KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.E.
Year : III

Course : CIEG 308
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 26 JUL 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

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

1. Which of the following is the equilibrium method of analysis?
   a. Method of consistent deformation
   b. Three moment theorem
   c. Moment distribution method
   d. Column analogy method

2. For a pin jointed space frame, the degree of kinematic indeterminacy is given by:
   a. $3j - r$
   b. $2j - r$
   c. $3j - (r + m)$
   d. $6j - (r + m)$

3. "In a linearly elastic structure in static equilibrium, the displacement at point *1* due to unit load at point *2* is equal to displacement at point *2* due to unit load at point *1*". This theorem is related to:
   a. Maxwell's theorem
   b. Betti's theorem
   c. Strain energy
   d. Muller-Breslau

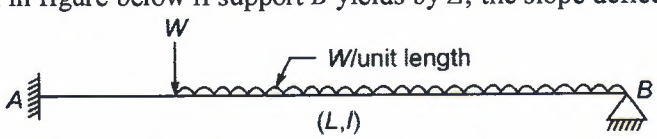
4. Which of the following is the mathematical expression of Castigliano's second theorem?
   a. $\frac{\partial U}{\partial \Delta} = P$
   b. $\frac{\partial P}{\partial U} = \Delta$
   c. $\frac{\partial \Delta}{\partial U} = P$
   d. $\frac{\partial U}{\partial P} = \Delta$

5. The structure which is determinate and statically stable is referred to as _____ structure:
   a. Redundant
   b. Primary
   c. Secondary
   d. Flexible

6. For truss with internal indeterminacy only, the redundant chosen is:
   a. Vertical reaction at any support
   b. Horizontal reaction at any support
   c. Axial force in any member
   d. Vertical reaction at one support and axial force in any member

7. Fixed end moment M_{FAB} for a beam AB of span $2L$ with moment M applied at mid-span in clockwise direction is:
   a. Zero
   b. M/4
   c. M/2
   d. M/8

8. In the beam shown in figure below if support B yields by Δ, the slope deflection equation for M_{BA} is:



   a. $M_{BA} = M_{FBA} - \frac{2EI}{L^2}\left(\theta_A + 2\theta_B - \frac{3\Delta}{L}\right)$
   b. $M_{BA} = M_{FBA} - \frac{2EI}{L^2}\left(2\theta_A + \theta_B - \frac{3\Delta}{L}\right)$
   c. $M_{BA} = M_{FBA} + \frac{2EI}{L^2}\left(\theta_A + 2\theta_B - \frac{3\Delta}{L}\right)$
   d. $M_{BA} = M_{FBA} + \frac{2EI}{L^2}\left(2\theta_A + \theta_B - \frac{3\Delta}{L}\right)$

9. For a fixed beam AB, support B sinks by Δ downwards. The moment produced at end B will be:
   a. $\frac{6EI\Delta}{L^2}, anticlockwise$
   b. $\frac{6EI\Delta}{L^2}, clockwise$
   c. $\frac{12EI\Delta}{L^3}, clockwise$
   d. $\frac{12EI\Delta}{L^3}, anticlockwise$

10. If M is the external moment which rotates the near end of a prismatic beam without translation, the far end being fixed, the moment induced at far end is:
   a. Zero
   b. M
   c. $M/2$ in same direction of M
   d. $M/2$ in opposite direction of M

11. Which of the following statement is **INCORRECT**?
   a. Stiffness for a beam with far end hinged is $3EI/L$.
   b. Distribution factor is the ratio 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 greater than 1.

12. A sway frame with columns AB and CD have lengths of 3m and 5m respectively. Column AB has dimension of 300mm x 300mm and column CD has dimension of 400mm x 400mm. The ratio of fixed end moments to be taken for column AB and CD for sway analysis is:
   a. 1:1.89 b. 1:1.14 c. 1:0.68 d. 1:3.6

13. Muller Breslau principle is particularly used to determine the _____ of a structure.
   a. Influence line b. Reactions c. Determinacy d. Displacement

14. The shape factor is the ratio of:
   a. M_y and M_p b. Z_e and Z_p c. M_p and Z_p d. M_p and M_y

15. "For a given structure and loading, if these exist any distribution of bending moment throughout the section which is both safe and statically admissible with a set of loads W, the value of W must be less than or equal to the collapse load W_c". The above theorem is known as _____ theorem.
   a. Kinematic b. Static c. Uniqueness d. Collapse

16. Collapse load in a fixed beam of span L, carrying u.d.l. over entire 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 of diameter 20mm has a length of 5m. The modulus of elasticity for the bar is 2x 10^5 N/mm^2. The axial stiffness of member is:
   a. 12,566 N/mm b. 1,256.6 N/mm c. 125.66 N/mm d. 12.56 N/mm

18. The relationship for global stiffness matrix with respect to local axis is given as:
   a. $[k] = [T]^T[T][k']$
   b. $[k] = [T][k'][T]^T$
   c. $[k] = [T]^T[k'][T]$
   d. $[k] = [T][T]^T[k']$

19. Each node of a plane truss has _____ degrees of freedom.
   a. 1 b. 2 c. 3 d. 4

20. Which of the following statement is **CORRECT**?
   a. Matrix method of analysis is not suited for computer application.
   b. The diagonal elements of flexibility and stiffness matrix can have negative values.
   c. If a displacement at a coordinate is impossible, stiffness matrix does not exist.
   d. Any element of the stiffness matrix gives the displacement value required for unit force.

