Assignment No: 01
Date: 07/01/2019

Fundamentals Of Statically Determinate Structures

Sub Code 2140603 **Title of Subject** Structural Analysis - I

#	Questions
1	Indeterminate structures are better than determinate structures" Comment on the statement.
2	Differentiate between stable and unstable structure.
3	Differentiate static and kinematic indeterminacy. Also explain these terms with respect to fixed beam.
4	State and Explain Principle of Superposition.
5	Explain and prove Maxwell's reciprocal theorem
6	Find static indeterminacy and kinematic indeterminacy of structures given in Figure – 1.
7	Analyze the rigid jointed portal frame shown in the Figure – 2. Draw shear force diagram, bending moment diagram and axial force diagram
8	Analyze the grid shown in the Figure – 3 and draw shear force, bending moment and twisting moment diagrams.
9	For the portal shown in the Figure – 4, find out moment at B, shear and axial force in member AB.
10	Find out SI and KI of the structures shown in the Figure – 5.
11	Find SI and KI of structures shown at Figure – 6.

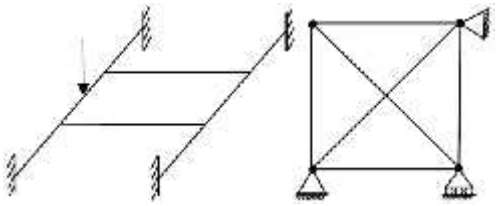

Figure - 1

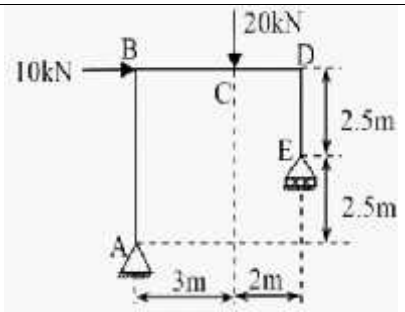

Figure - 2

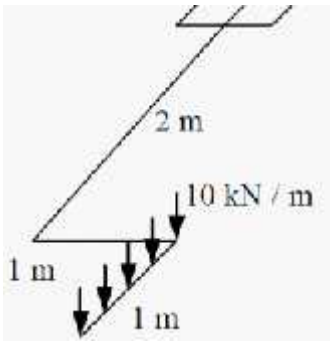

Figure – 3

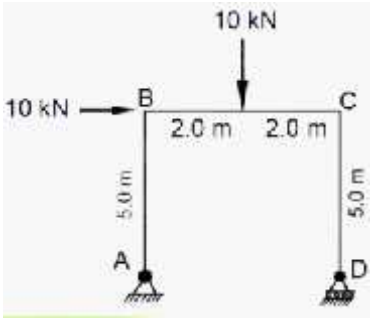

Figure - 4

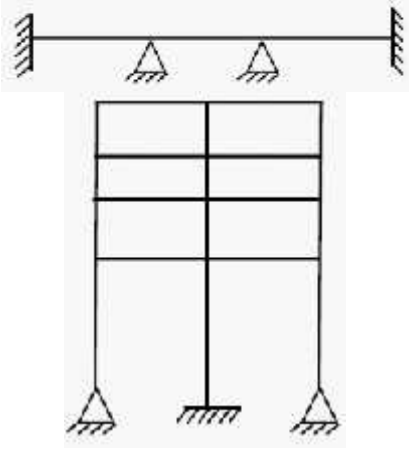

Figure - 5

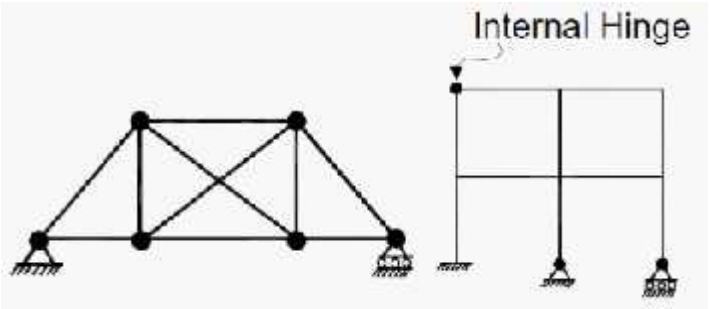

Figure – 6

Assignment No: 02

Date: 07 /01/2019

COLUMNS AND STRUTS

Sub Code 2140603 **Title of Subject** Structural Analysis - I

#	Questions
1	Write the equations for Euler's crippling load for different end conditions of a long column.
2	Write down any four assumptions made for derivation of Euler's crippling load formula.
3	Derive an expression for crippling load when one end of column is fixed and the other end is free.
4	A column one meter long has cross sectional area of 9 cm^2. Find the slenderness ratio if the section is (a) circular, (b) square and (c) hollow circular with inner radius half the outer radius.
5	A hollow cast iron column has outside diameter 200 mm and thickness of 20 mm. It is 4.5 m long and fixed at both ends. Calculate the safe load and ratio of Euler's and Rankine's critical load. For cast iron F_c = 550 N/mm, $\alpha = 1/1600$ and E = 0.8 X 10^5 N/mm^2.
6	A hollow cylindrical cast iron column is 4 m long with both ends fixed. Find the minimum diameter of the column if it has to carry a safe load of 250 kN with a factor of safety of 5. Take internal diameter as 0.8 times the external diameter. Take σc = 500 MPa and Rankine's constant $\alpha = 1/1600$.
7	A 2.5 m long pin ended column of square cross section is made up of timber. Using Euler's formula, find out size of the column with a factor of safety 2 for 250 kN axial load. Consider E = 12.5 GPa, Allowable stress in axial compression = 12 MPa.
