GUJARAT TECHNOLOGICAL UNIVERSITY

3rd Semester Civil Engineering – PDDC

Subject Code & Name : X30603 - Structural Analysis - II

Sr. No.	Course content
1.	**Displacement methods :** Analysis of continuous beams & plane frames for various loading including settlement/rotation of support by slope deflection method, Moment distribution method including sway.
2.	**Influence lines :** Muller-Breslau's principle, Influence Line Diagrams for reaction and internal forces in propped cantilever and continuous beams having one static indeterminacy, qualitative ILD for statically indeterminate structures such as beams & frames.
3.	**Matrix methods :** Analysis of indeterminate plane trusses, beams and frames by matrix flexibility and stiffness methods. Application of computer for analysis of various structures.
4.	**Buckling :** Buckling of columns, different end conditions, effective length, least radius of gyration, product of inertia, principal axes and Mohr's circle of inertia, Euler's and Rankin's formulae, columns with initial curvature, eccentrically loaded columns, columns with lateral loading.
5.	**Curved Structures :** Three hinge arches, two hinge arches - circular and parabolic shapes, internal actions and end actions. Forces and end actions in cables. Domes-spherical & conical, longitudinal and hoop stresses.

Term Work:

(A) Laboratory Experiments :

1. ILD of indeterminate beams.
2. Settlement of supports.
3. Buckling of columns.
4. End reactions of Arches.

(B) Assignments :

This will consist of analytical solution of at least 25 problems based on the syllabus of structural analysis II.

Reference Books :

1. Junarkar S.B. : Mechanics of Structures Vol. II
2. Vazirani & Ratwani : Analysis of Structures Vol. II
3. Wang C. K. : Intermediate Structural Analysis
4. Reddy C.S. : Basic Structural Analysis
5. Gere & Weaver : Matrix Analysis of Framed Structures
6. B.C. Punamia : Strength of Materials & Theory of Structures Vol. II

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–III • EXAMINATION – SUMMER • 2014

Subject Code: X 30603 **Date: 24-06-2014**

Subject Name: Structural Analysis-II

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)** Define influence line diagram. Explain its importance. **04**

(b) Draw ILD for V_A , V_B, and M_A for a propped cantilever beam of span 10 m subjected to a unit load. Take 1 m intervals. **10**

Q.2 **(a)** Differentiate between stiffness and flexibility. **07**

(b) A three hinged parabolic arch of span 20 m and central rise of 3 m is subjected to a point load of 100 kN at 5 m from left end support. Calculate Support reactions and find out maximum positive bending moment. **07**

OR

(b) A three hinged circular arch of span 16 m and central rise 4 m is subjected to a central point load of 100 kN on 4 m from left end support. Calculate support reactions and maximum negative bending moment. **07**

Q.3 **(a)** Analyse the beam as shown in **Figure-1** below and draw BMD. Use Slope Deflection Method. **14**

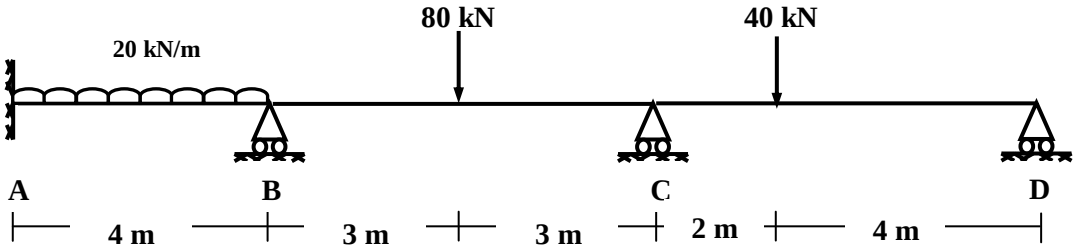

Fig. -1

OR

Q.3 Analyse the beam as shown in **Figure-1** using stiffness method and draw SFD and BMD. **14**

Q.4 **(a)** Calculate the load carrying capacity using Euler's and Rankine's Formula for a rectangular column having 400 mm external diameter and 25 mm thickness. The length of the column is 5m with one end fixed and other hinged. Take E = 2.1 x 10^5 N/mm^2 , Rankine's Constant = 1/1600, fc = 250 N/mm^2 **07**

(b) Define: Distribution Factor, Carry over Factor, Carry over moment, Stiffness **04**

(c) Explain : {AD}, {ADL}, {D} **03**

OR

Q.4 Analyse the plane frame as shown in **Figure-2** below using flexibility method. **14**

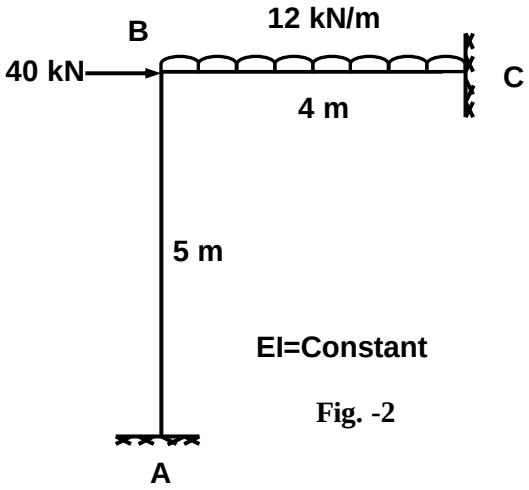

Fig. -2

Q.5 Analyse the plane frame as shown in **Figure-2** using Moment Distribution Method. **14**

