SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY:: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code: Mechanics of Solids (18CE0111) **Course & Branch**: B.Tech – CE

Year & Semester: II-B.Tech & II-Semester **Regulation:** R18

UNIT 1

THIN & THICK CYLINDERS

1. A cylindrical thin drum 80 cm in diameter and 3 m long has a shell thickness of 1 cm. If the drum is subjected to an internal pressure of 2.5 N/mm^2, Determine (i) change in diameter (ii) change in length and (iii) change in volume. Take E= 2x 10 5 N/mm^2 Poisson's ratio 0.25. [10M]

2. A cylindrical shell 100 mm long 200mm internal diameter having thickness of a metal as 10 mm is filled with a fluid at atmospheric pressure. If an additional 200 mm^3 pumped into the cylinder, Find i) the pressure exerted by the fluid on the cylinder and ii) the hoop stress induced . Take E = 2 X 10^5 N/ mm^2 and Poisson's ratio is 0.3 [10M]

3. A copper cylinder, 90 cm long, 40 cm external diameter and wall thickness 6 mm has its both ends closed by rigid blank flanges. It is initially full of oil at atmospheric pressure. Calculate additional volume of oil which must be pumped into it in order to raise the oil pressure to 5 N/mm 2 above atmospheric pressure. For copper assume E= 1.0 x 10 5 N/mm 2 and Poisson's ratio 1/3. Take bulk modulus of oil as K= 2.6 x 10 3 N/mm^2. [10M]

4. A closed cylindrical vessel made of steel plates 4 mm thick with plane and, carries fluid under a pressure of 3 N/ mm^2. The dia, of cylinder is 30 cm and length is 80 cm , calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and volume of the cylinder. Take E = 2 X 10^5 N/ mm^2 and Poisson's ratio is 0.286 [10M]

5. Derive an expression for hoop and radial stresses across thickness of the thick cylinder [10M]

6. Calculate the thickness of metal necessary for a cylindrical shell of internal diameter 160 mm to withstand an internal pressure of 8 N/mm 2 , if maximum hoop stress in the section is not exceed to 35N/mm^2 . [10M]

7. Determine the maximum and minimum hoop stress across the section of a pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 8 N/mm 2. Also sketch the radial pressure and hoop stress distribution across the section. [10M]

8. A compound cylinder is made by shrinking a cylinder of external diameter 300 mm and internal diameter of 250 mm over another cylinder of external diameter 250 mm and internal diameter 200 mm. The radial pressure at the junction after shrinking is 8 N/mm^2 . Find the final stresses set up across the section, when the compound cylinder is subjected to an internal fluid pressure of 84.5 N/mm^2 . [10M]

9. A steel cylinder of 300 mm external diameter is to be shrunk to another steel cylinder of 150 mm internal diameter. After shrinking, the diameter at the junction is 250 mm and radial pressure at the common junction is 28 N/mm^2 . Find the original difference in radii at the junction. Take E = 2 x 10 5 N/mm^2. [10M]

10. A thick spherical shell of 200 mm internal diameter is subjected to an internal fluid pressure of 7 N/mm^2 . If the permissible tensile stress in the shell material is 8 N/mm^2, Find thickness of the shell. [10M]

UNIT-II

DIRECT AND BENDING STRESS

1. A masonry dam of rectangular section, 20 m high and 10 m wide, has water upto a height of 16 mon its one side find:
   i) Pressure force due to water on one meter length of the dam
   ii) Position of centre of pressure
   iii) The position at which the resultant cuts the base and Maximum and minimum intensities at the base of the dam. Take weight density of masonry is19.62 kN/m^3 and of water 9.81 kN/m^3
   [10M]

2. Derive kernel of section for Rectangular, Circular and Hallow Circular sections [10M]

3. a) Derive the equation for resultant stresses when a column of rectangular section is subjected to a load which is eccentric to both axes [7M]

   b) A short column of rectangular cross-section 80 mm by 60 mm carries a load of 40 KN at a point 20 mm from the longer side and 35 mm from the shorter side. Determine the maximum compressive and tensile stresses in the section.
   [5M]

4. Determine the maximum and minimum stresses at the base of a hollow circular chimney of height 20m with external diameter 4m and internal diameter 2m. The chimney is subjected to a horizontal wind pressure of intensity 1 KN/m^2. The specific weight of the material of chimney is 22 KN/m^3
   [10M]