8	A circular column has both end hinged with length of 6.0 m and diameter of 160 mm. If the yield strength of the material is 410 N/mm and rankine's constant is 1/4800, calculate Euler's critical load and rankine's critical load.
9	A solid cast iron circular column of 4.0 m height is to be erected such that its one end remains fixed and other end remains hinged. Find the size of the section, if column has to carry a safe axial load of 300 kN. Take factor safety of 5, fc =500 N/mm^2, Rankine's constant $\alpha = 1/1500$.

Assignment No: 03

Date: 07 /01/2019

DIRECT AND BENDING STRESSES

Sub Code 2140603 **Title of Subject** Structural Analysis - I

#	Questions
1	A rectangular pier of size 300 mm X 300 mm is subjected to a compressive load of 900 kN at one of the corner. Find the stress intensities at all four corners of the pier and draw stress distribution diagram. If the load is acting at the center of the pier, also draw the stress distribution diagram. Refer **Figure – 1.**
2	A concrete dam of trapezoidal section has a top width 2 m, bottom width of 6 m and height 12 m. It retains water up to 10 m on vertical side. Determine the maximum and minimum stress intensities at the base of the section. The density of the material used is 24 kN/m^3 and density of water as 10 kN/m^3. Refer **Figure – 2.**
3	A masonry chimney 20 m high is of circular section, the external diameter and internal diameter of the section being 6 m and 4 m respectively. The chimney is subjected to horizontal wind pressure of 1.2 kN/m^2 of projected area. Find the maximum and minimum stresses at the base. Take unit weight of masonry as 20 kN/m^3.
4	A short column has a square section 300 mm X 300 mm with a square hole of 150 mm X 150 mm as shown in **Figure – 3**. It carries an eccentric load of 1500 kN, located as shown in figure. Determine the maximum and minimum stresses across the section.
5	A masonry retaining wall is 6 m high, 0.75 m wide at top and 2 m wide at bottom. The wall is retaining soil up to top. The face of the wall on soil side is vertical. The lateral pressure due to soil varies from zero at top to 3.2 kN/m^2 at bottom. Specific weight of masonry is 24 kN/m^3. Draw stress distribution at base of wall due to self-weight of wall alone and due to self-weight of wall and soil pressure, and shear force at section under load. Draw BMD.
7	A cylindrical chimney 24 m high of uniform circular section is 4 m external dia. & 2 m internal dia. It is subjected to a horizontal wind pressure of 1000 N/mm^2. If the coefficient of wind pressure is 0.66 & unit wt. of masonry is 22 kN/m^3. Find the maxm & minm stresses at the base of the section.
8	For a trapezoidal masonry dam as shown in the **Figure – 4**, plot the stress distribution at the base. Take density of masonry = 20 kN/m^3.