OR

Q.5 Analyse the beam as shown in **Figure-3** using Moment Distribution Method. **14**

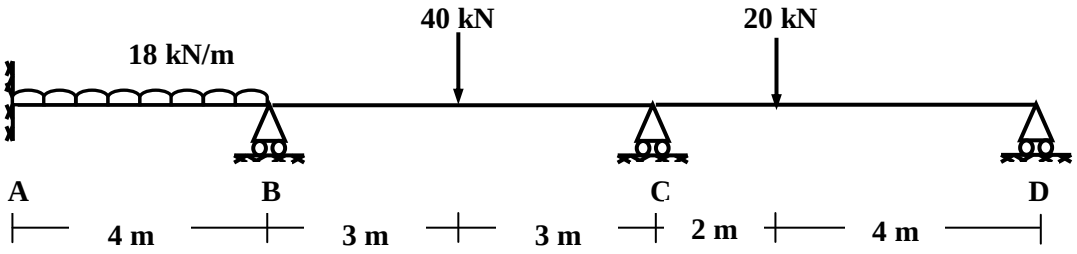

Fig. -3

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–III • EXAMINATION – SUMMER 2013

Subject Code: X 30603 **Date: 15-05-2013**

Subject Name: Structural Analysis-II

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)** Define ILD and Explain Muller Breslau's Principle. **04**

(b) Draw ILD for V_A , V_B and M_A for a propped cantilever beam of span 10 m subjected to a unit load. Take 1 m intervals. **10**

Q.2 **(a)** Define: Distribution factor, carry over factor, Stiffness, Flexibility. **04**

(b) Write assumptions of Euler's Formula. **03**

(c) A three hinged parabolic arch of span 20 m and central rise of 4 m is subjected to a point load of 20 kN at 5 m from left end support. Calculate Support reactions and find out maximum positive bending moment. **07**

OR

(c) A three hinged circular arch of span 16 m and central rise 4 m is subjected to a central point load of 100 kN on left half span. Calculate support reactions and maximum negative bending moment. **07**

Q.3 **(a)** Derive basic equation for slope deflection method. **04**

(b) Analyse the beam as shown in **Figure-1** below and draw BMD. Use Slope Deflection Method. **10**

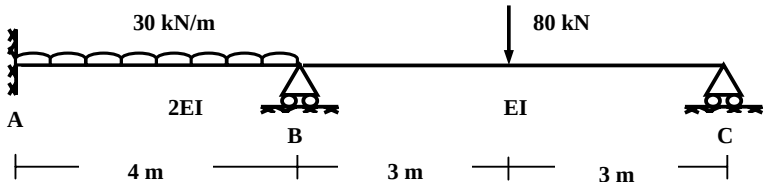

Fig. -1

OR

Q.3 Analyse the beam as shown in **Figure-1** using stiffness method and draw SFD and BMD. **14**

Q.4 **(a)** Calculate the load carrying capacity using Euler's and Rankine's Formula for a rectangular column having 300 mm x 400 mm size and 4 m length. The ends of the column are fixed. Take E = 1.6 x 10^5 N/mm^2 , Rankine's Constant = 1/1600, fc = 250 N/mm^2 **07**

(b) Differentiate between stiffness and flexibility **04**

(c) Describe the various end conditions of the column and their effective lengths. **03**

OR

Q.4 Analyse the plane frame as shown in **Figure-2** below using flexibility method. **14**

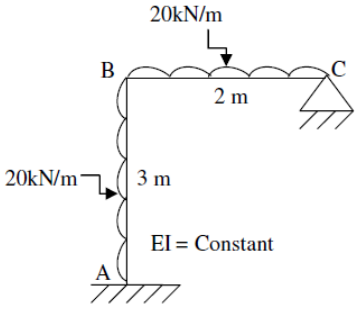

Fig. -2

Q.5 Analyse the plane frame as shown in **Figure-2** using Moment Distribution Method. **14**

OR

Q.5 Analyse the beam as shown in **Figure-3** using Moment Distribution Method. **14**

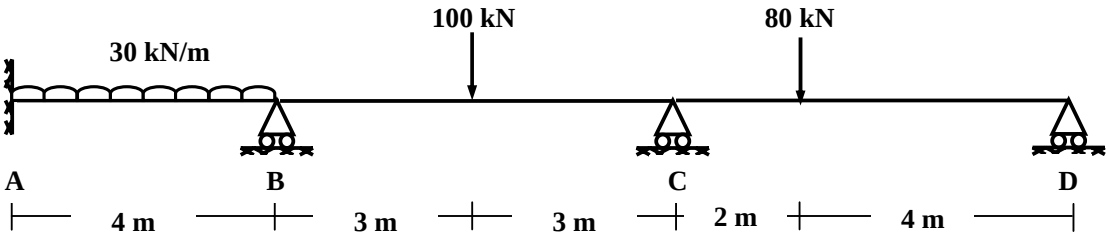

Fig. -3

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER – III • EXAMINATION – WINTER 2012