5. Find the position of centroid I_{XX} and I_{YY} for an unequal angle section 125mm X 75mm X 10mm
   [10M]

UNSYMMETRICAL BENDING

6. A cantilever of length 2m carries a point load of 2KN at the free end. The c/s of cantilever is an unequal of dimensions 150X50X15 mm^3. The small leg of angle 50 mm is horizontal. The load passes through the centroid of the c/s. Determine a) position of neutral axis b) the magnitude of maximum stress setup at the fixed section of the cantilever [10M]

7. A 45 mm X 45 mm X 5 mm angle is used as a SSB over a span of 2.4m. It carries a load of 300 N along the vertical axis passing through the centroid of the section. Determine the resulting bending stress on the outer corners of the section, along the middle section of the beam [10M]

8. Determine the centroidal moment of inertia of the equal section 30 X 30X 10 mm^3 [10M]

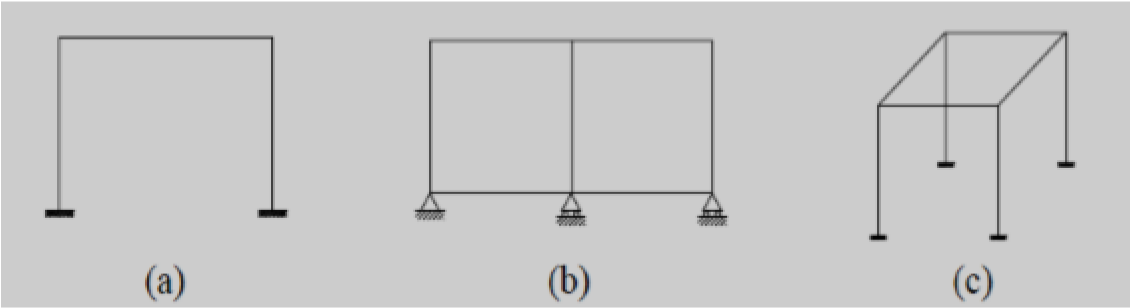
9. a) What is unsymmetrical bending [2M]

   b) Determine the prinicipal moment of inertia of unequal angle section 200X 150 X 10 X mm^3
   [10M]

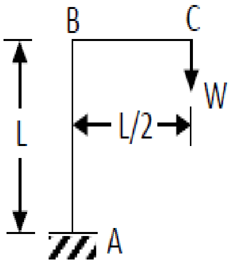
10. A wooden beam of c/s 100 mm X 150 mm is used as shown in fig to support a sloping tiled roof. It has an effective span of 4m and carries a uniformly distributed load 3 KN/M acting vertically download. Determine the maximum stresses developed in the beam [10M]

UNIT-III
INTROUDUCTION

1) Determine the number of indeterminacy for the three frames shown in figure below.

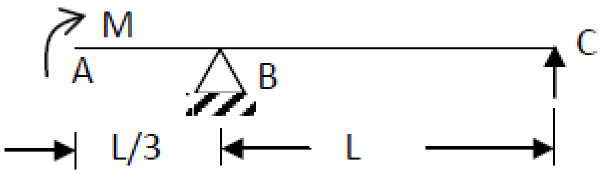


2. A vertical load W is applied to the rigid cantilever frame shown in figure below. Assuming EI to be constant throughout the frame determine the horizontal and vertical displacements of the point C. Neglect axial deformation. [**10M]**

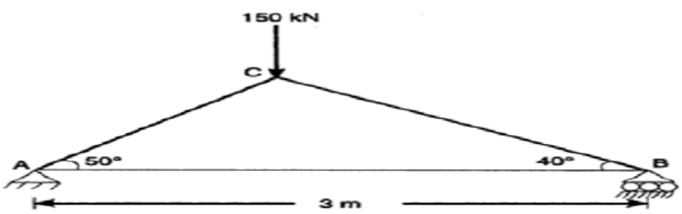


3. Calculate the central deflection and slope at ends of a simply supported beam carrying a U.D.L. **w** per unit length over the whole span. [**10M]**

