KATHMANDU UNIVERSITY
End Semester Examination [C]
November/December, 2023

Marks Scored:

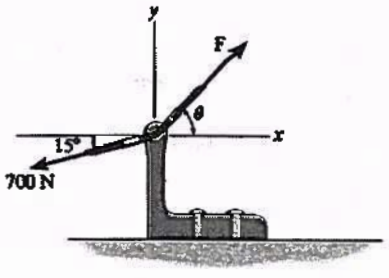
Level : B.E./B.Tech.
Year : II
Course : MEEG 216
Semester : I
Exam Roll No. :
Time: 30 mins.
F. M. : 20
Registration No.:
Date 05 DEC 2023

SECTION "A"
[20 Q. × 1 = 20 marks]

Encircle the most appropriate answer.

1. Concurrent forces are those forces whose lines of action
   a. Lie on the same line
   b. Meet at one point
   c. Meet on the same plane
   d. None of these

2. If the magnitude of the resultant force is to be 500 N, directed along the positive y-axis, the magnitude of force F is
   a. 690 N
   b. 960 N
   c. 906 N
   d. 609 N




3. Uniformly distributed load of 5 kN acts on a simply supported beam of length 10 m. What are the reactions at end points of the beam?
   a. 12.5 kN
   b. 25 kN
   c. 50 kN
   d. 10 kN

4. Indeterminate structures have number of unknown quantities _____ available conditions of equilibrium.
   a. equal to
   b. less than
   c. more than
   d. none of the above

5. The angle which an inclined surface makes with the horizontal when a body placed on the point of moving down, is called
   a. Angle of repose
   b. Angle of friction
   c. Angle of inclination
   d. None of the above

6. The limiting force of friction is
   a. The value of friction force which stops the movement of the body
   b. The value of friction force which cannot exit under a situation
   c. The friction force acting on the body is just about to move
   d. The friction force acting on a body when it is in motion

7. The coefficient of friction depends upon
   a. nature of surfaces
   b. area of contact
   c. shape of the surfaces
   d. all of the above

8. Moment of inertia of a circular section of radius '$R$' about its diametrical axis is:
   a. $\frac{\pi R^4}{64}$
   b. $\frac{\pi R^4}{32}$
   c. $\frac{\pi R^4}{4}$
   d. $\frac{\pi R^4}{8}$

9. Moment of inertia of an area about a non-centroidal axis is found out with the help of
   a. Theorem of perpendicular axis
   b. Theorem of parallel axis
   c. Polygon law of forces
   d. Theorem of parallelogram of forces

10. The moment of inertia of a rectangle base 'b' and depth 'd' about the base will be
   a. $\frac{bd^2}{6}$
   b. $\frac{bd^3}{12}$
   c. $\frac{db^3}{12}$
   d. $\frac{bd^3}{3}$

11. The velocity of a body having mass of 6 kg and linear momentum of 48 kg m/s is .... m/s
   a. 288
   b. 8
   c .6
   d. 54

12. What is the initial velocity of an object which travels a distance of $10t^2 + 15t + 5$ along a straight line in time t?
   a. -10
   b. +10
   c. -15
   d. +15

13. Starting from rest, a particle moving in a straight line has an acceleration of $a = (2t - 6)$ m/s², where $t$ is in seconds. The velocity of the particle at t=8s is ____
   a. 0 m/s
   b. 12 m/s
   c. 16 m/s
   d. 24 m/s

14. The range of a projectile is maximum, when the angle of projection is _____
   a. 30°
   b. 45°
   c. 60°
   d. 90°

15. The force for which work done is independent of _____ is called as conservative force.
   a. distance
   b. path
   c. time
   d. all of the above

16. A car travels on a horizontal circular track of radius 9 m, starting from rest at a constant tangential acceleration of 3 m/s². What is the resultant acceleration of the car, 2 sec after starting?
   a. 3 m/s²
   b. 4 m/s²
   c. 5 m/s²
   d. 7 m/s²

17. The velocity of a body on reaching the ground from a height $h$, is
   a. $2*\sqrt{(gh)}$
   b. $\sqrt{(gh)}$
   c. $\sqrt{(2gh)}$
   d. $2*g*\sqrt{(h)}$