Subject code: X 30603 **Date: 31/12/2012**

Subject Name: Structural Analysis - II

Time: 10.30 am - 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		Analyze the portal frame as shown in fig. 1 using slope deflaction method, where joint A is fixed and D is hinged. Draw only bending moment diagram only.	**14**
Q.2	**(a)**	Analyze the beam shown in fig. 2 by moment distribution method and draw only bending moment diagram.	**07**
	(b)	Explain Muller – Breslau Principle. Also explain how influence line diagram for any quantity is different than that of normal quantity?	**07**
		OR	
	(b)	Draw ILD for moment at B in the continuous beam shown in fig. 3. Calculate ordinates at 2 m intervals. Assume EI is constant through out.	**07**
Q.3	**(a)**	Analyze the frame shown in fig. 4 by using flexibility matrix method by reliving joint D. Find out unknowns at joint D only.	**10**
	(b)	Find load vector and stiffness matrix the continuous beam shown in fig. 5.	**04**
		OR	
Q.3	**(a)**	Analyze the frame shown in fig. 4 by using stiffness matrix method. Find only end moments.	**10**
	(b)	Find only flexibility matrix for continuous beam shown in fig. 5. Ma and Mb are to be taken as redundant.	**04**
Q.4	**(a)**	A two hinged parabolic arch of span L and rise h carries a concentrated load W at the crown. Prove horizontal thrust developed at spring is as (25/128) WL/h.	**06**
	(b)	Determine the centroidal principal moment of inertia of the equal angle section 30 x 30 x 10mm.	**08**
		OR	
Q.4	**(a)**	A two hinged parabolic arch of span 30m and rise 6 m carries two point loads each 60 kN, acting at 7.5m and 15 m from the left end, respectively. The moment of inertia varies as the secant of slope. Determine the horizontal thrust.	**04**
Q.4	**(b)**	Determine the principal moment of inertia of the unequal angle section 90 x 60 x 10 mm.	**10**
Q.5	**(a)**	Derive the Eular's buckling formula, when the ends of column are hinged.	**07**
	(b)	Analyze the beam shown in fig. 6 by stiffness matrix method. Find only end moments.	**07**

OR

Q.5 **(a)** Define slenderness ratio. Explain the assumptions made in the Eular's formula. Also elaborate the limitation of Eular's formula. **07**

(b) Analyze the continuous beam shown in fig. 7 by moment distribution method. Find only end moments. **07**

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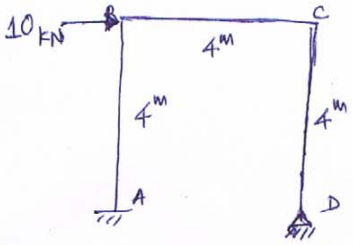


EI const.

(Q. 1) Fig. 1

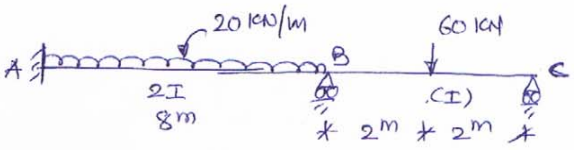


Fig. 2 (Q. 2(a))

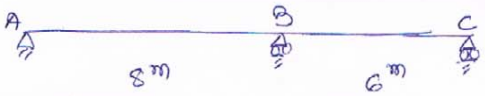


Fig. 3 (Q. 2 (b) OR)

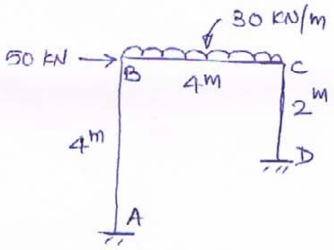


Fig. 4 (Q. 3 (a)) and OR Q. 3 (a))

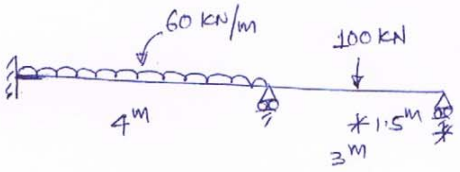


Fig. 5 (Q. 3 (b) and OR Q. 3 (b))

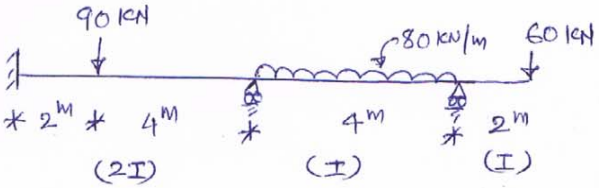
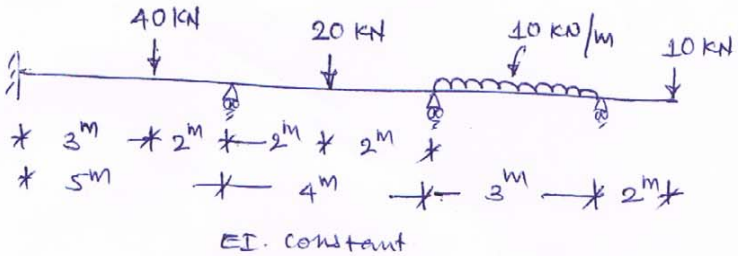


