SHANTILAL SHAH ENGINEERING COLLEGE, BHAVNAGAR
APPLIED MECHANICS DEPARTMENT

Assignment No:	**01**	**Unit:1 - Fundamental of Statically Determinate Structures**	
Date:	**11/03/2022**		
Sub Code	**3140603**	**Title of Subject**	**STRUCTURAL ANALYSIS - I**

#	Questions
	Basics & Framed Structures
1	Give advantages & disadvantages of statically indeterminate structures
2	Differentiate statically determinate and indeterminate structures
3	Differentiate Plane frame and Grid
4	Give advantages of fixed beam over a simply supported beam
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	Determine Structural indeterminacy of the structures shown in figure

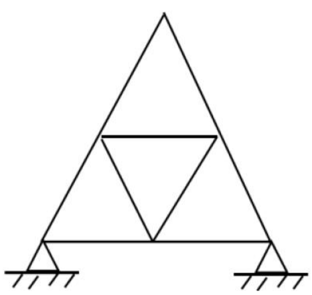


Figure- 1

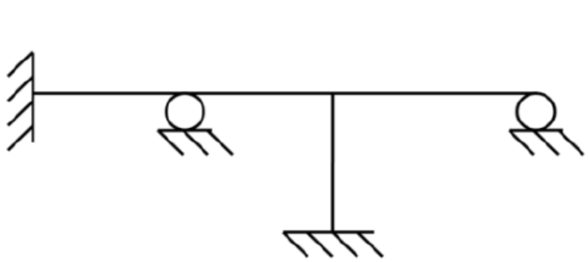


Figure- 2

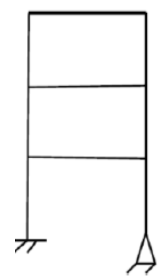


Figure- 3

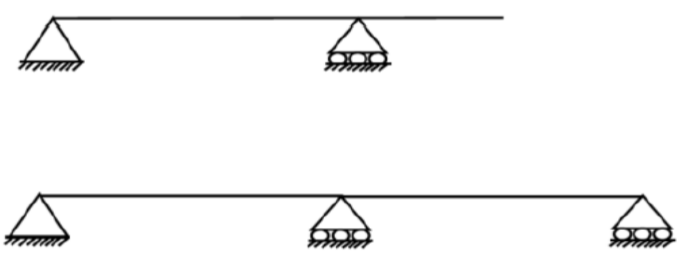


Figure- 4

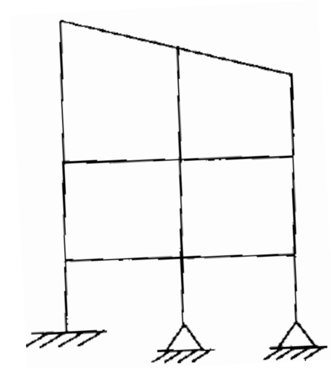
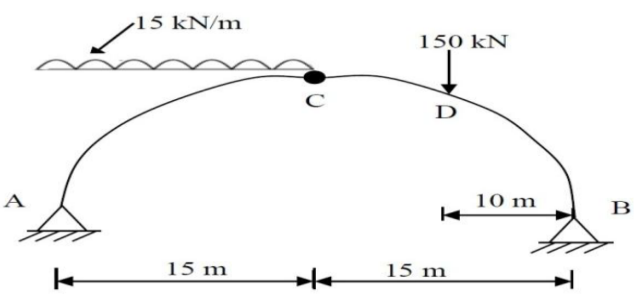


Figure- 5

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
3	A symmetrical three hinged circular arch has a span of 16 m and a rise to the central hinge of 4 m. It carries a vertical load of 20 kN at 5 m from the left-hand end. Find (a) the magnitude of the thrust at the springing, (b) the Reactions at the supports, (c) Bending moment at 8 m from the left hand hinge
4	Calculate reaction at supports and draw bending moment diagram for the three-hinge arch as shown in figure. 
5	A cable of horizontal span of 28 m is to be used to support six equal loads of 50 kN each at 4 m spacing. The central dip of the cable is limited to 2.0 m. Find the length of the cable required and its sectional area if the safe tensile stress is 750 N/mm^2.

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 I, 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: 11/03/2022	
Sub Code 3140603	**Title of Subject** STRUCTURAL ANALYSIS - I

#	Questions
	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 X10^5 N/mm^2.
4	Determine the strain energy of a cantilever beam of span 3m having size 30 mm width and 70 mm depth (a) when 2kN concentrated load is placed at free end, (b) when a UDL of 2 kN/m is applied over entire span. Take E=2 X 10^5 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 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 modulus of elasticity of wire 2 X 10^5 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 kN/mm^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=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 X 10^5 N/mm^2 & I = 2 X 10^8 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 KN-m^2.