18. What is the coefficient of restitution (e) for elastic impact?
   a. $e = 0$
   b. $e = 1$
   c. $e < 0$
   d. $e > 1$

19. A car moves along a circular arc at a speed of 30 m/s, if speed of the car is increased at the rate of 50 m/s², what is the resultant acceleration of the car? (Radius of arc = 15 m)
   a. 78.10 m/s²
   b. 58.10 m/s²
   c. 60.23 m/s²
   d. 33.16 m/s²

20. A car is traveling down the road at a constant speed. What is the velocity of the front of the car relative to the rear of the car?
   a. Zero
   b. The same as the speed of the car
   c. Half the speed of the car
   d. Twice the speed of the car

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SECTION "B"

Attempt *ALL* questions. Assume suitable data if missing/necessary.

1. a. Determine the tension in cables *BA* and *BC* necessary to support the 60-kg cylinder shown in figure 1 [4]

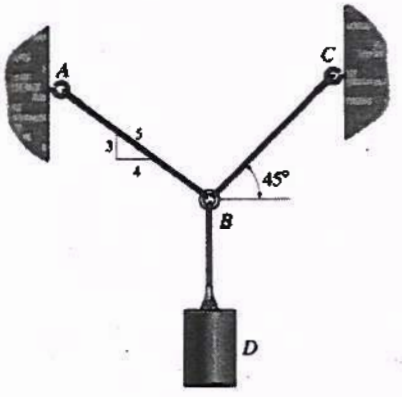


Figure 1

b. Find the total moment about A due all the forces as shown in the figure 2. [4]

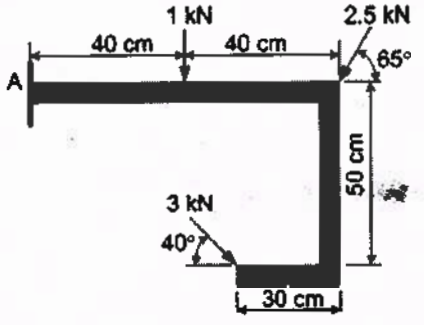


Figure 2

c. A cantilever beam supports the variable load as shown in figure 3. Determine the reactions at A. [4]

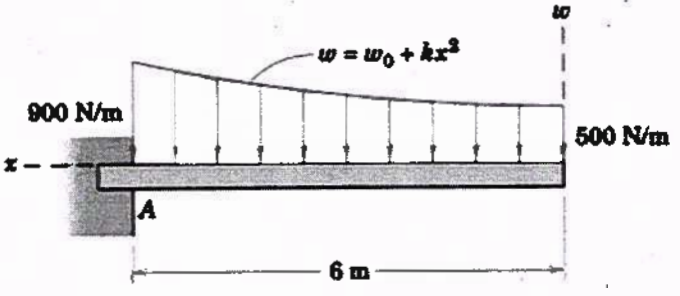


Figure 3

2. Determine the force developed in members FE, EB, and BC of the truss and state if these members are in tension or compression. [5]

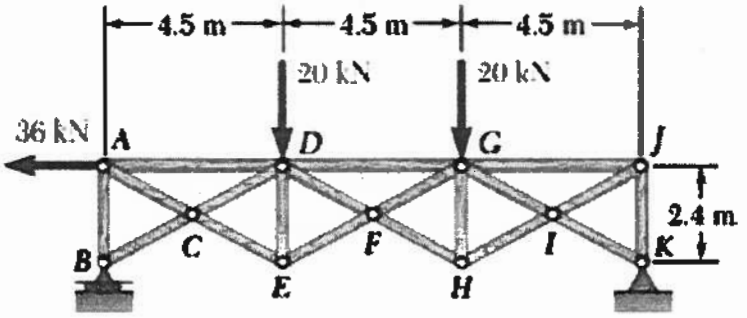


Figure 4

3. The coefficients of friction are $\mu_s = 0.4$ and $\mu_k = 0.3$ between all surfaces of contact. Determine the smallest force **P** required to start the 30-kg block moving [4]

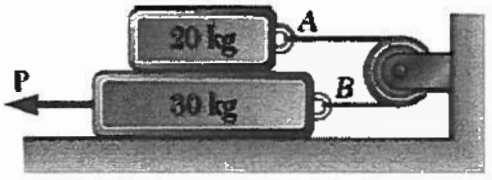


Figure 5

4. a. Determine the centroid $(\bar{x}, \bar{y})$ of the shaded area. [4]