Fig. 6 (Q. 5 (b))



EI. constant

Fig. 7 (Q. 5 (b) - OR)

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC-Semester –III (May-2012) Examination

Subject code: X30603

Subject Name: Structural Analysis- II

Date:16 /05/2012

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)** Analyze the continuous beam as shown in **figure-1** by Slope Deflection Method. Find the end moments of the beam and draw bending moment diagram. **07**

(b) A three hinged arch of span (l) and rise (h) carries a uniformly distributed load of w per unit run over the whole span. Show that the horizontal thrust at each support is $wl^2 / 8h$ and also show that the arch is not subjected to any bending moment at any section. **07**

Q.2 Define the below: **04**

(a) 1. Statically Indeterminacy 2.Distribution Factor 3. Carry over factor 4. Influence line Diagram

(b) State Muller – Breslau's Principle **03**

(c) A three hinged parabolic arch has span 20 m and central rise 3.0 m. It carries a point load of 10 kN at 7.5 m from the left hinge. Calculate the normal thrust, shear and B.M at section 7.5 m from right end hinge. **07**

OR

(c) A light cable, 18 m long, is supported at two ends at the same level. The supports are 16 m apart. The cable supports three loads of 8, 10 and 12 N dividing the 16 m distance in four equal parts. Fine the shape of the string. **07**

Q.3 **(a)** Analyze the beam shown in **figure (2)** by Moment distribution method and draw only the bending moment diagram. **07**

(b) Analyze the frame as shown in **figure (3)** by Moment Distribution Method and draw only the bending moment diagram. **07**

OR

Q.3 **(a)** State the assumptions of Euler's formula. **04**

(b) Define: 1. Radius of gyration 2. Effective length 3. Crippling load **03**

(c) A hollow rectangular column having outside dimension 200 mm x 150 mm and inside dimension 150 mm x 100 mm. Its length is 6.0m and both ends are fixed. Find Euler's load if $E = 2 \times 10^5$ N/mm^2 **07**

Q.4 **(a)** Draw influence line diagram for a propped cantilever beam of span l = 10.0 m for 1. Reaction at A (V_a) 2. Reaction at B (V_b) **07**

(b) A hollow circular pipe having internal dia 400 mm and 50 mm thickness is used as a column. Find critical load it can carry if Slenderness ratio = 90. Take Rankine's constant as 320 N/mm2 and $\alpha = 1/4800$, what will be the length of the column if it is fixed at one end and free at the other end. **07**

OR

Q.4 **(a)** Differentiate between **(any two)** **07**

1. Slope deflection and Moment distribution.
2. Strut and Column
3. Stiffness and Flexibility matrix
4. Long column and Short column

(b) A cable is used to support five equal and equidistant loads over a span of 30 m. Find the length of the cable required and its sectional area if the safe tensile stress is 140 N/mm^2 **07**

The central dip of the cable is 2.5 m and loads are 5 kN each.

Q.5 **(a)** Describe the various end conditions of the column and their effective lengths. **07**

(b) A three hinged parabolic arch has span of 20 m and rise of 5 m. It carries u.d.l of 20 kN/m on left half span and a point load of 120 kN at 5m from right end. Calculate B.M, normal thrust and radial shear at 4m from left end. **07**

OR

Q.5 **(a)** Determine the reactions and moments over the supports for the beam as shown in **figure (4)** using Flexibility method **07**

(b) Determine the end moments for the frame shown in **figure (5)** using Stiffness method. **07**

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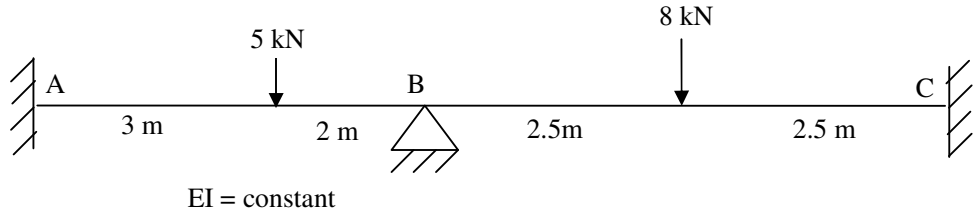

Figure -1

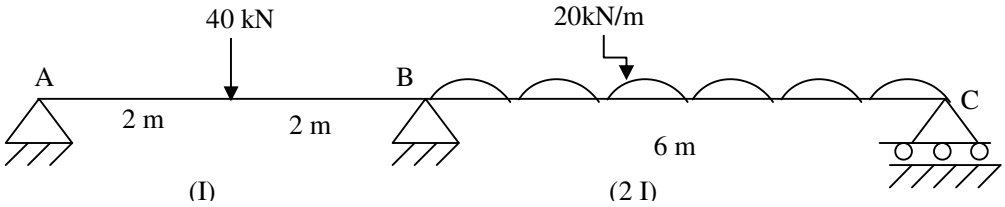

Figure (2)

