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KATHMANDU UNIVERSITY
End Semester Examination
August/September, 2017

AUG 2 7 2017

Level : B. E.
Year : III
Course : CIEG 308
Semester : II

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

Registration No.:
Date :

SECTION "A"
[20 Q × 0.5 = 10 marks]

Choose the most suitable answer.

1. Two beams of equal cross sectional area are subjected to equal bending moment. If one beam has square cross section and the other has circular section, then
   a. Both beams will be equally strong
   b. Circular section beam will be stronger
   c. Square section beam will be stronger
   d. The strength of the beam will depend on the nature of loading

2. When a beam is subjected to bending moment, the stress at any point is _____ the distance of the point from the neutral axis.
   a. Equal to
   b. Directly proportional to
   c. Inversely proportional to
   d. Independent of

3. A beam of uniform strength has
   a. Same cross section throughout the beam
   b. Same bending stress at every section
   c. Same bending moment at every section
   d. Same shear stress at every section

4. A simply supported beam carries two equal concentrated loads W at distances L/3 from either support. The maximum bending moment M is
   a. WL/3
   b. WL/4
   c. 5 WL/8
   d. 3 WL/12

5. The deflection of any rectangular beam simply supported is
   a. Directly proportional to its weight
   b. Inversely proportional to its width
   c. Inversely proportional to the cube of its depth
   d. Directly proportional to the cube of its length

6. If two forces acting at a joint are not along the straight line, then for the equilibrium of the joint
   a. One of the forces must be zero
   b. Each force must be zero
   c. Forces must be equal and of the same sign
   d. Forces must be equal in magnitude but opposite in sign

7. Which condition is appropriate where same bending moment is applied to beams having square and circular cross sections?
   a. Circular beam is more economical
   b. Square beam is more economical
   b. Both the beams are equally economical
   d. It cannot be determined with the information given

8. A tie is a member which
   a. Connects two joints
   b. Is subjected to axial tension primarily
   c. Does not suffer any stress irrespective of loading conditions
   d. Suffers two equal and opposite forces at the two ends

9. A cantilever AB is subjected to a concentrated load (W) at the free end. The slope and deflection at the free end are $WL^2/2EI$ and $WL^3/3EI$. If the same load is applied at mid span point, the deflection at the free end will be
a. $5\ WL^3/384\ EI$ b. $5\ WL^3/48\ EI$ c. $WL^3/6\ EI$ d. $WL^3/16\ EI$

10. Three beams made of same material (but of different sections) of same span are subjected to same maximum bending moment. Which section will have the maximum weight per unit length?
a. Circular b. Square c. Rectangular d. Prismatic

11. The stiffness factor of a member is the moment required to be applied at the simply supported end to produce
a. A unit rotation of one radian at fixed end
b. A unit rotation of one radian at simply supported end
c. A unit deflection at the simply supported end
d. A unit rotation of one radian at both the ends

12. The stiffness factor at the near end of a member with far end fixed is
a. 4 EI/L b. 3 EI/L c. EI/L d. EI

13. If K_i is the stiffness of i^{th} member at a joint, the distribution factor for the member is
a. $K_i/\sum K_i$ b. $\sum K_i$ c. K_i d. $\sum K_i - K_i$

14. In moment distribution method, the sum of distribution factors of all the members meeting at any joint is always
a. Zero b. <1 c. >1 d. $=1$

15. The method of moment distribution in structural analysis is
a. An iterative method b. An exact method
c. An approximate method d. Integration method

16. The shape factor of standard rolled beam varies from
a. 1.1 to 1.2 b. 1.2 to 1.3 c. 1.3 to 1.4 d. 1.4 to 1.5

17. To generate the j^{th} column of the flexibility matrix
a. Unit force is applied at the coordinate j and the displacement are calculated at all coordinates
b. A unit displacement is applied at coordinate j and the forces are calculated at all coordinates
c. A unit force is applied at coordinate j and the forces are calculated at all coordinates
d. A unit displacement is applied at coordinate j and the displacement are calculated at all coordinates.

18. "Carry Over" in moment distribution is _____ the distributed moments.
a. Equal to b. Double of c. Half of d. Quarter of

19. The shape factor is defined as the ratio of
a. Z_p/Z b. Z/Z_p c. M/M_y d. M_p/M

20. The section modulus of a rectangular section is proportional to
a. Area of the section b. Square of the area of the section
c. Product of the area and depth d. Product of the area and width

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SECTION "B"

Attempt *ALL* questions.

1. Determine the moment on the supports and draw bending moment diagram for the frame shown in Figure 1. Use moment distribution method. [10]

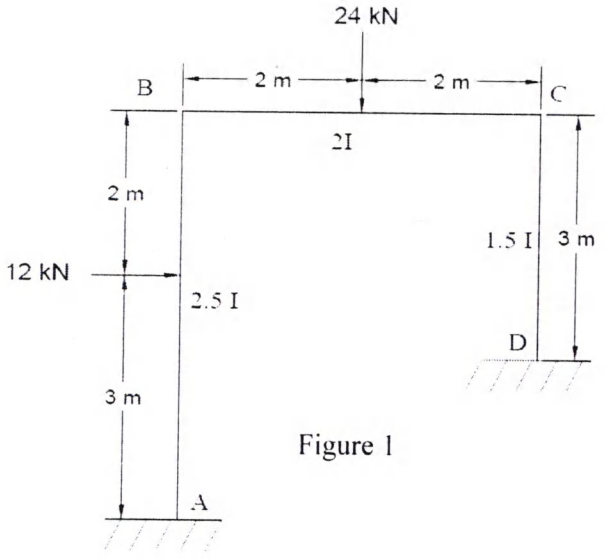

Figure 1

2. Determine the reactions in the supports using slope deflection method and draw the bending moment diagram for the beam shown in Figure 2. [5]

