

KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024

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

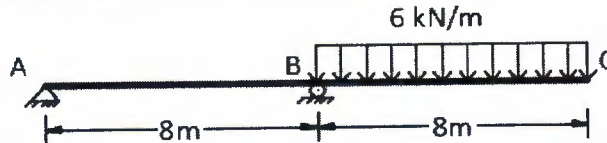
08 FEB 2024

Course : CIEG 305
Semester : I
F.M. : 40

SECTION "B"

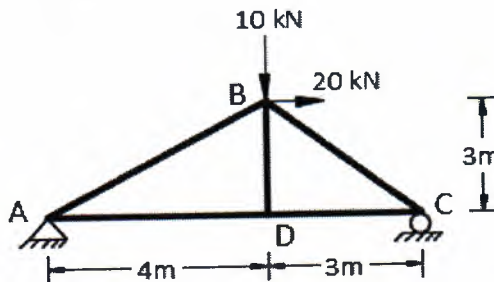
Attempt *ALL* questions. Assume any necessary data.

1. Determine the slope at point A and deflection at point C of the beam shown in figure below using Moment-Area method. Take $E = 200 \text{ GPa}$ & $I = 250 \times 10^6 \text{ mm}^4$. [6]

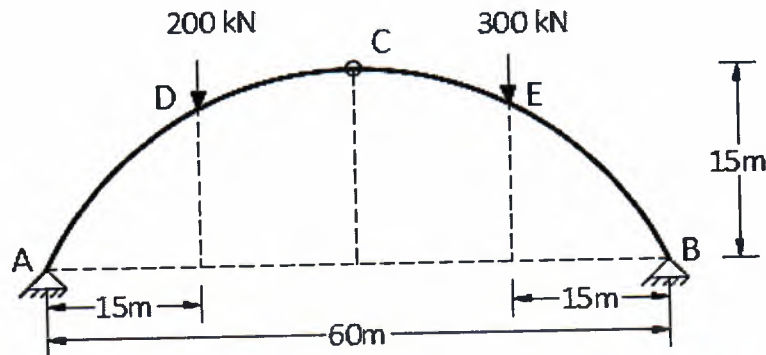


2. A bar 12mm diameter gets stretched by 3mm under a steady load of 8000N. What stress would be produced in the same bar by weight of 800N, which falls vertically through a distance of 8cm on to a rigid collar attached at its end? The bar is initially unstressed. [5]
Take $E = 2 \times 10^5 \text{ N/mm}^2$.

3. For the given truss in figure below, determine the horizontal & vertical deflection at joint B using Unit Load Method. The member BC is too short by 2mm and member CD is too long by 1.5mm. Also, members AD and CD are subjected to increase in temperature of 5°C . Take $\alpha = 12 \times 10^{-6} / ^\circ\text{C}$ and $AE = 100 \times 10^3 \text{ kN}$. [8]

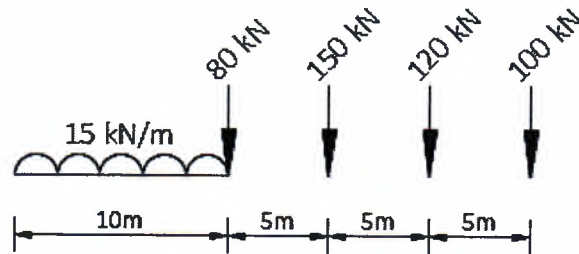


4. A three-hinged symmetrical parabolic arch is shown in figure below. Determine the normal thrust, radial shear and bending moment at point 20m from left end support. [6]



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5. A cable supported on piers 80m apart at the same level has a central dip of 8m. Calculate the diameter and length of cable, when it is carrying a load of 30 kN/m. The allowable stress in the cable material is not to exceed 1.2×10^5 kN/m². Also determine the forces on the pier, if the backstay is inclined at angle of 60° to the vertical when the cable passes over rollers. What will be the change in length of cable if temperature in cable raises by 20°C. Take coefficient of thermal expansion, $\alpha = 12 \times 10^{-6}$ /°C. [7]
6. Use Influence Line Diagram to determine the maximum shear force and bending moment at a section 30m from left-hand support of a simply supported beam of span 75m. The loading system consist of four wheel loads followed by a distributed load of 15 kN/m extending over 10m, which moves from left to right of beam as shown in figure below. [8]



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Marks Scored:

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Course : CIEG 305

Semester : I

F. M. : 10

Registration No.:

Date :

SECTION "A"

[20Q. \times 0.5 = 10 marks]