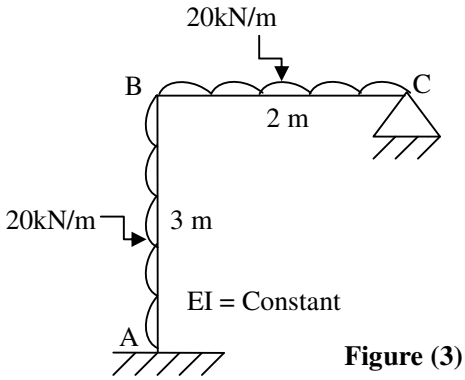

Figure (3)

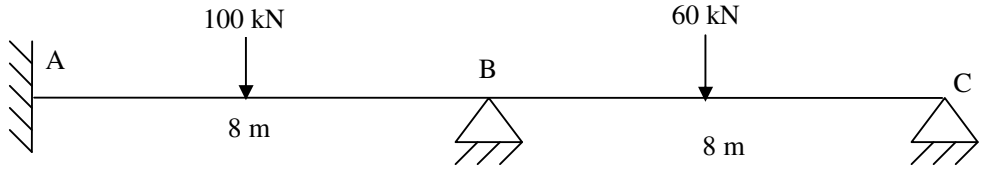

Figure (4)

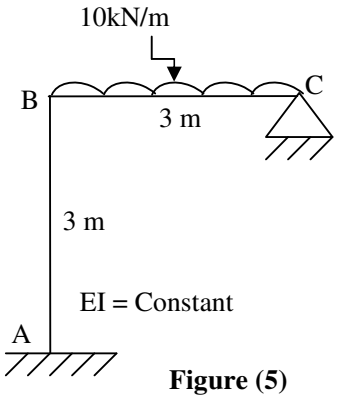

Figure (5)

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC SEM-III Winter Examination-Dec-2011

Subject code: X30603 **Subject Name: Structural Analysis-II**

Date: 17/12/11 **Total Marks: 70** **Time:2:30pm to 5:00pm**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Define distribution factor, carry over factor and relative stiffness with illustration.	**04**
	(b)	Analyze the Beam shown in the **figure (1)** by moment distribution method and draw SF and BM diagram.	**10**
Q.2	**(a)**	Solve the Beam shown in **figure (2)** by stiffness method and draw SFD and BMD.	**07**
	(b)	Solve the Frame shown in **figure (3)** by flexibility method and draw bending moment diagram.	**07**
		OR	
	(b)	Solve the beam shown in **figure (1)** by flexibility method and draw SFD and BMD.	**07**
Q.3	**(a)**	Explain Principle of superposition and Maxwell's reciprocal theorem	**04**
	(b)	Draw ILD for continuous beam as shown in **figure (4)** for R_A ,R_B & R_C using first principle and hence draw ILD for Shear force at D.	**10**
		OR	
Q.3	**(a)**	Compare Curved arch elements with beam elements	**04**
	(b)	Draw ILD for Bending Moment at point D for the beam shown in **figure (4).**	**10**
Q.4	**(a)**	Enlist various methods for obtaining buckling load for a column and explain any one.	**04**
	(b)	Determine the minimum diameter of a hollow cylindrical cast iron column is 4.5 m long with one end fixed and other hinged and internal diameter = 0.65 times the external diameter. Column has to carry a safe load of 250 kN with factor of safety as 3. Take ultimate crushing stress =550MPa, rankine's constant = 1/1600.	**10**
		OR	
Q.4	**(a)**	Define buckling and use basic principle to derive the buckling load for a column hinged at both ends.	**04**
	(b)	A symmetrical three hinged circular arch has a span of 20 m and central rise of 5m. A 20 kN load acting at 4m from the central hinge. Find the reactions and maximum positive and negative bending moment.	**10**
Q.5	**(a)**	Differentiate between Flexibility and Stiffness.	**04**
	(b)	Solve the beam shown in the **figure (5)** by slope-deflection method and draw SF and BM diagram.	**10**
		OR	
Q.5	**(a)**	Differentiate between slope deflection method and Moment distribution method.	**04**
	(b)	A cable of horizontal span 20m is to be used to support 6 equal loads of 40kN each at 3m spacing. The central dip of the cable is limited to 1.5m .Find the length of the cable required and also it's sectional area if safe tensile stress is 700MPa.	**10**

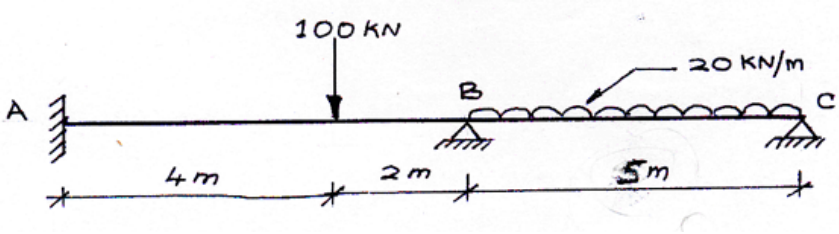

Figure (1)