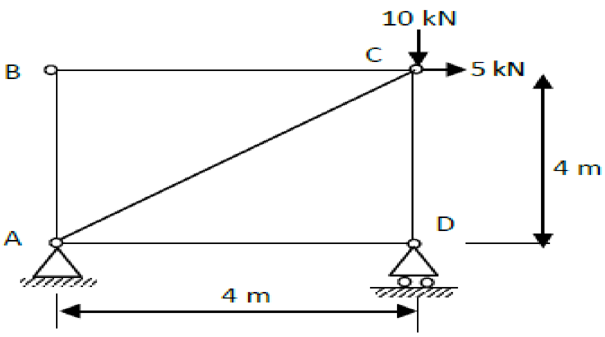
4. Using Castigliano's theorem, determine the deflection and rotation of the overhanging end A of the beam loaded as shown in figure below. [**10M]**



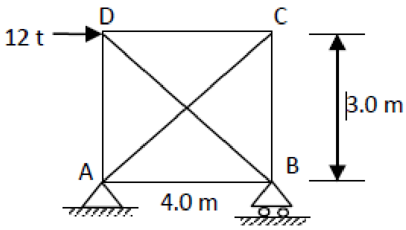
5. Determine the horizontal and vertical deflection components of joint C of the truss shown in figure below by energy method. Take E = 200 GPa and cross sectional area of each member is 1500 x 10^{-6} m^2. [**10M]**



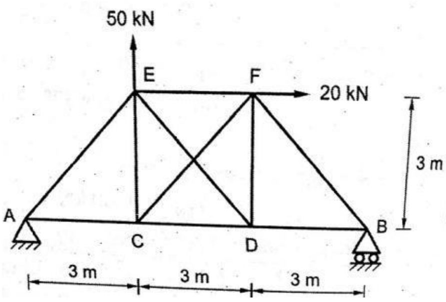
6. Find horizontal and vertical deflection of joint C of truss ABCD loaded as shown in figure below. Assume that, all members have the same axial rigidity. **[10M]**



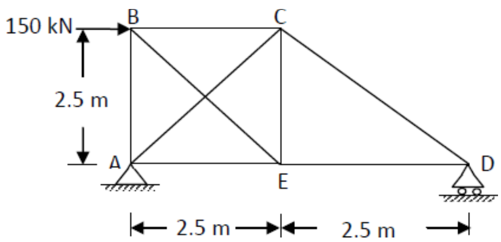
7. A pin jointed framed structure is loaded as shown in figure below. Calculate the forces in all members. Take area for horizontal members as 20 cm^2, vertical members as 30 cm^2, inclined members as 50 cm^2 and E = 2000 t/cm^2. **[10M]**



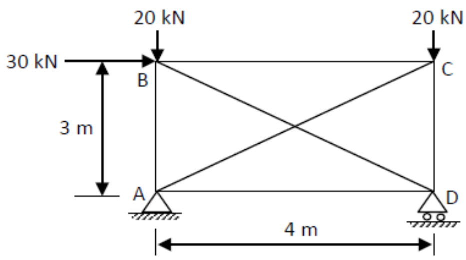
8.Analyze the truss shown in figure below. Assume that the cross sectional area of all members are same. **[10M]**



9. Determine the force in the members AC of a pin-jointed truss shown in figure below. Assume cross-sectional area of each member to be 15 x 10^{-4} m^2. **[10M]**



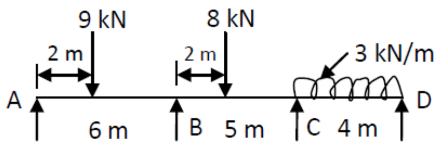
10.Determine the stresses in all the members of the frame shown in figure below, in which the cross sectional area of vertical members are 30 cm^2 each and those of all other members are 22 cm^2. Take E = 200 GPa. **[10M]**



UNIT-IV

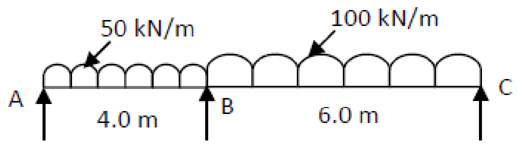
ANALYSIS OF FIXED BEAMS & CONTINUOUS BEAMS