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

- The change in the slope between two points in a straight member under flexure is equal to the area of M/EI diagram between those two points. This statement is known as:
a. Conjugate beam theorem
b. Macaulay's theorem
c. Moment area-I theorem
d. Moment area-II theorem
- A beam has end A fixed end B is on roller and there is internal hinge at C . Its conjugate beam is:
a. End A free, end B and C on roller
b. End A is hinged, end B fixed, C on roller
c. End A is free, end B fixed, C hinged
d. End A is fixed, and B hinged, C hinged
- Bar A and bar B are made up of the same material and are of same length but bar A has diameter d while bar B has diameter $2d$. Bar A is subjected to axial load twice that of bar B , the ratio of strain energy of bar A to strain energy of bar B is:
a. 16
b. 8
c. 4
d. 2
- In virtual work method, we determine slope at any point by applying:
a. Unit force
b. Unit moment
c. Unit force and moment
d. Unit deflection
- A simply supported beam deflects by 5 mm when it is subjected to a concentrated load of 10 kN at its centre. What will be deflection in a 1/10 model of the beam if the model is subjected to a 1 kN load at its centre?
a. 5mm
b. 0.5 mm
c. 0.05 mm
d. 0.005 mm
- Which one of the following is *WRONG* with respect to strain energy method for finding deflection?
a. Structure should be subjected to a single concentrated load.
b. Deflection can be found only at the loaded point.
c. Deflection can be found only in the direction of load.
d. Deflection can be found at any point in desired direction.
- The maximum bending moment at 6m from end A in a simply supported beam of span 15m due to a moving udl, spanning 5m occurs when the tail of load is at _____ distance from A .
a. 4.5m
b. 4.0m
c. 3.2m
d. 3.0m
- Four point loads 8, 15, 15 and 10 kN have centre-to-centre spacing of 2 m between consecutive loads and they traverse a girder of 30 m span from left to right with 10 kN load leading. The maximum shear force at 8 m from left support will be?
a. 8.2 kN
b. 25.4 kN
c. 30.2 kN
d. 42.2 kN

9. Which of the following statement is **TRUE**?
- The shape of ILD for shear force in cantilever beam is triangular.
 - The maximum value of ordinate in ILD of reaction for simply supported beam is 1.
 - When an *udl* shorter than span travels a beam, maximum bending moment occurs at a section when the c.g. of load lies at the section.
 - For a train of concentrated loads, the maximum bending moment under any particular load occurs when the resultant of load lies at center of beam.
10. For a 3-hinged arch with span L and rise h , the maximum ordinate of ILD for horizontal thrust is:
- $4L/h$
 - $3L/h$
 - $L/3h$
 - $L/4h$
11. A circular arch of span 25m with a central rise 5m is hinged at the crown and springings. It carries a point load of 100 kN at 6m from the left support. In this case, the horizontal thrust is:
- 60 kN
 - 45 kN
 - 90 kN
 - 75 kN
12. A parabolic arch of span L has central rise h . Taking springing point as the origin its equation is given by:
- $y = \frac{4hx}{L^2}(L - 2x)$
 - $y = \frac{4hx}{L^2}(2L - x)$
 - $y = \frac{4hx}{L^2}(L - x)$
 - $y = \frac{4hx}{L^2}(x - L)$
13. If a 3-hinged parabolic arch of span L and rise h is carrying an *udl* w /unit length throughout the entire span:
- Horizontal thrust is $wL^2/(4h)$
 - Bending moment will be maximum at $L/4$ from end support
 - Bending moment will be zero throughout
 - All of the above
14. Which of the following statement is **INCORRECT** for suspension cable system?
- Due to rise in temperature, length of cable increases.
 - Due to rise in temperature, dip of cable increases.
 - Due to rise in temperature, horizontal thrust decreases.
 - Due to rise in temperature, horizontal thrust increases.
15. A suspension cable of horizontal span 50m is subjected to uniformly distributed load of 20 kN/m causing sag of 2m at mid-span. The maximum tension in cable is calculated as:
- 3000 kN
 - 3165 kN
 - 3605 kN
 - 2584 kN
16. A suspension cable of span l has a central dip $1/15^{\text{th}}$ of its span. The total length of cable is:
- $1.078l$
 - $1.052l$
 - $1.012l$
 - $1.008l$
17. The ratio of stress due to suddenly applied and gradually applied load is:
- 1.5
 - 2.0
 - 2.5
 - 3.0
18. A cantilever beam of span 5m has a point load of 10 kN at its free end. The maximum deflection at free end is:
- $416.67/EI$
 - $625.55/EI$
 - $83.33/EI$
 - $125.25/EI$

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19. Bending moment at any section of 3-hinged arch is given by:
- a. Beam moment + H_y
 - b. Beam moment - H_y
 - c. Beam moment $\times H_y$
 - d. Beam moment / H_y
20. The bending moment at any distance x from free end of cantilever beam is given by $M=10x$. If the span of beam is 5m & $EI= 6000 \text{ kNm}^2$, the strain energy due to bending is:
- a. 0.69 kNm
 - b. 0.25 kNm
 - c. 0.54 kNm
 - d. 0.35 kNm

