



**SHANTILAL SHAH ENGINEERING COLLEGE,
BHAVNAGAR
APPLIED MECHANICS DEPARTMENT**



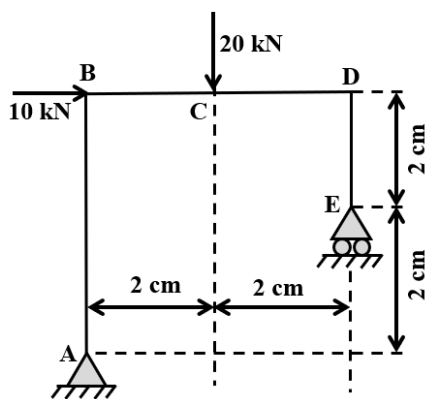
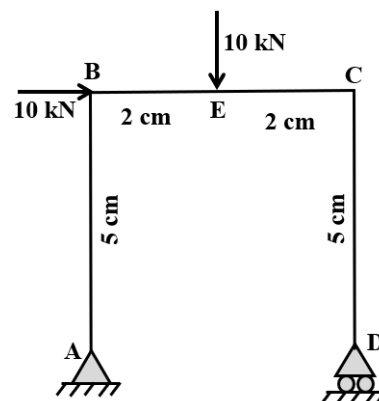
Name of Student :
Enrollment Number :
Name of Subject : **Structural Analysis – I**
Subject Code : **2940601**

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Assignment No: **01****Unit:1 - Fundamental of Statically Determinate Structures**Date: **31/03/2023**Sub Code **2940601**Title of Subject **STRUCTURAL ANALYSIS - I**

#	Questions
[1.1] Basics & Framed Structures	
1	Differentiate statically determinate and indeterminate structures
2	Give advantages & disadvantages of statically indeterminate structures
3	Give advantages of fixed beam over a simply supported beam
4	Differentiate Plane frame and Grid
5	Define Static & Kinematics indeterminacy
6	Give equations of Static and Kinematics Indeterminacy for the following structures with meaning of each term used (i) Beam, (ii) Plane truss, (iii) Plane Frame, (iv) Grid
7	State and explain principle of superposition
8	Explain Maxwell's theorem of reciprocal deflections
9	Find static indeterminacy and kinematic indeterminacy of structures given in Figure - 1.
10	Analyze the rigid jointed portal frame shown in the Figure - 2. Draw shear force diagram, bending moment diagram and axial force diagram
11	For the portal shown in the Figure - 3, find out moment at B, shear, and axial force in member AB.

**Figure- 2****Figure- 3**

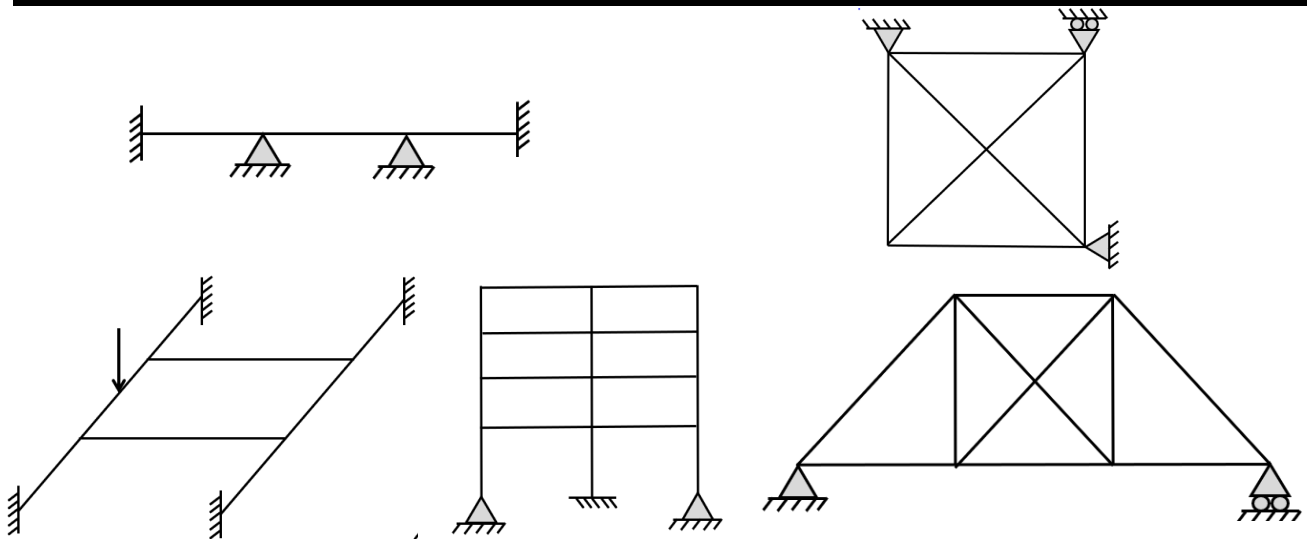
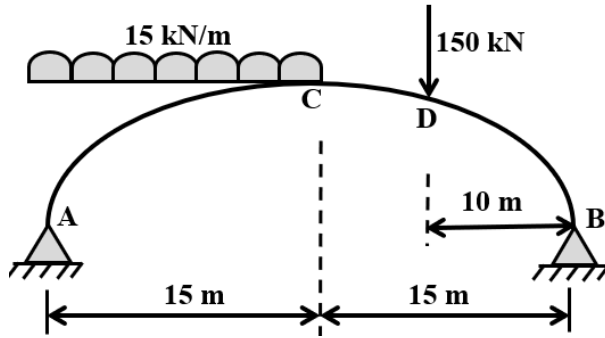