1. A fixed beam of length 6 m carries two point loads of 30 kN each at a distance of 2 m from both ends. Determine the fixed end moments and draw BMD. **[10M]**
2. A Fixed beam of span 6 m is subjected a UDL of 5 kN/m on the left half of the span and a point load of 15 kN at the middle of the right half of the span. Draw the SFD and BMD **[10M]**
3. Calculate the fixed end moments and the reactions at the supports for a fixed beam AB of length 6 m. The beam carries point loads of 160 KN and 120 KN at a distance of 2 m and 4 m from the left end A. Draw SFD & BMD. **[10M]**
4. Derive an expression to find BM and SF of fixed beam carrying an eccentric load. **[10M]**
5. Determine the fixed end moments for the fixed beam with applied clockwise moment ‘M’ of distance ‘a’ from left end. The total length of beam is ‘L’. Sketch the bending moment and shear force diagram. **[10M]**
6. A continuous beam ABC of constant moment of Inertia carries a load of 10 kN in mid span AB and a central clockwise moment of 30 kN-min span BC. Span AB = 10 m and span BC = 15 m. Find the support moments and plot the shear froce and bending moment diagram. **[10M]**
7. Analyze the continuous beam ABCD shown in the figure below using theorem of three moments. Draw SFD and BMD. **[10M]**

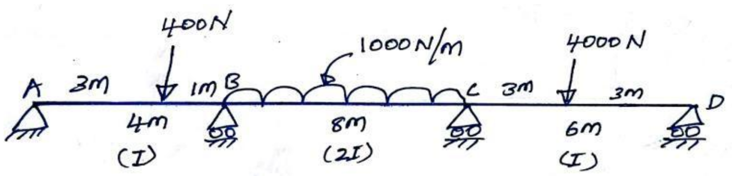


8. A continuous beam ABC of uniform section with span AB and BC as 4 m each, is fixed at A and simply supported at B and C. The beam is carrying a uniformly distributed load of 6 kN/m run throughout its length. Find the support moments and the reactions using theorem of three moments. Also draw SFD and BMD. **[10M]**

9. Analyze the beam and draw BMD and SFD **[10M]**



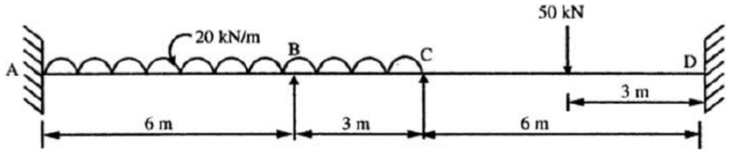
10. A continuous beam ABCD 18 m long is loaded as shown in figure below. During loading support ‘B’ sinks by 10 mm Find support moments and plot shear force and bending moment diagrams for the beam.Take E= 20 kN/mm^2 , I = 8 X10^6 mm^4 **[10M]**



UNIT-V

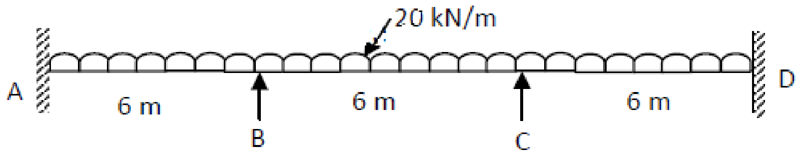
SLOPE DEFLECTION METHOD& MOMENT DISTRIBUTION METHOD

1. Analyze the continuous beam as shown in figure below by slope deflection method. Support B sinks by 10 mm. Take E = 200 GPa and I = 16 x 10^7 mm^4. Draw the bending moment diagram.

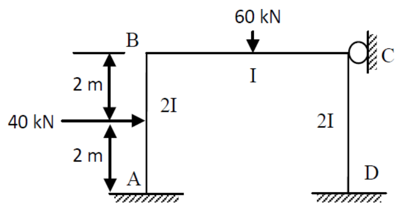


10M

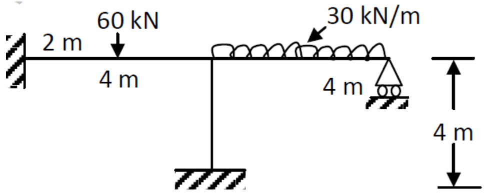
2. Analyze the continuous beam shown in figure below by slope deflection method and sketch SFD and BMD. EI is constant. **10M**



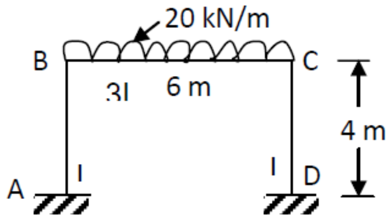
3. Analyze the portal frame shown in figure below, by slope deflection method. The relative moment of inertia value for each member is indicated in the figure below. Sketch the bending moment diagram **10M**



