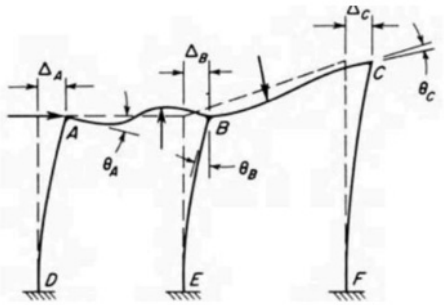


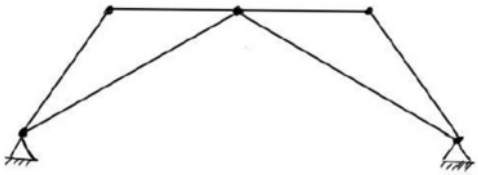
Fig 2

Q.3	**(a)**	Draw "Restrained Structure" and "Released structure" for a three span continuous beam.	**03**
	(b)	Discuss causes of sidesway in analysis of frame.	**04**

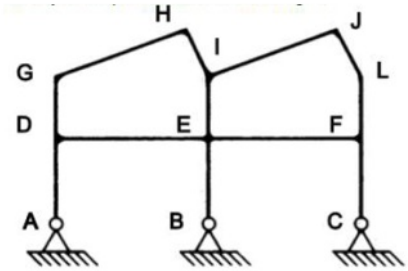
(c) Determine the static Indeterminacy of problems given in Fig 3. **07**



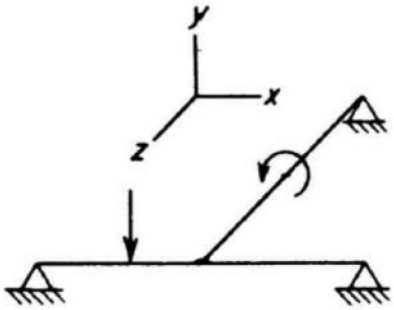
(i) Portal Frame



(ii) Truss



(iii) Plane Frame



(iv) Grid

Fig 3.

OR

(a) Differentiate between slope deflection method and moment distribution method for analysis of plane frame. **03**

(b) Write steps for analysis of plane frame with sway by moment distribution method. **04**

(c) Determine the Kinematic Indeterminacy or Degree of Freedom for problems given in Q. 3 Fig. 3. **07**

Q.4 **(a)** List out the different types of displacement methods used in structural analysis. **03**

(b) Two wheel loads, 50 kN and 150 kN spaced 2m move on a simply supported girder of 12 m long. Determine the values of maximum positive and negative shear force at a section 3m from the left end. Any wheel load can lead the other. **04**

(c) Calculate the final end moments for continuous beam as shown in Fig 4 using the slope deflection method. **07**

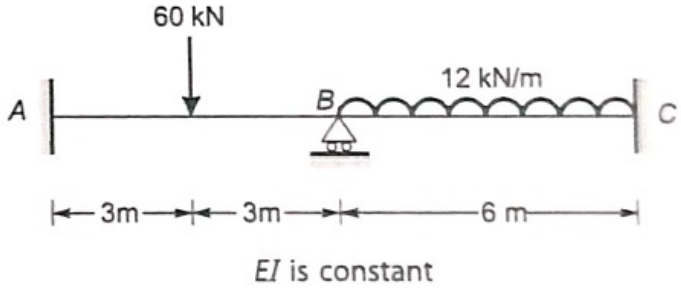


Fig 4

OR

(a) Calculate the distribution factor of continuous beam shown in Fig 5. Portion AB has second moment of area 1.5 I and BC is I. **03**

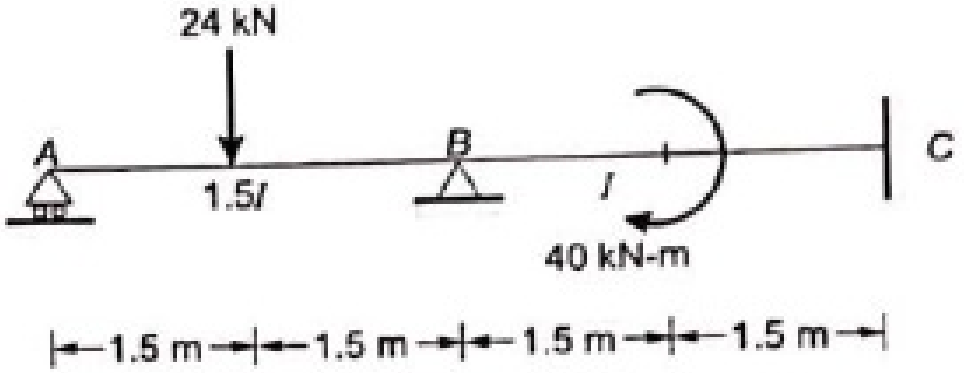


Fig 5

(b) Two wheel loads of 120 kN and 80 kN spaced 2 m apart moves on the span of simple supported girder 16 m long. Determine the maximum bending moment at section 6 m from the left end. Any wheel load can lead the other. **04**

(c) Evaluate the final end moments and reactions at supports using the Moment Distribution method for the Fig 5 (OR Q.4a). **07**

Q.5 **(a)** A unit rotation, without any vertical displacement, is applied at support A of a prismatic beam AB with both ends fixed and of length L and flexural rigidity EI. Evaluate is the moment induced at support B? **03**

(b) Determine the stiffness matrix of a axially rigid Cantilever beam with span L and flexural rigidity EI. **04**

(c) In a simply supported beam, two end rotations are adopted as available degrees of freedom to express stiffness matrix of the structure. The half span of beam from left side has flexural rigidity two times more than remaining span. Determine the stiffness matrix. **07**

OR

(a) Assume that you are calculating deflection at the free end of a cantilever beam under some transverse load conditions. Now, if the stiffness matrix of this linear elastic beam is halved without changing loading condition, then what will be the deflection value at the free end now? **03**

(b) Describe the properties of stiffness matrix for structural analysis. **04**

(c) In a simply supported beam, two end rotations are adopted as available degrees of freedom to express stiffness matrix of the structure. The half span of beam from left side has flexural rigidity two times more than remaining span. Determine the flexibility matrix. **07**

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