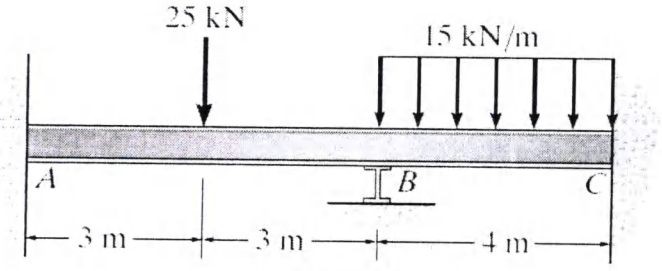

Figure 2

3. Determine the deflection at the end B of the clamped A-36 steel strip. The spring has a stiffness of k = 2 N/mm. The strip is 5 mm wide and 10 mm high (Figure 3). Also, draw the shear and moment diagrams for the strip. Use Force method. [5]

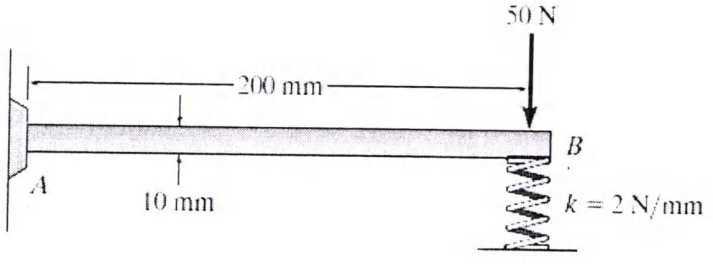

Figure 3

4. A two hinged parabolic arch of span 30 m and rise 7.5 m carries a uniformly distributed load of 10 kN/m on the left half of the span. Determine (i) the horizontal thrust at each support (ii) position and magnitude of maximum bending moment (iii) normal thrust and radial shear at the section of maximum bending moment. [8]

5. Determine the plastic modulus and the shape factor for the T section shown in Figure 4. The units are in mm. [3]

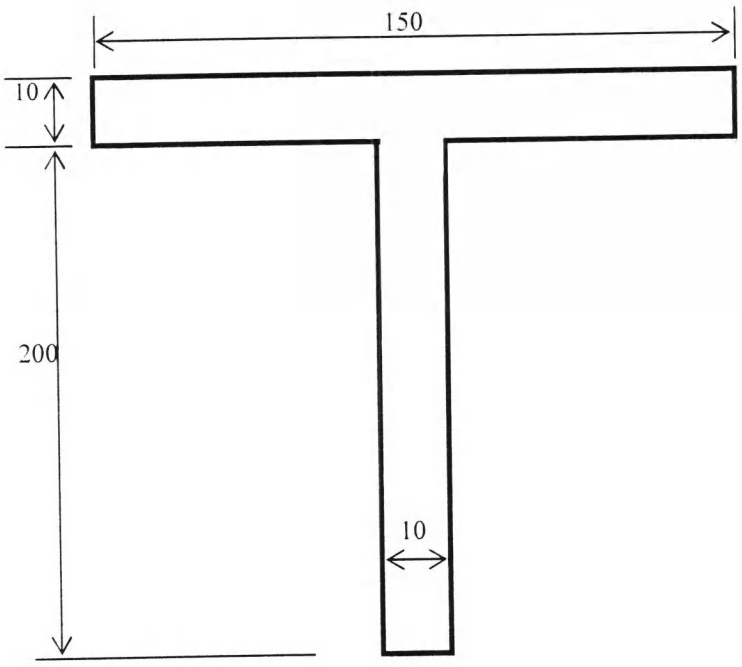

Figure 4

6. Determine the plastic moment capacity M_p for the frame shown in the Figure 5. (Loads shown are already factored.) [3]

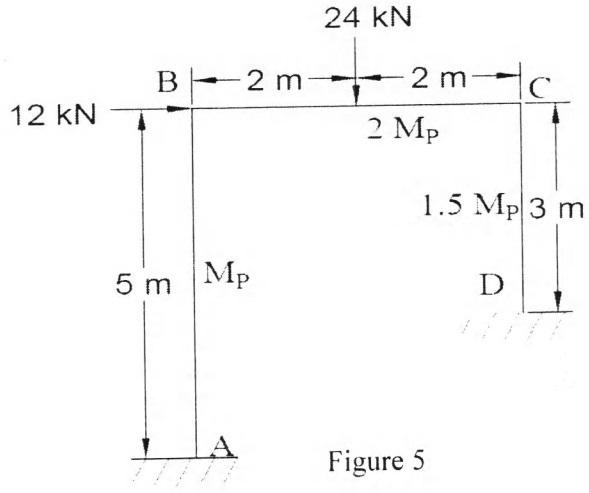

Figure 5

7. Analyse the portal frame ABCD shown in Figure 6 by stiffness matrix method. EI is constant throughout. [6]

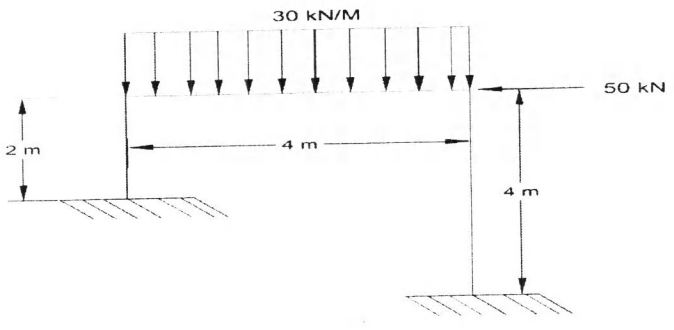

Figure 6