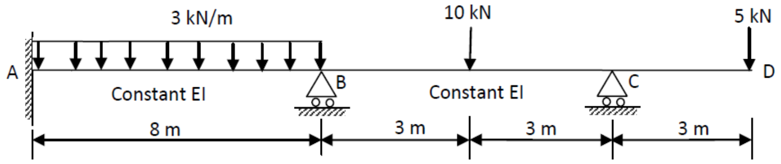
4. Analyze the frame shown in figure by slope deflection method. Draw BMD flexural rigidity is same for all members **10M**



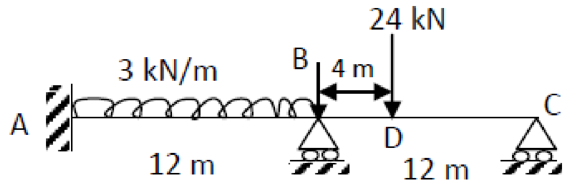
5. Analyze the frame shown in figure by slope deflection method. Draw BMD flexural rigidity is same for all members **10M**



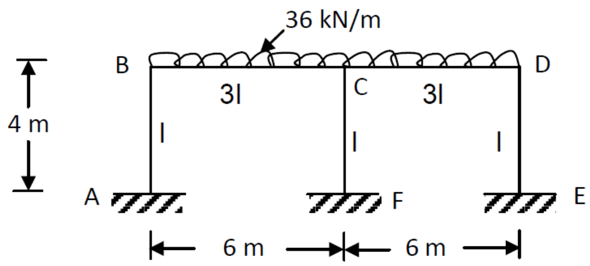
6.Analyze the continuous beam shown in figure below, using moment distribution method. Draw shear force and bending moment diagram for the continuous beam. **10M**



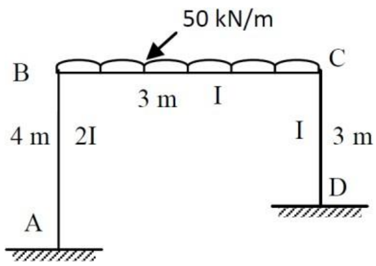
7.Analyze the continuous beam shown in figure below by using moment distribution method. The support B sinks 30 mm, values of E and I are 200 GPa and 0.2 x 10^9 m^4 respectively uniform throughout. Draw S.F and B.M diagrams. **10M**



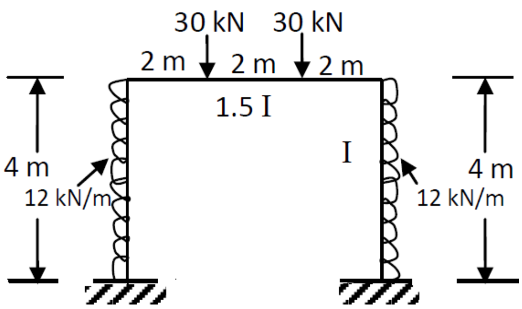
8.Analyze the rigid jointed frame shown in figure by moment distribution method and draw BMD **10M**



9.Analyze the portal frame shown in figure using moment distribution method **10M**



10.Analyze the portal frame shown in figure using moment distribution method **10M**



TWO MARK QUESTIONS

UNIT-1

1) Define thick and thin cylinders
2) Write the formulae for hoop, longitudinal and volumetric stress
3) Write the formulae for change in diameter and change in length
4) Define lames theorem and formula
5) write the equation for difference in radii for shrinkage

UNIT-2

1) Define parallel axis theorem with equation
2) Write the equation for maximum and minimum stress
3) Write ant three conditions for stability of dam
4) What is meant by unsymmetrical bending
5) Define retaining walls

UNIT-3

1) Define determinate and indeterminate structures
2) Define strain energy
3) Define Maxwells Bellis theorem
4) Define Castiglianos first theorem
5) Define Castiglianos second theorem and unit load method

UNIT-4

1) Write general equation for three moment equation
2) What are the merits and demerits of continuous beam over simply supported beam
3) What are the applications of three moment equation
4) What are the merits and demerits of fixed beam over simply supported beam
5) Define point of contraflexure

UNIT-5

1) Write slope deflections equation for a span AB and BA
2) What is sway and non sway portal
3) Define stiffness factor, carryover factor
4) Define distribution factor
5) What is degree of indeterminacy?