

KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.E.

Year : III

Exam Roll No. :

Time: 30 mins.

Registration No.:

Course : CIEG 308

Semester : II

F. M. : 10

Date : 11 DEC 2024

SECTION "A"

[20 Q. \times 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices

- Which of the following statement is **INCORRECT**?
 - The maximum stresses in statically indeterminate structures are generally lower.
 - Statically indeterminate structures generally have lower stiffness.
 - Support settlement induce significant stresses in indeterminate structures.
 - Temperature changes induce significant stresses in indeterminate structures.
- For a rigid jointed plane frame, the degree of static indeterminacy is given as:
 - $m + r - 2j$
 - $3j - r - m$
 - $3m + r - 3j$
 - $2j - r$
- Betti's theorem is also known as:
 - Generalized reciprocal theorem
 - Strain energy theorem
 - Maxwell's theorem
 - Three moment theorem
- Deflection at any point in a truss using Castigliano's theorem is obtained as:
 - $\sum \left(\frac{\partial F}{\partial P} \right) \frac{AE}{FL}$
 - $\sum \left(\frac{\partial F}{\partial P} \right) \frac{FL}{AE}$
 - $\sum \left(\frac{\partial F}{\partial P} \right) \frac{FL}{EI}$
 - $\sum \left(\frac{\partial F}{\partial P} \right) \frac{EI}{FL}$
- Which of the following statement is **CORRECT**?
 - Method of consistent deformation is also known as stiffness method.
 - The indeterminate structure, which is statically stable is called as primary structure.
 - In method of consistent deformation, the redundants are applied as unknown loads.
 - The value of redundants are determined using equilibrium equations at joints.
- A propped cantilever beam AC has a fixed support at A and roller at C . Taking moment at A as redundant, the compatibility equation for the joint A is:
 - $M_A = \frac{-f_{AA}}{\theta_{A0}}$
 - $M_A = \theta_{A0} f_{AA}$
 - $\theta_{A0} f_{AA} = 0$
 - $M_A = \frac{-\theta_{A0}}{f_{AA}}$
- Fixed end moment M_{FAB} for a beam AB of span $2L$ with point load P applied at mid-span is:
 - $PL/4$
 - $PL/8$
 - $PL/12$
 - $PL/30$
- In a sway frame, the additional equation required to analyze the frame using slope-deflection method is called as:
 - Frame equation
 - Beam equation
 - Shear equation
 - Moment equation

9. A beam AB of length 3m has its end B settled 10mm below end A . Taking flexural rigidity of beam as $50,000 \text{ kN}\cdot\text{mm}^2$, the end moments developed in the beam is:
 a. $0.66 \text{ kN}\cdot\text{mm}$ b. $0.33 \text{ kN}\cdot\text{mm}$ c. $0.55 \text{ kN}\cdot\text{mm}$ d. $0.16 \text{ kN}\cdot\text{mm}$
10. Four members AO , BO , CO & DO meet at a joint O whose stiffness are EI , $2EI$, $1.5EI$ & $3EI$ respectively. The value of distribution factor for member CO is:
 a. 0.13 b. 0.26 c. 0.40 d. 0.20
11. Which of the following statement is **CORRECT**?
 a. Stiffness for a beam with far end hinged is $4EI/L$.
 b. Distribution factor is the product of moment shared by member to applied moment at joint.
 c. Sum of stiffness of members meeting at a joint is called as joint stiffness.
 d. Sum of distribution factors for members meeting at joint is less than 1.
12. A sway frame with columns AB and CD have lengths of 2.5m and 5.5m respectively. Column AB has dimension of 350mm x 350mm and column CD has dimension of 450mm x 450mm. The ratio of fixed end moments to be taken for column AB and CD for sway analysis is:
 a. 1:0.85 b. 1:0.42 c. 1:0.33 d. 1:0.56
13. Which of the following statement is **INCORRECT**?
 a. Muller-Breslau principle is based on Maxwell's theorem of reciprocal displacement.
 b. According to Muller-Breslau principle, the curve of the deformed shape represents to some scale, the influence line for particular stress or reaction component.
 c. If the influence line diagram for moment at particular point is required, a small displacement is to be given at that point.
 d. Muller-Breslau principle is applicable only when the material is within the elastic limit and obeys Hooke's Law.
14. A rectangular beam of width 300mm and depth 450mm has a shape factor of 1.5. The plastic section modulus of beam is:
 a. $15,187.5 \text{ cm}^3$ b. $10,125 \text{ cm}^3$ c. $6,750 \text{ cm}^3$ d. $22,781.25 \text{ cm}^3$
15. Number of plastic hinge formed in a propped cantilever beam with point load as mid-span is:
 a. Two b. Three c. One d. Four
16. Collapse load in a fixed beam of span L , carrying point load at mid-span and having plastic moment capacity M_p is:
 a. $6M_p/L$ b. $8M_p/L$ c. $8M_p/L^2$ d. $16M_p/L^2$
17. A circular bar has a length 2m and has its axial stiffness 15,000 KN/m. If the Modulus of Elasticity of bar is 200,000 MPa, the diameter of circular bar required is:
 a. 9.54mm b. 22.63mm c. 18.18mm d. 13.82mm