Figure- 1

#	Questions
[1.2] Arches & Cables	
1	Show that for a three hinged parabolic arch carrying a uniformly distributed load over the whole span, the Bending moment at any section is zero and also calculate horizontal thrust at support
2	Write advantages of Three Hinge parabolic arch over a Simply supported beam
	A three hinged parabolic arch of 20.0 m span and 4.0 m central rise carries a point load of 4 kN at 4.0 m from left hand hinge. Calculate the normal thrust and radial shear under the load point. Also calculate the maximum positive and negative Bending Moment.
3	A symmetrical three hinged circular arch has span of 16.0 m and central rise of 4.0 m. it carries a point load of 16 kN at 4.0 m from left hand. Find out 1) magnitude of thrust at springing, 2) Reactions at support, 3) B.M. at 6m from left hinge, 4) maxi +ve & -ve B.M.
4	Calculate reaction at supports and draw bending moment diagram for the three-hinge arch as shown in figure.
	



#	Questions
[1.3] Thin cylinder	
1	Define: a) Thin cylinder, b) Thick cylinder, c) Hoop stress, d) Longitudinal stress
2	Derive the expression of increase in volume for thin spherical cell subjected to internal fluid pressure.
3	A thin cylindrical shell of internal diameter d , wall thickness t and length l , is subjected to internal pressure p . Derive the expression for change in volume of the cylinder
4	A cylindrical vessel 2.5 m long and 400 mm in diameter with 8 mm thick plates is subjected to an internal pressure of 2.5 MPa. Calculate the change in length, change in diameter and change in volume of the vessel. Take $E = 200$ GPa and Poisson's ratio = 0.3 for the vessel material. Also calculate maximum shear stress.
5	A thin cylindrical shell of internal diameter 1200 mm, wall thickness 12 mm and length 3000 mm, is subjected to internal pressure 1.5 N/mm ² . Find the circumferential and longitudinal strains developed and hence find the increase in capacity of the shell.
6	A thin seamless spherical shell of 1.5 m dia. Is 8mm thick. It is filled with a liquid, so that the internal pressure is 1.5 N/mm ² . Determine the increase in diameter & capacity of the shell. Take $E = 200$ GPa & Poisson's ratio = 0.3.



Assignment No:	02	Unit:2 - Strain Energy & Displacement of Statically Determinate Structures	
Date:	31/03/2023		
Sub Code	2940601	Title of Subject	STRUCTURAL ANALYSIS - I

#	Questions
[2.1] Strain Energy	
1	Define: (i) Strain Energy, (ii) Proof Resilience, (iii) Modulus of Resilience, and (iv) Resilience
2	Derive an expression for strain energy stored in a body for any loading condition
3	A steel bar of 100 cm long and rectangular in section 50 mm X 100 mm is subjected to an axial load of 1.5 kN. Find the maximum stress if, (a) the load is applied gradually, (b) the load is applied suddenly, (c) the load is applied after falling through a height of 10 cm. What are the strain energies in each of the above case? Take $E = 2 \times 10^5 \text{ N/mm}^2$.
4	Determine the strain energy of a cantilever beam of span 3.0 m having size 30 mm width and 70 mm depth (a) when 2 kN concentrated load is placed at free end, (b) when a UDL of 2 kN/m is applied over entire span. Take $E = 2 \times 10^5 \text{ N/mm}^2$.
5	A vertical steel rod of 1.25 m long is rigidly secured at its upper end and a weight of 1000 N is allowed to slide freely on the rod through a distance of 50 mm on the stop at the lower end. The upper 750 mm length of the rod has a diameter of 28 mm while the lower 500 mm length is 15 mm diameter. Calculate the maximum instantaneous stress and elongation of the rod and strain energy at maximum elongation. $E = 200 \text{ GN/mm}^2$.
6	A 1.5 m long wire of 30 mm^2 cross sectional area is hanged vertically. It receives a sliding collar of 200 N weight and stopper at the bottom end. The collar is allowed to fall on stopper through 250 mm height. Determine the instantaneous stress induced in the wire, corresponding elongation and the strain energy stored in the wire. Take $E = 2 \times 10^5 \text{ N/mm}^2$.
7	It is found that a bar 36 mm in diameter stretches 2.1 mm under a gradually applied load of 120 kN. If a weight of 1500 N is dropped on to a collar at the lower end of this bar, through a height of 60 mm before commencing to stretch the bar, calculate the maximum instantaneous stress and elongation produced in the bar. $E = 210 \text{ kN/mm}^2$.