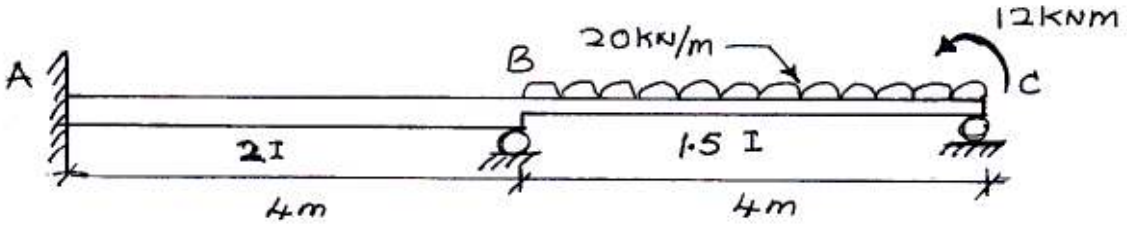

Figure (2)

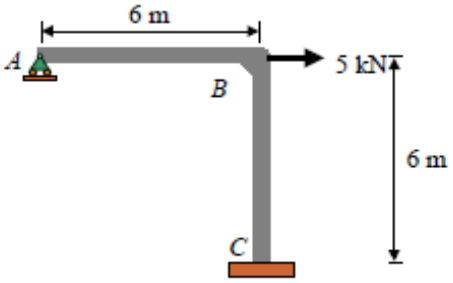

Figure (3)

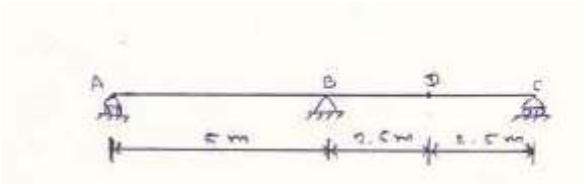

Figure (4)

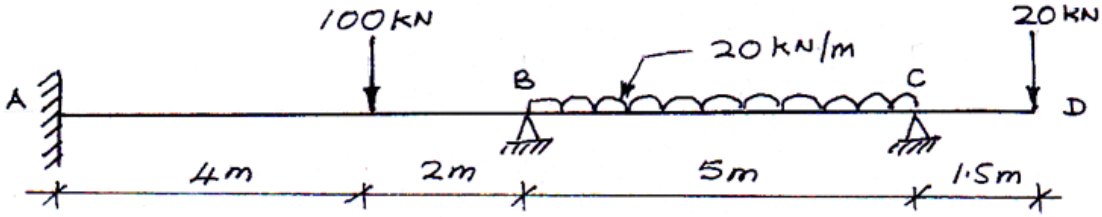

Figure (5)

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

P.D.D.C Sem-III Examination May 2011

Subject code: X30603

Subject Name: Structural Analysis II

Date:25/05/2011 **Time: 10.30 am – 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)**	Draw bending moment diagram for the frame as shown in **figure-1** using slope deflection method.	**07**
	(b)	Draw bending moment diagram for the frame as shown in **figure-1** using moment distribution method.	**07**
Q.2	**(a)**	Draw bending moment diagram for the beam as shown in **figure-2** using moment distribution method.	**07**
	(b)	For the beam as shown in **figure -3** ,construct the influence lines for (I) the shear at the cross section to the left of A,(II) the shear at D,(III)the bending moment at A and (IV) the bending moment at D.	**07**
		OR	
	(b)	One propped cantilever beam *AB* having *A* end is fixed and *B* end is propped. Draw influence line diagram for support reaction at *B* using Muller-Breslau principle. Compute the ordinates at intervals of 2m.	**07**
Q.3	**(a)**	Draw shear force and bending moment diagram of beam as shown in **figure-4** using flexibility matrix method. Choose moments as a redundant.	**07**
	(b)	Draw shear force and bending moment diagram of beam as shown in **figure-4** using stiffness matrix method.	**07**
		OR	
Q.3	**(a)**	Analyze the plane truss as shown in **figure-5** using flexibility matrix method. Take E=200kN/mm^2, A=800mm^2(diagonal member), A=1200mm^2 (other member). Find only diagonal redundant.	**07**
	(b)	Analyze the plane frame as shown in **figure-6** using stiffness matrix method.	**07**
Q.4	**(a)**	An unequal angle 60mmx40mmx6mm is used as a strut for a length of 3m. The strut may be considered as hinged at top and fixed at bottom. Using Euler's formula, calculate the safe load the column can carry, at a factor of safety of 2.0. Take E=2x10^{5}N/mm^2.	**07**
	(b)	A cast iron column of hollow cylindrical section 5 meters long, with ends firmly built-in, has to carry an axial load of 300kN. Determine the section, using a factor of safety of 8. Internal diameter to be 8/10 of the external diameter. Rankine's constants for C.I. are f_c =550 N/mm^2; a =1/1600.	**07**
		OR	
Q.4	**(a)**	A slender strut, 1800mm long and of rectangular section 30mm x 12 mm transmits a longitudinal load P acting at the center of each end. The strut was slightly bend about is minor principal axis before loading. If P is increased from 500N to 1500N, the deflection at the middle of the length increases by 4mm. Determine the amount of deflection before loading. Find also the total deflection and the maximum stress when P is 2000N. Take E=2.15x10^5 N/mm^2	**07**

