KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.Arch.
Year : II

Course : CIEG 231
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 19 DEC 2024

SECTION "A"

[20Q. × 0.5 = 10 marks]

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

1. The point where bending moment changes sign is known as
   a. Zero Shear b. Support c. Contraflexure d. Change point

2. The shear force diagram for a uniformly varying load is of _____ nature.
   a. Constant b. Linear c. Parabolic d. Cubic

3. Two like parallel forces of 50 N and 100 N act at the ends of a rod 360 mm long, the resultant force is
   a. 150 N b. 100 N c. 50 N d. 200 N

4. The shear force diagram of a loaded beam is shown in ***Figure 1***. The maximum bending moment in this beam is

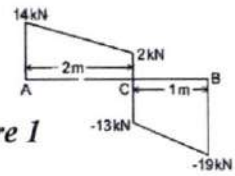

Figure 1

   a. $16\ kNm$ b. $11\ kNm$ c. $28\ kNm$ d. $8\ kNm$

5. What is the moment generated for a cantilever beam of length 'l' m loaded with uniform load of 'w' kN/m
   a. wl b. $wl/2$ c. wl^2 d. $wl^2/2$

6. The centroid of a semi-circle lies ..... above its base (r is the radius of the semi-circle)
   a. exact at its base b. $4r/3\pi$ c. $2r/3\pi$ d. $r/3\pi$

7. If the resultant of two forces P and Q acting at an angle (α) with P, then
   a. $tan\alpha = \frac{Psin\theta}{P+Qcos\theta}$ b. $tan\alpha = \frac{Psin\theta}{P+Qcos\theta}$ c. $tan\alpha = \frac{Psin\theta}{P+Qcos\theta}$ d. $tan\alpha = \frac{Psin\theta}{P+Qcos\theta}$

8. For a cantilever beam, bending moment is zero at
   a. One fourth form the free end b. Fixed end
   c. Center of beam d. Free end

9. For triangle ABC the side AB represents magnitude of force and altitude of triangle represents moment arm from moment center C then moment about C is .....
   a. Area of triangle ABC b. ½ area of triangle
   c. 2 area of triangle ABC d. 3 area of triangle ABC

10. If r is number of reactions, n is number of members, for a statically determinate structure,
a. $r < 3n$ b. $r > 3n$ c. $r = 3n$ d. $r \leq 3n$

11. The moment of inertia of a circular section of diameter (d) is given by the relation
a. $\frac{\pi d^4}{16}$ b. $\frac{\pi d^4}{32}$ c. $\frac{\pi d^4}{64}$ d. $\frac{\pi d^4}{96}$

12. Time of flight of a projectile on a horizontal plane, is
a. $2u \sin \alpha/g$ b. $2u \cos \alpha/g$ c. $2u \sec \alpha/g$ d. $2u \tan \alpha/g$

13. In a couple, the line of action of forces are.
a. parallel b. inclined c. intersect d. start from same origin

14. We are given an equation of displacement 's' in terms of time 't'. If we differentiate it with respect to 't'. the equation so obtained will give
a. Height b. Acceleration c. Distance d. Velocity

15. If the reaction of a beam, at one of its supports is the resultant of horizontal and vertical forces, then it is a
a. Simply supported end b. Roller supported end
c. Hinged end d. Fixed end

16. Parallel Axis theorem states the following
a. $I_{AB} = I_G + Ah^2$ b. $I_G = I_{AB} + Ah^2$ c. $I_{AB} = I_G + Ah^3$ d. $I_{AB} = I_G - Ah^2$

where, I_{AB} is MOI about axis AB, I_G is MOI about Centroidal axis, A is area of lamina and h is perpendicular distance between centroid and AB.