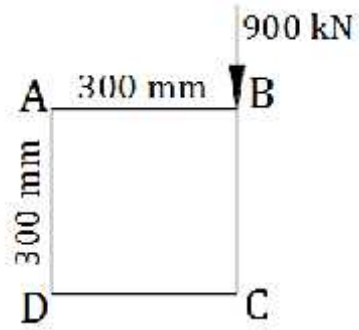

Figure – 1

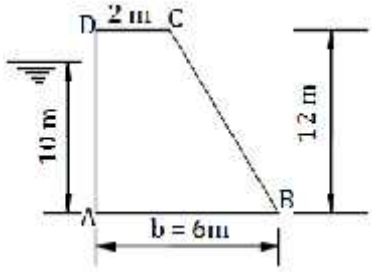

Figure – 2

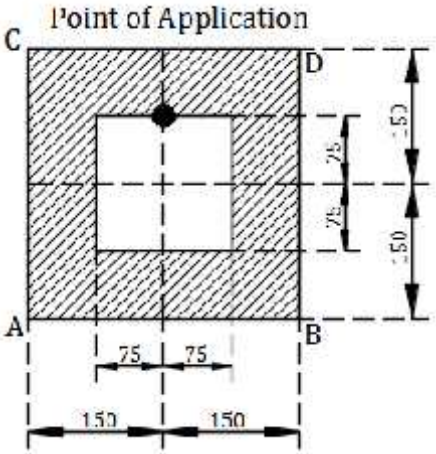

Figure - 3

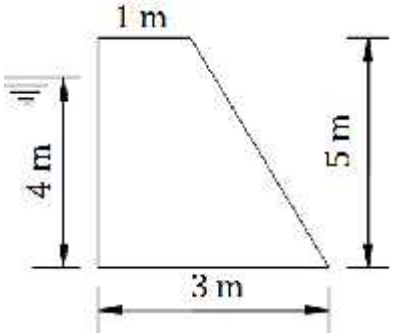

Figure – 4

Assignment No: 04
Date: 07/01/2019

DISPLACEMENT OF DETERMINATE BEAMS AND PLANE TRUSS

Sub Code 2140603 **Title of Subject** Structural Analysis - I

#	Questions
1	Differentiate between the real beam and conjugate beam
2	Derive an expression of slope at supports for the simply supported beam subjected to point load at the center of the beam.
3	For the simply supported beam subjected to UDL, derive the expressions for slope at support and deflection at the mid span using moment area method.
4	Find the slope and deflection at the free end B of a cantilever beam AB as shown in Figure – 1 by moment area method. Take I = 2 X 10^8 mm^4, E = 2 X 10^5 N/mm^2.
5	Find the slope and deflection at the center C of a simply supported beam AB as shown in Figure – 2 by moment area method. Take I = 2 X 10^8 mm^4, E = 2 X 10^5 N/mm^2.
6	Find the deflection and slope for a cantilever beam shown in Figure – 3, using moment area method.
7	A simply supported beam of 3 m span carries two point loads of 120 kN and 80 kN at a distance of 0.6 m and 2 m from the left support. If for the beam I = 16 X 10^8 mm^4 and E = 2.1 X 10^5 N/mm^2, Calculate the deflection under loads using Macaulay's method. Refer Figure – 4.
8	A cantilever 2 m long is loaded as shown in Figure – 5. Find slope and deflection at free end using Macaulay's method. Take E = 200 GPa and I = 160 X 10^6 mm^4.
9	For the beam shown in figure – 6, determine the deflection and slope at C using Macaulay's method.
10	Find the slope at A and deflection under B for the beam shown in the Figure – 7 using Macauly's method. Take EI = 3000 kN m^2
11	Determine the horizontal deflection and vertical deflection at D, of a truss shown in Figure – 8. Using unit load method. AE is same for all members.
12	For the truss shown in figure – 9, calculate horizontal deflection at C by unit load method. Area of member AB is 400 mm^2. Area of AC and BC is 600 mm^2.
13	Find out slope and deflection at C for the beam shown in Figure – 10 by conjugate beam method.
14	Find the slope and deflection at point A and B for the beam shown in the Figure – 7 using conjugate beam method. EI = 3000 kN m^2
15	Find the deflection and slope under load 100 kN using conjugate beam method. Refer Figure – 11. Take E = 200 GPa and I = 150 X 10^6 mm^4.

16	Find the slope and deflection at point B and C for the beam shown in the Figure – 12. Take EI = 3000 kN m^2
17	Find the slope at A and deflection under C for the beam shown in the Figure – 13. Take EI = 3000 kN m^2