Q.4 **(b)** A steel column made of a 4, long channel section, 300mmx 100mm, is fixed at both the ends, The thickness of flange is 11.6mm while the thickness of web is 6.8mm. Using Rankine's formula, calculate the load it can carry with a factor safety of 3. Take f_c = 330 N/mm^2 and Rankine's constant = 1/7500. **07**

Q.5 **(a)** A three hinged parabolic arch, hinged at the crown and springing has a horizontal span of meters and a central rise of 2.5m. It carries a uniformly distributed load of 30kn per horizontal meter run over the left hand half of the span. Calculate the reactions at the end hinges. Also calculate the values of the normal thrust, shear force and bending moment at 1.5m, from the left hand hinges. **07**

(b) A parabolic arched rib, span 30meters, central rise 6m, is hinged at the ends. It carries a uniformly distributed load of 20kN per horizontal meter run extending over 12 meter from the left hinge towards the center. Calculate the horizontal thrust, the reactions at the the hinges. Take moment inertia at a section $I = I_0 \sec\theta$ where θ is the inclination of the arch at the section to the horizontal and I_0 is the moment of inertia of the section at the crown. **07**

OR

Q.5 **(a)** A three hinged parabolic arch of 20metre span and 4m central rise carries a point load of 4kN at 4 m horizontally from the left hand hinges. Calculate the normal thrust and shear force at the section under the load. Also calculate the maximum bending moment positive and negative. **07**

(b) A parabolic arch, hinged at the ends has a span 30m and rise 5m. A concentrated load of 12kN acts at 10m from the left hinge. The second moment of area varies as the secant of the slope of the rib axis. Calculate the horizontal thrust and the reactions at the hinges. Also calculate the maximum bending moment anywhere on the arch. **07**

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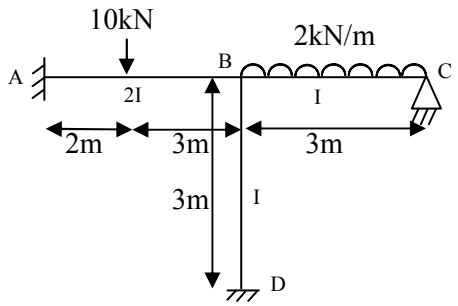

Figure-1

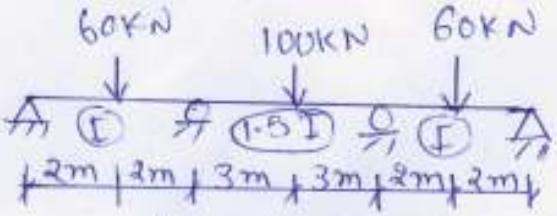

Figure-2

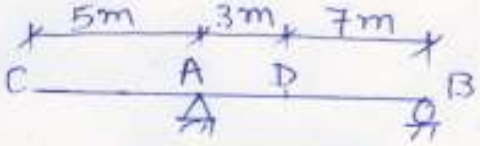

Figure-3

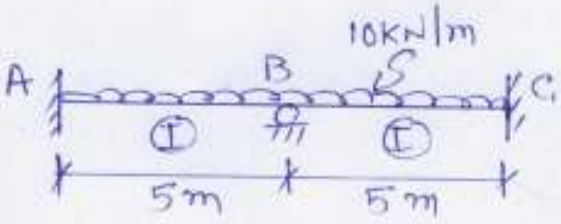

Figure-4

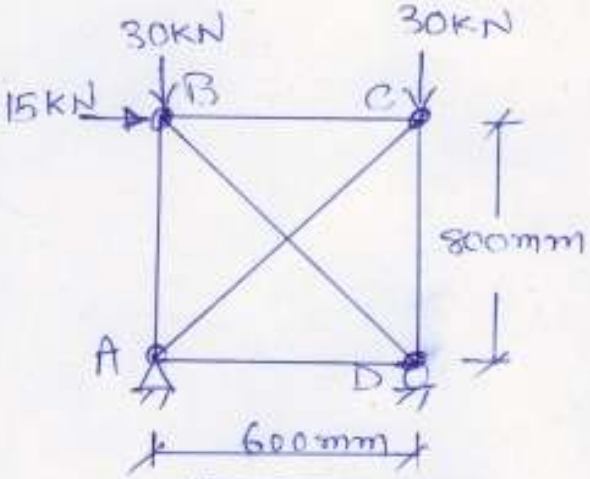

Figure-5

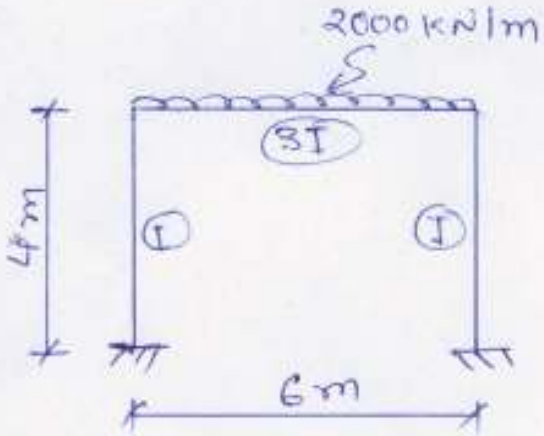

Figure-6

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

P.D.D.C. Sem- III Examination December 2010

Subject code: X30603

Subject Name: Structural Analysis-II

Date: 15 /12 /2010 **Time: 10.30 am – 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)** Analyze the frame shown in **figure-1** by using slope deflection method. **07**