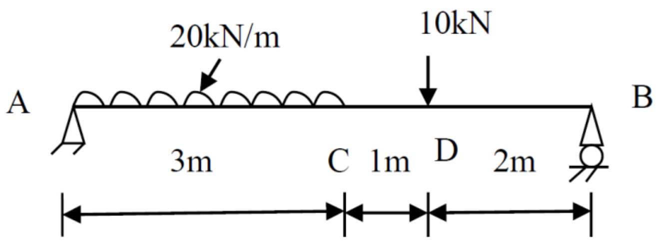


Figure – 1

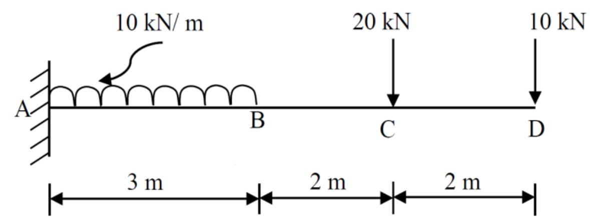


Figure – 2

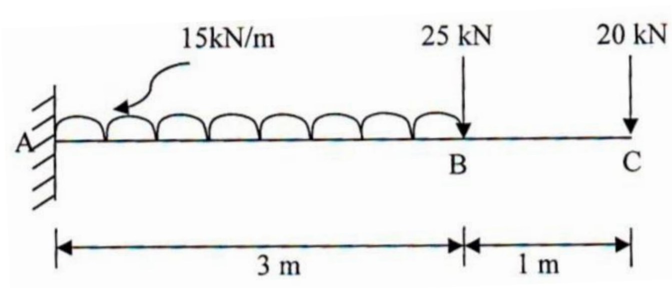


Figure – 3

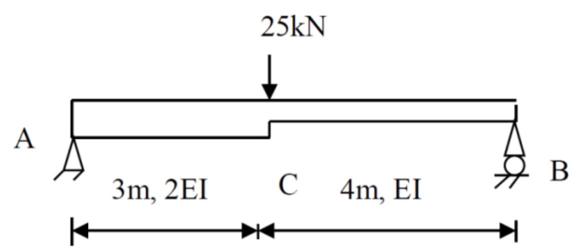


Figure – 4

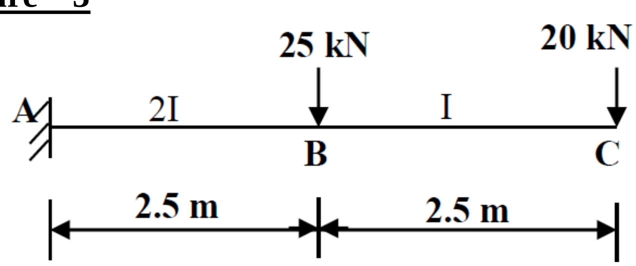
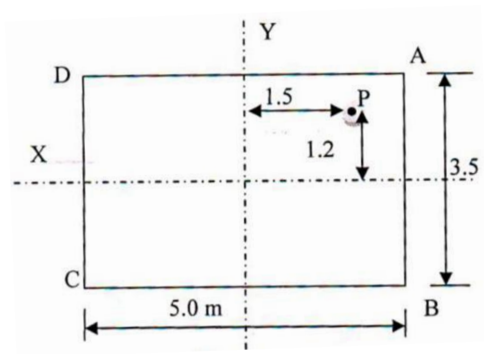


Figure – 5

Assignment No:	**03**	**Unit:3 – Direct and Bending Stresses + Column & Struts**	
Date:	**11/03/2022**		
Sub Code	**3140603**	**Title of Subject**	**STRUCTURAL ANALYSIS - I**

#	Questions
	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 dam 5 m high, 1 m wide at the top and 3 m wide at the base retains water to the full height. The water face of the dam is vertical. Determine the extreme pressure intensities at the base. Water and masonry weigh 10 kN/m^3 and 22 kN/m^3 respectively.
8	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 300
9	A masonry wall, 6.0 m high is of solid rectangular section, 4.0 m wide and 1.5 m thick. A horizontal wind pressure of 1.3 kN/m^2 acts on the 4.0 m side. Find maximum and minimum stresses induced on the base, if unit weight of masonry is 23 kN/m^3.
10	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
11	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/mm^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.
Columns and Struts	
1	Define the terms: a) Crippling Load, b) Crushing Load, c) Slenderness Ratio, d) Radius of Gyration,
2	Explain buckling load in a column
3	Differentiate between column and strut
4	State assumptions and limitations of Euler's formula
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 X 10^5 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 fc = 500 N/mm^2, Rankine's constant α = 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 fc = 550 N/ mm^2 and α = 1/1600

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Assignment No:	**04**	**Unit:4 Statically Indeterminate Beams**	
Date:	**11/03/2022**		
Sub Code	**3140603**	**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 = 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.

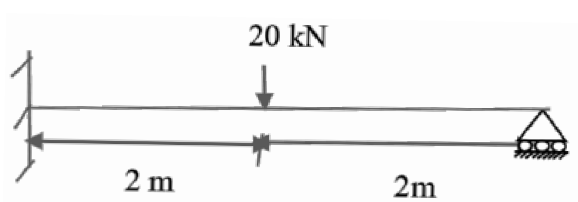

Figure - 1

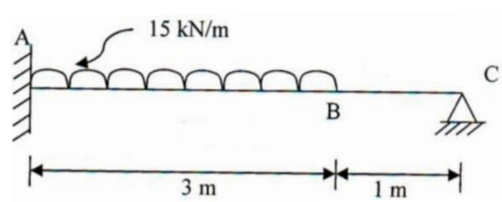

Figure - 2

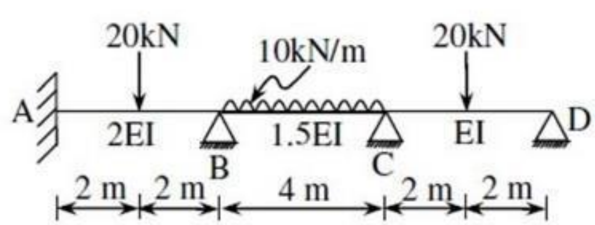

Figure - 3