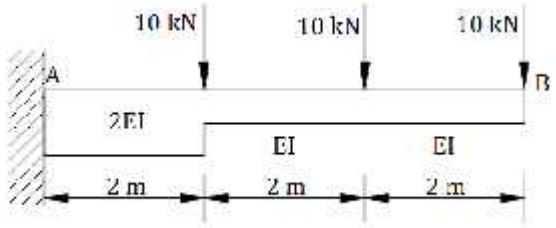

FIGURE – 1

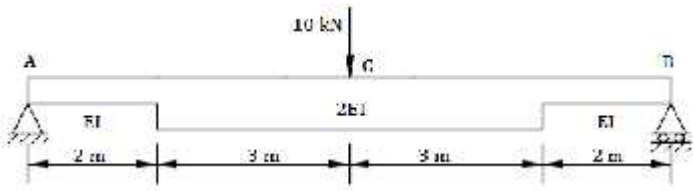

FIGURE – 2

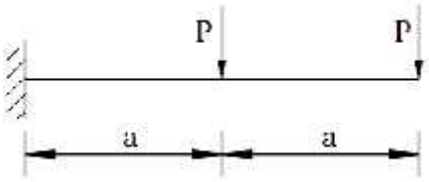

FIGURE – 3

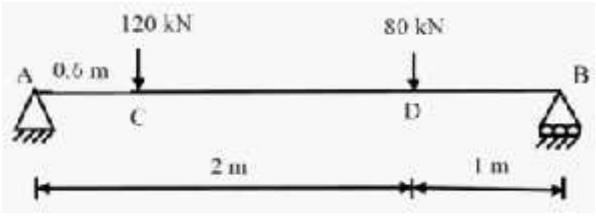

FIGURE – 4

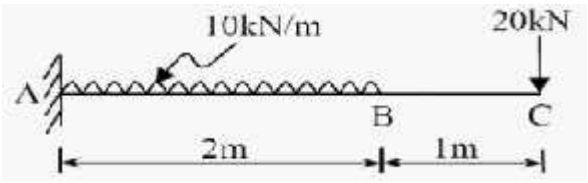

FIGURE – 5

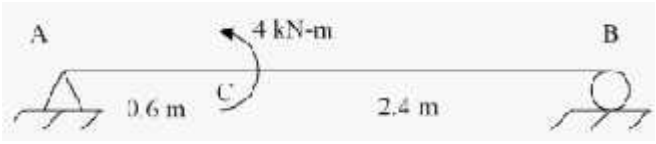

FIGURE – 6

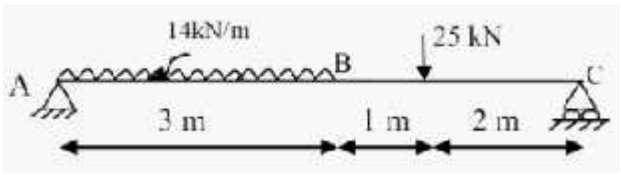

FIGURE – 7

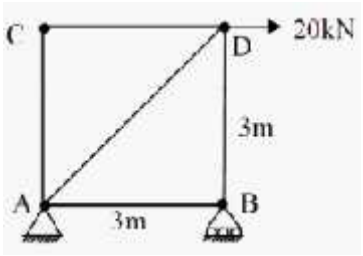

FIGURE – 8

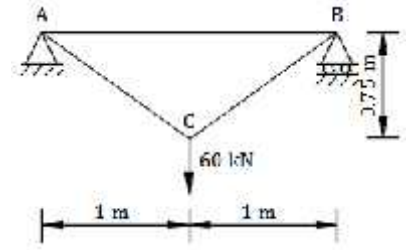

FIGURE – 9

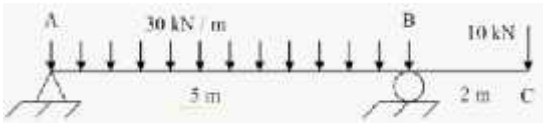

FIGURE – 10

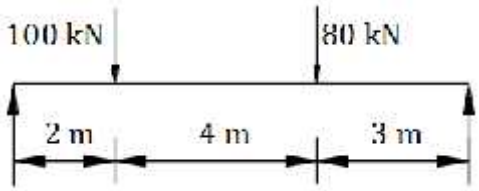

FIGURE – 11

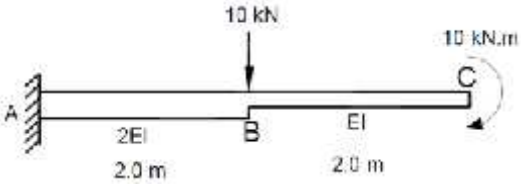

FIGURE – 12

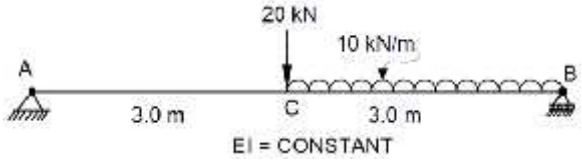

FIGURE – 13

Assignment No: 05

Date: 07 /01/2019

Fixed Beams & Consistent Deformation Method

Sub Code 2140603 **Title of Subject** Structural Analysis - I

#	Questions
1	Analyse a fixed beam has span 5 m subjected to central point load of intensity 20 kN. Draw bending moment diagram
2	Derive the equation for fixed end moment developed if one of the supports of a fixed beam settles by amount 'δ'.
3	Calculate fixed end moments if left support of fixed beam is rotates clockwise by an amount 'θ '
4	Find out fixed end moment for a fixed beam carrying point load at the center of the span
5	A fixed beam AB carries an U.D.L. of 20 kN/m over entire span of 5 meter. If support B sink by 1 mm find out fixed end moments
6	A beam AB of span 5 meter fixed at both ends carries a uniformly distributed load of 20 kN/m over the whole span. The left end 'A' rotates clockwise by 0.8^0 & right end 'B' sinks by 10 mm. Determine the fixed end moments & the reactions at the supports. Draw also shear force & bending moment diagrams. Take E = 200 kN /mm^2 & I = 10 X 10^7 mm^4
7	Find reaction at support for the propped cantilever beam having span 6 m and U.D.L. of 10 kN/m throughout span using Consistence deformation method. Take EI = Constant.

Assignment No: 06

Date: 07/01/2019

STRAIN ENERGY

Sub Code 2140603 **Title of Subject** Structural Analysis - I

#	Questions
1	Define: Strain energy, Resilience, Proof Resilience and Modulus of Resilience.
2	Derive the equation for strain energy stored in an element due to Bending.
3	Write-down only equation for strain energy due to Impact
4	Derive the equation for strain energy stored in an element due to Torsion
5	Derive an expression for strain energy stored in a body for any loading condition
6	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 x 10^5 N/mm^2