#	Questions
[2.2] Displacement of Determinate Beams	
1	Derive relation among slope, deflection, and radius of curvature
2	Derive an equation to determine deflection at centre for the simply supported beam subjected to uniformly distributed load over an entire span.
3	Using Macaulay's method calculates slope at point C and deflection at point D for a simply supported beam as shown in Figure - 1 . Take $EI = \text{Constant}$
4	Determine deflection at B, C and D for the cantilever beam loaded as shown in Figure - 2 using Macaulay's method. Take $E = 2 \times 10^5 \text{ N/mm}^2$ & $I = 2 \times 10^8 \text{ mm}^4$.
5	Explain theorems of moment area method
6	Enlist advantages of double integration method and moment area method
7	Find slope & deflection for the structure shown in Figure - 3 below by Moment area method
8	Define Conjugate beam Theorems
9	Write difference between conjugate beam and real beam
10	Find deflection at C and slope at A for a simply supported beam as shown in Figure - 4 by conjugate beam method
11	Find slope and deflection at point C for the beam shown in Figure - 5 using Conjugate beam method. Take $EI = 20000 \text{ kNm}^2$.

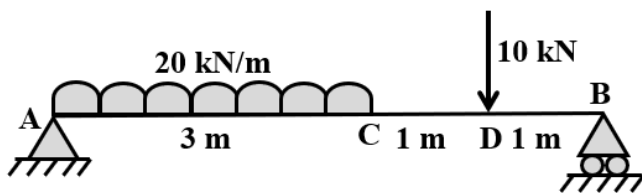


Figure - 1

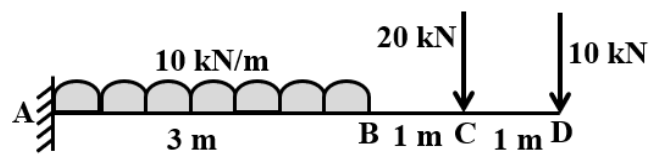


Figure - 2

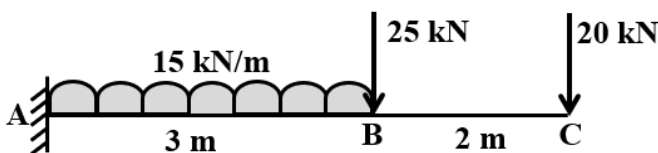


Figure - 3

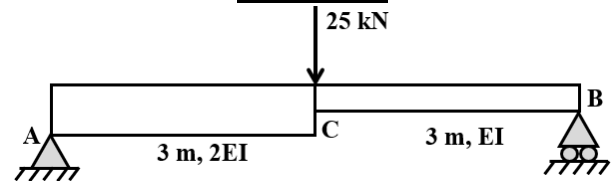


Figure - 4

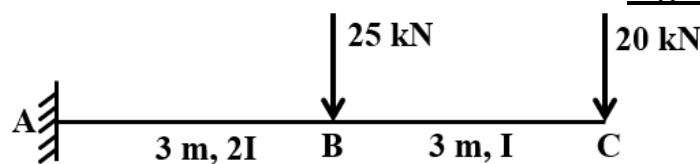


Figure - 5



Assignment No:	03	Unit:3 - Direct and Bending Stresses +
Date:	31/03/2023	Column & Struts
Sub Code	2940601	Title of Subject
		STRUCTURAL ANALYSIS - I

#	Questions
[3.1] Direct and Bending Stresses	
1	Define and Explain core and Kernel of a section with suitable example
2	Write condition for no overturning in a retaining wall
3	Derive the formula for no tension condition at base for a dam
4	Draw 'Core' for the (a) Rectangular section (b) Hollow circular section.
5	Explain the condition to avoid tensile stresses at the base of a masonry dam when subjected to hydrostatic pressure
6	A Raft footing is supporting a vertical load of 150 kN as shown in figure. Compute the stresses at each corner of the pier. Draw stress distribution diagram also
7	A masonry Retaining wall with vertical face is 6.0 m high. Its width at top is 1 m and at base the width is 3.0 m. Weight of masonry is 24 kN/m ³ . Up to what height a soil weighing 15 kN/m ³ can be retained by this wall, so that maximum pressure at the base is 1.2 times the minimum pressure at the base? Angle of repose of the soil is 30°
8	A masonry dam 6.0 m high has 1.0 m top width and 4.0 m base width. It retains water on its vertical face for its total height. Determine the stresses that develop at its base and check the section for its stability. Assume the density of the masonry to be 24 kN/m ³ , safe bearing capacity of the soil as 150 kN/m ² and the coefficient of friction between masonry and foundation bed as 0.3
9	A cylindrical chimney 25 m high of uniform circular section is 6 m external dia. & 2.5 m internal dia. It is subjected to a horizontal wind pressure of 1500N/m ² . If the coefficient of wind pressure is 0.7 & unit weight of masonry is 20 kN/ m ³ . Find the maximum & minimum stresses at the base of the section.