17. When a body moves along a curve, the body is said to be in _____ motion.
a. Curvilinear b. Rectilinear c. Linear d. Circular

18. _____ support allows rotation & lateral movement but no vertical movement.
a. Fixed b. Roller c. Pin d. Free

19. The slope of bending moment curve is equal to
a. Tension force b. Compression force
c. Axial force d. Shear force

20. Three forces 7 N, 14 N and 28 N act along three sides of an equilateral triangle AB, BC and CA. Side AB being horizontal. The resultant of system is
a. 18.15N b. 31.77N c. 23.71N d. 71.31N

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SECTION "B"
[40 marks]

Attempt *ALL* questions.

1. State and explain De' Albert Principle. Show that rate of change of angular momentum about any point at any instant of time is equal to moment of force about that point. [2+2]

2. Locate the centroid of the plane area given in ***Figure 1***. All dimensions are in inch. [5]

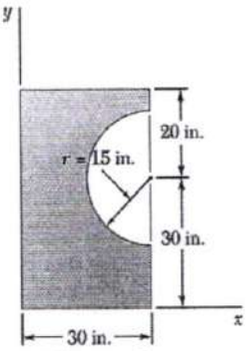

Figure 1

3. Determine **Moment of inertia (moi)** of a built-up section shown in ***Figure 2*** about x- axis passing through center of gravity of the section. Also calculate moi w.r.t the top of section using transfer theorem. [5]

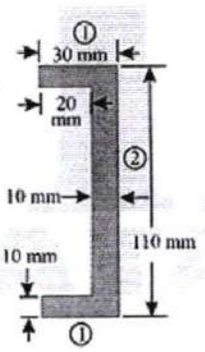

Figure 2

4. A string ABCD, attached to fixed points A and D has two equal weights of 1000 N attached to it at B and C. The weights rest with the portions AB and CD inclined at angles as shown in ***Figure 3,*** find the tensions in the portions AB, BC and CD of the string, if the inclination of the portion BC with the vertical is 120°. [5]

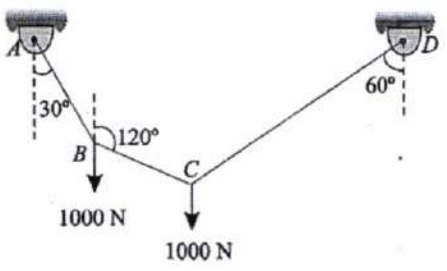

Figure 3

5. State and derive the parallel axis theorem. [1+3]

P.T.O.

6. Two rough plane inclined at 30 degree and 60 degrees to the horizontal and same height are placed back-to-back. Mass of A is 12 kg and B is 24 kg are connected by string ***(Figure 4).*** If μ=0.6, and taking g = 9.8 m/s^2,

   i. Find the resulting acceleration of system.
   ii. Tension in the string and
   iii. Reaction of pulley [2+2+1]

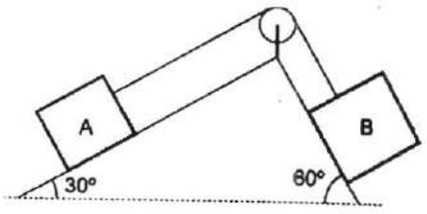

Figure 4

7. A ball is tossed with a velocity of 10 m/s directed vertically upward from a window located 20m above the ground. Knowing that the acceleration of ball is constant and equals to 9.81m/s^2 downwards. Determine:

   i. The velocity and elevation 'y' of the ball above the ground at any time, t.
   ii. The highest elevation reached by the ball and corresponding value of t.
   iii. The time when the ball will hit the ground and corresponding velocity. [2+2+1]

8. Draw the Shear Force Diagram and Bending Moment Diagram for the beam in ***Figure 5.*** Also determine the point of contra flexure and the point of zero shear. [7]

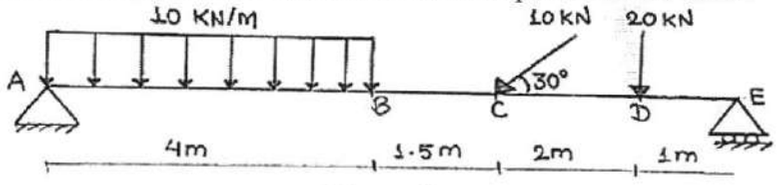

Figure 5