KATHMANDU UNIVERSITY
End Semester Examination [C]
April/May, 2023

Marks Scored:

Level : B.E./B.Tech.
Year : III
Course : CIEG 305
Semester : I

Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date : 28 APR 2023

SECTION "A"
[20Q. × 0.5 = 10 marks]

Encircle the most appropriate option.

1. The strain energy stored in a simply supported beam of span 'I' and flexural rigidity 'EI' due to a central concentrated load 'w' is _____.
   a. $\frac{w^2l^3}{48EI}$ b. $\frac{w^2l^2}{48EI}$ c. $\frac{w^2l^3}{96EI}$ d. $\frac{w^2l^2}{96EI}$

2. Maximum energy that a given component can absorb without undergoing any permanent deformation upto elastic limit is known as _____.
   a. proof resilience b. resilience c. hardness d. toughness

3. A cantilever beam, 2 mm in length, is subjected to a uniformly distributed load of 5 Kn/m. if E = 200 GPa and I = 1000 cm4, the strain energy stored in the beam will be _____.
   a. 7 Nm b. 12 Nm c. 8 Nm d. 10 Nm

4. Which of the following is carried by truss members?
   a. flexural load b. bending load c. axial load d. shear load

5. Which of the following methods of structural analysis is a force method?
   a. three-moment equation b. slope deflection method
   c. column analogy method d. moment distribution method

6. An arch may be subjected to _____.
   a. shear and axial force b. bending moment and shear force
   c. bending moment and axial force d. shear force, thrust, and bending moment

7. What is the SI unit of stiffness coefficient?
   a. m/kN b. kN/m c. kN d. m

8. For a beam carrying a UDL, the strain energy will be maximum in case the beam is
   a. cantilever b. simply supported
   c. propped cantilever d. fixed at both ends

9. Strain energy per unit volume that a material can absorb without exceeding its proportional limit is called _____.
   a. strain hardening b. shear modulus of material
   c. bulk modulus of material d. modulus of resilience

10. Cable in a suspension bridge supports load mainly by _____.
    a. shear b. bending c. torsion d. tension

11. Beam composed of more than one material rigidly connected together so as to behave as a single piece are known as _____.
    a. Compound beams
    b. Determinate beams
    c. Flexural beams
    d. Composite beams

12. A three-hinged parabolic arch of span 20 m and rise 4m carries a concentrated load of 150 kN at 4m from the left support 'A'. Calculate the vertical reaction and the horizontal thrust, respectively at support 'A'.
    a. $V_A = 40$ kN and $H_A = 80$ kN
    b. $V_A = 75$ kN and $H_A = 120$ kN
    c. $V_A = 80$ kN and $H_A = 50$ kN
    d. $V_A = 120$ kN and $H_A = 75$ kN

13. A two-hinged arch is a _____.
    a. determinate structure
    b. indeterminate structure
    c. parabolic structure
    d. semi-circular structure

14. Pin joint is replaced by _____ in conjugate beam.
    a. roller
    b. pin
    c. fixed support
    d. link

15. The area moment theorem with respect to the bending of beams states that the area of the M/EI diagram between the sections of a beam gives _____.
    a. the difference in slopes between those two sections
    b. the difference in the maximum bending strains between those two sections
    c. the difference in deflections between those two sections
    d. the difference in strain energies between those two sections

16. A prismatic beam fixed at both ends carries a uniformly distributed load. The ratio of bending moment at the supports to the bending moment at the mid span is ___.
    a. 0.5
    b. 1
    c. 1.5
    d. 2.0

17. A UDL of 10 kN/m of length is moving from left to right support on a simply supported beam of span 10 m. The maximum bending moment at 4m from the left support is _____.
    a. 70 kN-m
    b. 90 kN-m
    c. 50 kN-m
    d. 30 kN-m

18. In moment distribution method, the sum of distribution factors of all the members meeting at any joint is always _____.
    a. 0
    b. less than 1
    c. 1
    d. greater than 1

19. In influence line diagram (ILD) _____.
    a. points remain fixed, position of load changes
    b. point changes, position of load remains fixed
    c. both of them
    d. neither of them

20. The principle of virtual work states that, for a body to be in equilibrium, the virtual work should be _____.
    a. any value between 0 and 1
    b. 0
    c. maximum
    d. minimum

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SECTION "B"

Attempt ***ALL*** questions. Assume data if necessary.