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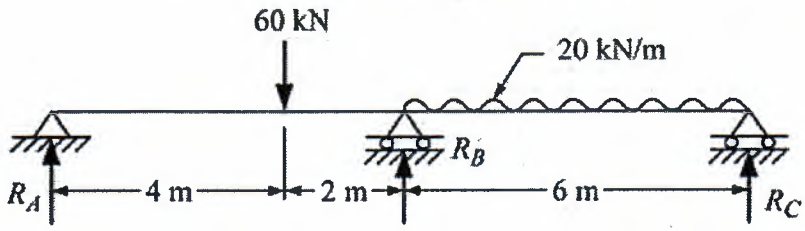
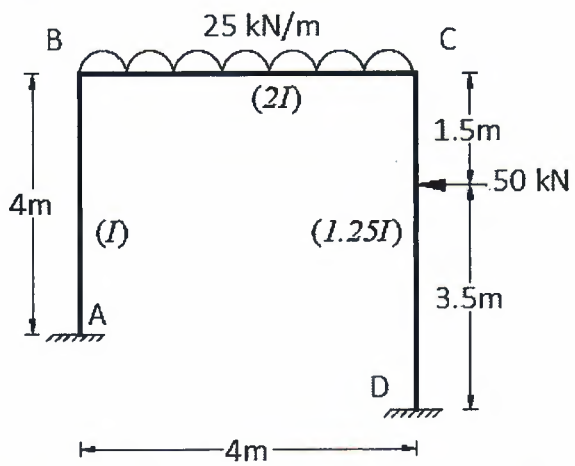
SECTION "B"
[40 marks]

Attempt *ALL* questions. *Assume any suitable data if required.*

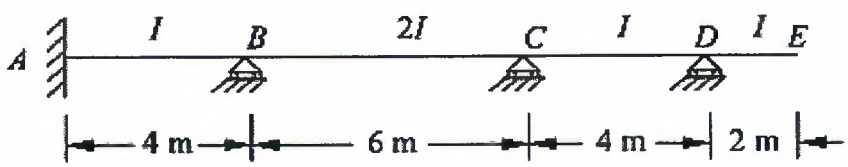
1. Determine the reaction components in the continuous beam shown in figure below using Method of Consistent Deformation. Flexural rigidity is constant throughout. [6]



2. Analyze the frame shown in figure below using Slope Deflection method and draw the bending moment diagram. [8]



3. Determine the end moments for a continuous beam shown in figure below using Moment Distribution Method, if support *B* sinks by 12mm. Given E= 200 kN/mm^2 and I= 20 × 10^6 mm^4. [6]



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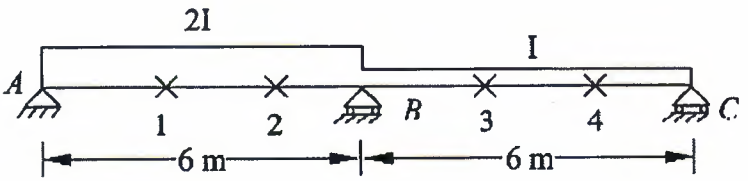
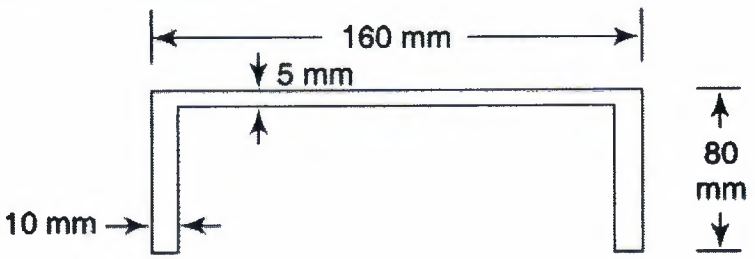
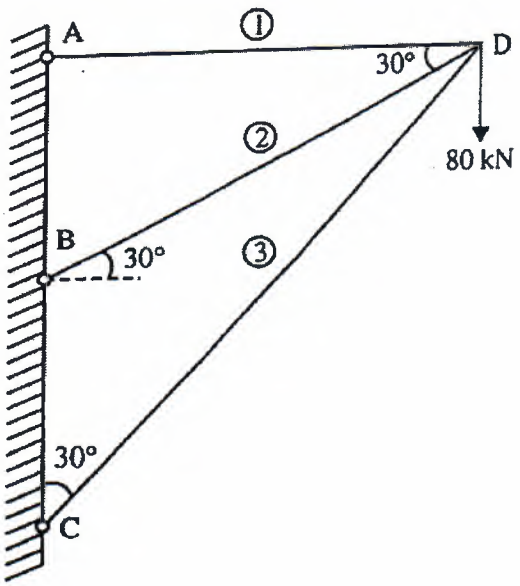
4. Draw the influence line diagram for reaction at B in the continuous beam shown in figure below at 2m interval. [6]



5. Explain in short about plastic bending of beams with figures. Calculate the shape factor of the C-section shown in figure below. [3+4]



6. For a pin jointed frame shown in figure below, determine the stiffness matrix for a structure and also the forces in all members using the matrix method. The values of axial rigidity (in *kN*) and length of members (in *cm*) are tabulated below. [7]



Member	AE	l
AD	400	400
BD	461.9	461.9
CD	800	800