18. The global stiffness matrix for a bar element is given as:

$$\text{a. } [k] = \frac{AE}{L} \begin{bmatrix} C^2 & CS & C^2 & -CS \\ CS & S^2 & -CS & S^2 \\ C^2 & -CS & C^2 & -CS \\ -CS & S^2 & -CS & S^2 \end{bmatrix} \quad \text{b. } [k] = \frac{AE}{L} \begin{bmatrix} -C^2 & CS & -C^2 & -CS \\ CS & -S^2 & -CS & -S^2 \\ -C^2 & -CS & -C^2 & CS \\ -CS & -S^2 & CS & -S^2 \end{bmatrix}$$

$$\text{c. } [k] = \frac{AE}{L} \begin{bmatrix} C^2 & CS & -C^2 & -CS \\ CS & S^2 & -CS & -S^2 \\ -C^2 & -CS & C^2 & CS \\ -CS & -S^2 & CS & S^2 \end{bmatrix} \quad \text{d. } [k] = \frac{AE}{L} \begin{bmatrix} C^2 & CS & -C^2 & CS \\ CS & -S^2 & -CS & -S^2 \\ -C^2 & -CS & C^2 & CS \\ CS & -S^2 & CS & -S^2 \end{bmatrix}$$

19. For a beam AB of length L carrying uniformly distributed load w per unit length over the entire span, the equivalent nodal loads and moments respectively are:

a. $wL/2, wL^2/8$ b. $wL/2, wL^2/12$ c. $wL/4, wL^2/12$ d. $wL/4, wL^2/8$

20. Which of the following statement is **INCORRECT**?

- Matrix method of analysis is suited for computer application.
- The diagonal elements of flexibility and stiffness matrix can't have negative values.
- If a displacement at a coordinate is impossible, stiffness matrix do exist.
- Any element of the stiffness matrix gives the force value required for unit displacement.

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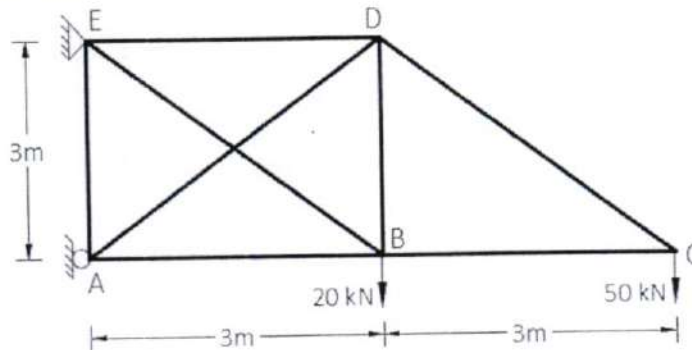
Level : B.E.
Year : III
Time : 2 hrs. 30mins.