(b) State "Muller Breslau's Principle" and explain it with suitable example. **07**

Q.2 **(a)** Analyze the beam shown in figure-2 by using "Moment distribution method". **07**

(b) Draw influence line diagram for Shear Force at point D for the beam shown in **figure-2.** **07**

OR

(b) Draw influence line diagram for Bending Moment at point D for the beam shown in **figure-3.** **07**

Q.3 **(a)** Derive the stiffness matrix for the frame shown in **figure-4.** **07**

(b) Find reactions of the beam shown in **figure-5** by "flexibility matrix method". **07**

OR

Q.3 **(a)** Derive the flexibility matrix for the frame shown in **figure-4.** **07**

(b) Find bending moments of the beam shown in **figure-5** by using "stiffness matrix method". **07**

Q.4 **(a)** Derive the expressions of horizontal reaction and tension at the ends for the uniformly loaded cable. **07**

(b) Write down short note on the followings, **07**

(1)Assumptions made in "Euler's column theory".

(2)Effective length of column.

OR

Q.4 **(a)** Define the following terms, **07**

(1) Settlement of support

(2) Statically indeterminate structure

(3) Truss

(4) Buckling of column

(5) Longitudinal stress

(6) Hoop stress

(7) Radius of gyration

(b) Determine the minimum diameter of a hollow cylindrical cast iron column is 5 m long with both ends fixed and internal diameter = 0.6 times the external diameter. Column has to carry a safe load of 200 kN with factor of safety is 5. Take ultimate crushing stress =550MPa, rankine's constant = 1/1600. **07**

Q.5 **(a)** Differentiate the followings. **07**

(1)Slope deflection method and Moment distribution method,

(2)Stiffness matrix method and Flexibility matrix Method.

(b) A symmetrical three hinged circular arch has a span of 20 m and central rise of 5 m. A 20 kN load acting at 4m from the central hinge. Find the reactions and maximum positive and negative bending moment. **07**

OR

Q.5 **(a)** Derive the equation of crippling load for the column which is having one end fixed and another end hinged. **07**

(b) Derive the expression of stresses and hoop stresses for dome loaded with uniformly distributed load over its plane length L. **07**

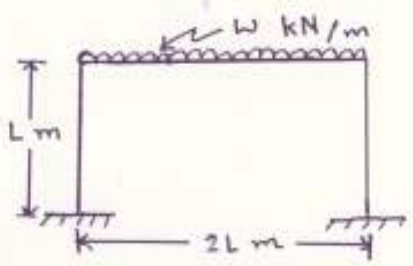

FIGURE-1

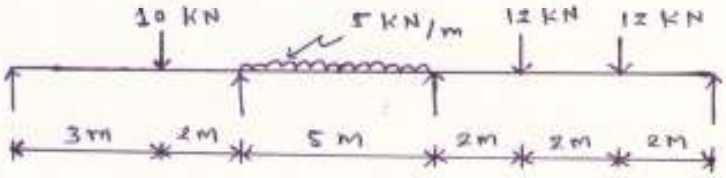

FIGURE-2

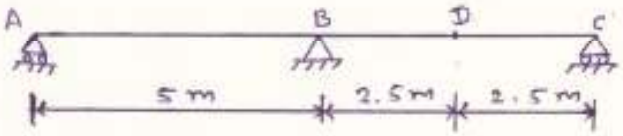

FIGURE-3

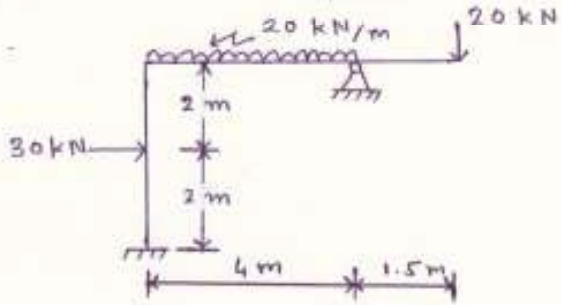

FIGURE-4

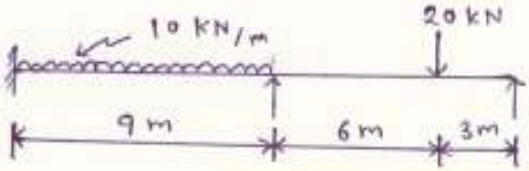

FIGURE-5

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