7	Determine the ratio of strain energy stored in the simply supported beam AB of span 5 m carries a 25 kN load at a central point and the same load uniformly distributed over its entire span

Assignment No:	**07**	**Thin Cylinder**	
Date:	**07 /01/2019**		
Sub Code	**2140603**	**Title of Subject**	**Structural Analysis - I**

#	Questions
1	The Boiler is subjected to an internal pressure of 3 N/mm^2. The thickness of plate is 2.5 cm and the permissible tensile stress is 125 N/mm^2. Find out the maximum diameter when efficiency of longitudinal joint is 90 % and circumferential joint is 35 %.
2	The boiler shell is to be made of 20 mm thick plate having a limited tensile stress of 125 N/mm^2. If the efficiencies of the longitudinal & circumferential joints are 80% and 30% respectively. Determine a. The maximum permissible diameter of the shell for an internal pressure of 2.5 N/mm^2. b. Permissible intensity of internal pressure when shell diameter is 1.6 m
3	A vessel in the shape of a spherical shell of 1.4 m internal diameter and 4.5 mm thickness is subjected to a pressure of 1.8 N/mm^2. Determine the stress induced in the material of vessel.
4	A thin spherical cylinder of 1.2 m internal diameter is subjected to an internal pressure of 1.6 N/mm^2. If the permissible stress is 80 N/mm^2 and joint efficiency is 75 % find out the maximum thickness of shell.
5	A thin spherical shell of internal diameter 1.5 m and thickness 8 mm is subjected to internal pressure of 1.5 N/mm^2. Determine the increase in diameter & increase in volume in shell. Take E = 2 X 10^5 N/mm^2 and Poisson ratio = 0.3

Assignment No: 08

Date: 07 /01/2019

Arches, Cables & Suspension Bridges

Sub Code 2140603 **Title of Subject** Structural Analysis - I

#	Questions
1	A three hinged parabolic arch of 20 m span and 4 m central rise carries a point load of 4 KN at 4 m from left hand hinge. Calculate the normal thrust and radial shear under the load point. Also calculate the maximum positive and negative B.M.
2	A three hinged parabolic arch rib has span of 84 m and rise of 18 m to the central pin at the crown. The rib carries load of intensity 2 kN/m over a length of 1/3 of the span from left hand hinge. Calculate the B.M at quarter span points.
3	A symmetrical three hinged circular arch has span of 16 m and central rise of 4 m. it carries a point load of 16 kN at 4 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	A light cable 18 m long is supported at two ends at same level. The supports are 16 m apart. The cable supports three loads 8, 10, 12 kN diving 16 m distance in four equal parts. Find the shape of the cable and tension in various parts.