1. A cable of span l has its end at the height of h_1 and h_2 above the lowest point of the cable. It carries a uniformly distributed load of w per unit run of the span. Show that the horizontal reaction at each end is given by [6]

$$H = \frac{wl^2}{2(\sqrt{h1} + \sqrt{h2})^2}$$

2. A three-hinged arch consists of two quadrantal parts AC and CB of radii 2m and 4m respectively as shown in figure 1. For the load system acting on the arch, calculate the reactions at the support and the bending moments under the load. [6]

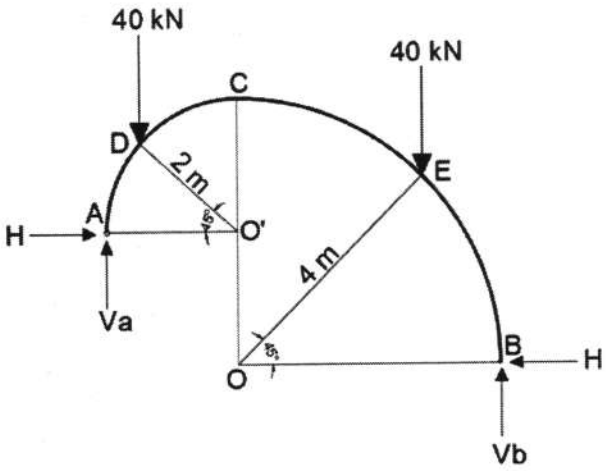

Figure 1

3. A simply supported beam has a span of 15 m. A uniformly distributed load of 50 kN/m and 5 m long crosses the girder from left to right. Draw the influence line diagram for shear force and bending moment at a section 6 m from left end. Use these diagrams to calculate the maximum shear force and bending moment at this section. [6]

4. Determine the maximum forces in the members 1,2,3, and 4 of the truss shown in the given figure 2, when uniformly distributed load of 40 kN/m longer than the span traverses along the bottom chord members. [7]

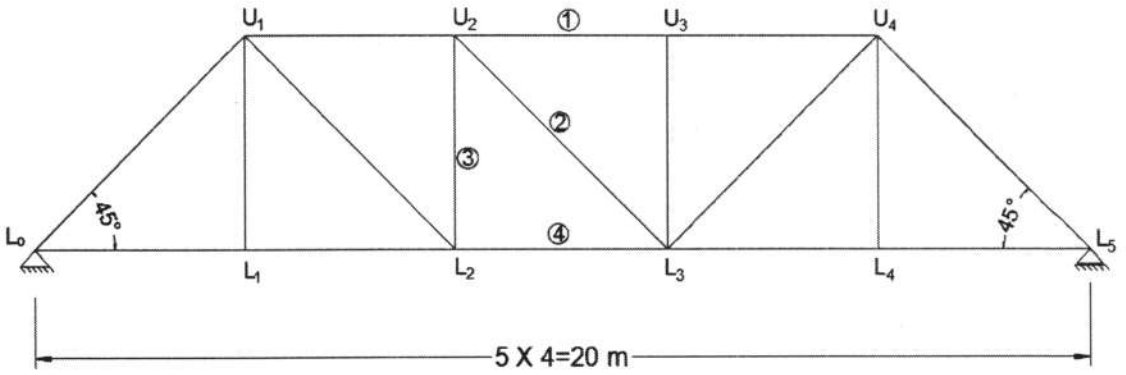

Figure 2

5. Calculate the deflection at point B and D using conjugate beam method for the figure 3 as shown below. [8]

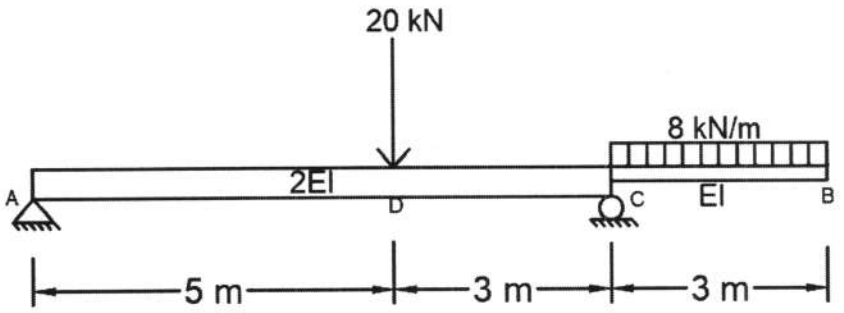

Figure 3

6. Determine the vertical displacement at joint B as shown in figure 4. For each member A=400 mm^2, E= 200 GPa. Use the method of virtual work. [7]

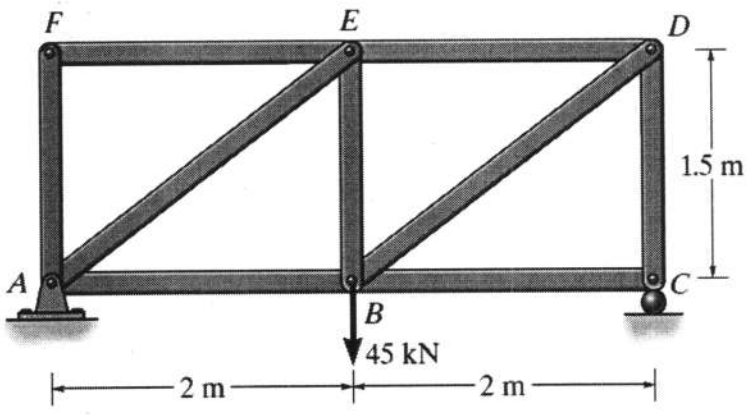

Figure 4