KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024

Marks Scored:

Level : B.Tech.
Year : II

28 JAN 2024

Course : ENVE 205
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date :

SECTION "A"
[20Q. × 1 = 20 marks]

Encircle the most appropriate answer.

1. A concentrated load is one which
   a. acts at a point on a beam
   b. spreads non-uniformly over the whole length of a beam
   c. spreads uniformly over the whole length of a beam
   d. varies uniformly over the whole length of a beam

2. In a cantilever carrying a uniformly varying load starting from zero at the free end, the shear force diagram is
   a. A horizontal line parallel to x-axis
   b. A line inclined to x-axis
   c. Follows a parabolic law
   d. Follows a cubic law

3. If the shear force along a section of a beam is zero, the bending moment at the section is
   a. zero
   b. always maximum
   c. always minimum
   d. Max or Min

4. The shape of the bending moment diagram over the length of a beam (with no self-weight) having no external load, is always
   a. Linear
   b. parabolic
   c. cubical
   d. circular

5. Center of gravity of plane triangle
   a. One-half of the total height above base
   b. One-third of the total height above base
   c. One-fourth of the total height above base
   d. One –fifth of the total height above base

6. The moment of Inertia of a body is measurement of:
   a. Its resistance against translation
   b. Its resistance against shear
   c. Its resistance against linear deformation
   d. Its resistance against rotation

7. The ratio of the moment of inertia of a circular plate and that of a square plate for equal depth, is
   a. less than one
   b. equal to $3\pi/16$
   c. more than one
   d. equal to one

8. If a part of shaft is constrained to move and heated, it will develop
   a. Principle stress
   b. Tensile stress
   c. Compressive stress
   d. Shear stress

9. For a given material Young's modulus is 200 GN/m^2 and modulus of rigidity is 80 GN/m^2. The value of Poisson's ratio is
   a. 0.10 b. 0.25 c. 0.20 d. 0.30

10. The neutral axis of the cross-section a beam is that axis at which the bending stress is
    a. Zero b. Minimum c. Maximum c. Infinity

11. For a thin cylinder shell, the ratio of hoop stress to longitudinal stress is
    a. 2 b. ½ c. 1 d. 3

12. The hoop stress in a cylindrical shell is
    a. Longitudinal stress
    b. Compressive stress
    c. Radial Stress
    d. Circumferential tensile stress

13. What is the stress developed in bending a 10 mm diameter steel rod of E = 2 x 10^5 N/mm^2 to 2000mm diameter?
    a. 2000 N/mm^2 b. 1000 N/mm^2 c. 400 N/mm^2 d. 500 N/mm^2

14. A relation governing the simple bending of beam is
    a. $\left[\frac{M}{I} = \frac{y}{\sigma} = \frac{E}{R}\right]$ b. $\left[\frac{M}{I} = \frac{\sigma}{y} = \frac{R}{E}\right]$ c. $\left[\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}\right]$ d. $\left[\frac{M}{y} = \frac{\sigma}{I} = \frac{E}{R}\right]$

15. The section modulus of a rectangle with a depth d and breadth b will be
    a. $bd^3 / 6$ b. $bd^3 / 12$ c. $bd^2 / 12$ d. $bd^2 / 6$

16. The point of contraflexure is a point where
    a. shear force changes sign
    b. bending moment changes sign
    c. shear force is maximum
    d. bending moment is maximum

17. A shaft turning 150 r.p.m. is subjected to a torque of 150 kgm. Horse power transmitted by the shaft is
    a. π b. 10π c. $\pi 2$ d. $1/\pi$

18. The shear stress at any section of a shaft is maximum at
    a. the center of the section
    b. a distance $r/2$ from the center
    c. the top of the surface
    d. a distance 3/4 r from the center

19. The Euler's load equal to $\left[\frac{\pi^2 EI}{4L^2}\right]$ is applicable for long column with the end condition as:
    a. Both end hinged
    b. Both ends fixed
    c. One end fixed and other end hinged
    d. One end fixed and other end free

20. Euler's formula holds good only for
    a. short columns
    b. long columns
    c. both short and long columns
    d. weak columns

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F.M. : 55

SECTION "B"

Attempt *ALL* questions. Make suitable assumptions when needed.

1. Draw the SFD and BMD for the given beam shown in figure 1: [12]

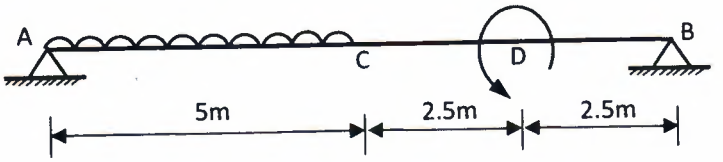

Figure 1

2. For the given figure 2 find the [5+5]
   a. Moment of inertia and product of inertia about the centroid along (X,Y) axis.
   b. Principal moment of inertia about its centroid and principal axes (orientation)

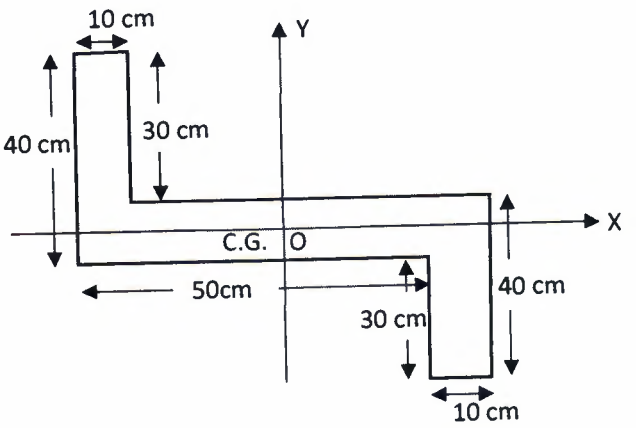

Figure 2

3. Sketch stress-strain diagram for mild-steel with all the salient points. [7]

4. A cylindrical thin drum 80cm in diameter and 3m long has a shell thickness of 1cm. If the drum is subjected to an internal pressure of 2.5 N/mm^2, determine the change in diameter (δd), change in length (δl), and change in volume (δV). Take E= 2 × 10^5 N/mm^2, Poisson's ratio = 0.25. [10]

5. Derive the Torsional equation $\left[\frac{T}{J} = \frac{\tau}{R} = \frac{G\emptyset}{L}\right]$ [8]

6. Derive an expression for Euler's formula when both end of the columns are Hinged. [8]