#	Questions
[3.2] Columns and Struts	
1	Explain buckling load in a column
2	Differentiate between column and strut
3	State assumptions and limitations of Euler's formula
4	Define the terms: a) Crippling Load, b) Crushing Load, c) Slenderness Ratio, d) Radius of Gyration,
5	Derive Euler's formula for crippling load a column I) Both end hinges, II) Both ends fixed, III) One end fixed another end hinged, IV) One end fixed another end free
6	A hollow rectangular column having outside dimensions 300mmx200mm and inside dimensions 200mm X 100 mm is fixed at both the ends. Find Euler's crippling load. Take $E = 2 \times 10^5 \text{ N/mm}^2$.
7	A solid cast iron circular column of 5.0 m height is to be erected such that its both ends are hinged. Find the size of the section, if column has to carry a safe axial load of 500 kN. Take Factor of safety of 5. Take $f_c = 500 \text{ N/mm}^2$, Rankine's constant $\alpha = 1/1500$
8	A hollow cylindrical cast iron column is 4.0 meter long, both ends being fixed. Design the column to carry an axial load of 250 kN use Rankine formula and adopt a factor of safety of 5. The internal diameter may be taken as 0.8 times the external diameter. Take $f_c = 550 \text{ N/mm}^2$ and $\alpha = 1/1600$



Assignment No: 04

Date: 31/03/2023

Unit:4 - Statically Indeterminate Beams

Sub Code 2940601

Title of Subject STRUCTURAL ANALYSIS - I

#	Questions
1	Write advantages and disadvantages of fixed end beam.
2	Find out fixed end moment for a fixed beam carrying point load at the centre of the span
3	Calculate fixed end moments if left support of fixed beam is rotates clockwise by an amount ' θ '
4	Derive the equation for fixed end moment developed if one of the supports of a fixed beam settles by amount ' δ '.
5	A propped cantilever beam of span 6.0 m is acted upon by a point load of 20 kN at a distance of 3.0 m from fixed end. Calculate support reactions
6	A fixed end beam of span 7.0 m carries a UDL of 35 kN/m over entire span and a point load of 45 kN at a distance 5.0 m from left support. Calculate fixed end moments and draw BMD. Take $EI = \text{Constant}$.
7	A fixed beam AB carries an U. D. L. 20 kN/m over entire span of 5.0 meter. If support B sink by 1 mm find out fixed end moments
8	Determine all reaction components and draw shear force and bending moment diagrams for a propped beam as shown in Figure - 1 by consistent deformation method.
9	Find reaction at support for the beam shown in figure - 2 with using Consistence deformation method.
10	Determine the support moment for a continuous beam as shown in figure - 3 by moment distribution method. Also draw bending moment diagram.

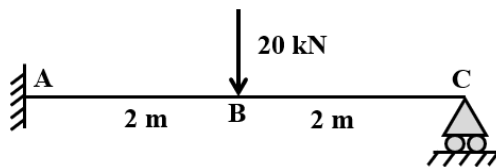


Figure - 1

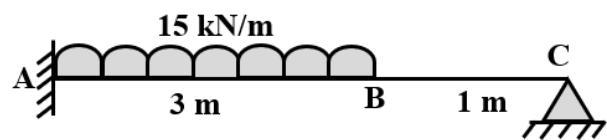


Figure - 2

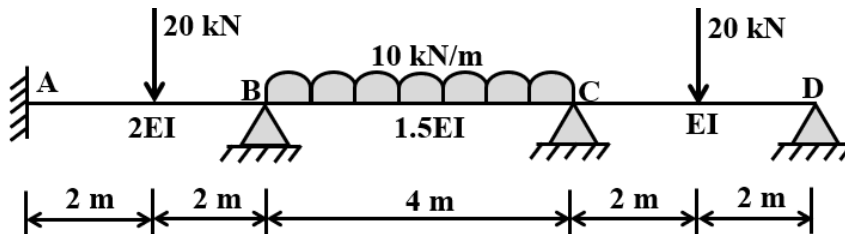


Figure - 3