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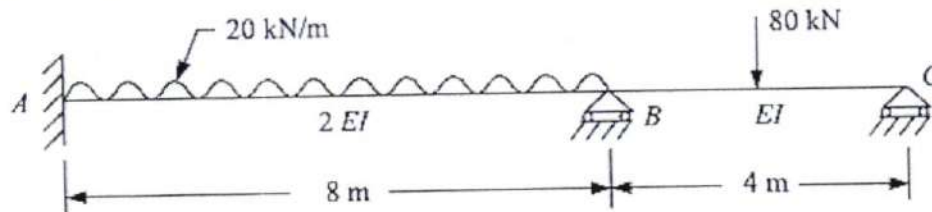
SECTION "B"
[40 marks]

Attempt ALL questions. Assume any suitable data if required.

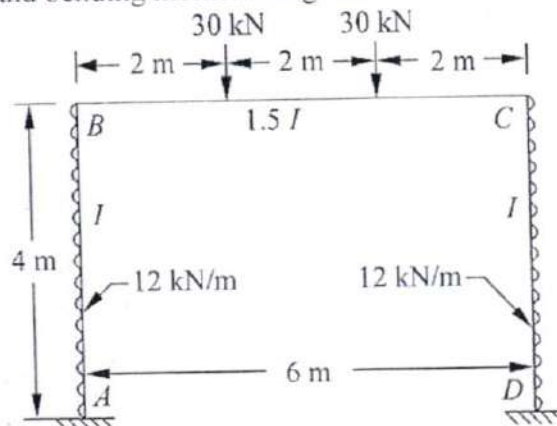
1. A braced cantilever truss is loaded as shown in figure. All the members are of the same material and have the same cross-section area. Find the axial force in the member AD using method of consistent deformation. [7]



2. A continuous beam ABC consist of u.d.l. 20 kN/m over the span AB and point load of 80kN at mid-span of BC as shown in figure below. Using Slope Deflection Method, analyze the beam if joint B sinks by 10mm. Given $EI = 4000 \text{ kNm}^2$. Also draw the bending moment diagram. [7]



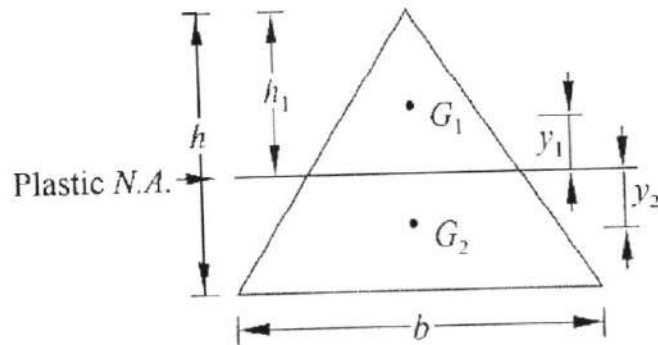
3. Analyze the frame shown in figure below using Moment Distribution Method and draw the shear force and bending moment diagram. [8]



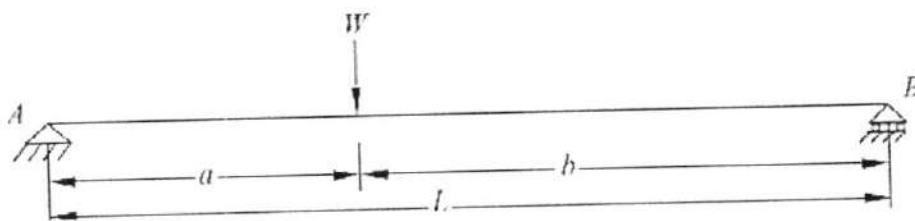
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4. State the Muller-Breslau principle and prove the theorem. [4]

5. a. Determine the shape factor of the triangular section of base b and height h as shown in figure below. [4]



b. Determine the collapse load for the beam shown in figure below. The plastic moment capacity for the beam is M_p . [4]



6. For a beam shown in figure below, determine the stiffness matrix of the structure and also analyze the beam using Matrix Stiffness Method. [6]