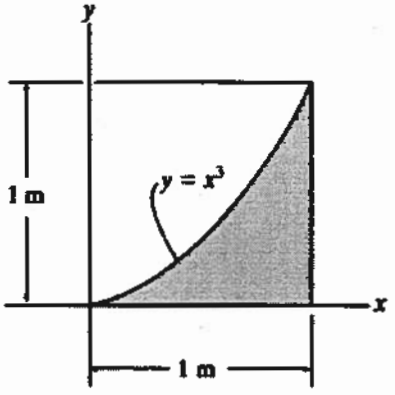


Figure 6

b. Determine the moments of inertia of the shaded area shown with respect to the $x$ and $y$ axes when $a = 20$ mm. [4]

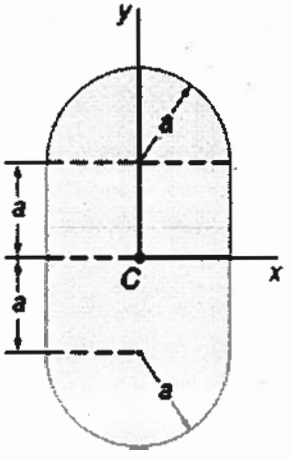


Figure 7

5. a. The acceleration of a particle is directly proportional to the square of the time $t$. When $t = 0$, the particle is at $x = 24$ m. Knowing that at $t = 6$ s, $x = 96$ m and $v = 18$ m/s, express $x$ and $v$ in terms of $t$. [4]

b. A projectile is fired with an initial velocity of 240 m/s at a target B located 600 m above the gun A and at a horizontal distance of 3,600 m. Neglecting air resistance, determine the value of the firing angle α needed to hit the target. [4]

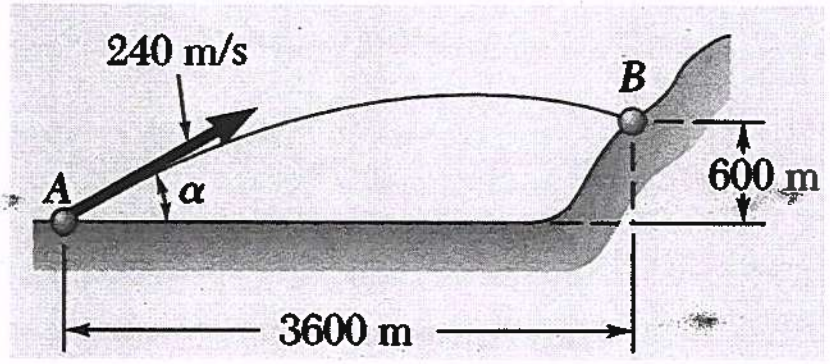


Figure 8

6. a. Two blocks are joined by an inextensible cable as shown in figure 9. If the system is released from rest, determine the velocity of block $A$ after it has moved 3 m. Assume that the coefficient of friction between block $A$ and the plane is $\mu_k = 0.25$ and that the pulley is weightless and frictionless. [4]

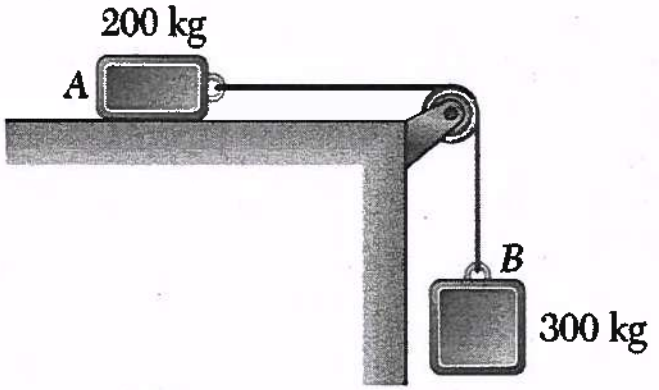


Figure 9

b. Ball $A$ has a mass of 3 kg and is moving with a velocity of 8 m/s when it makes a direct collision with ball $B$, which has a mass of 2 kg and is moving with a velocity of 4 m/s. If $e = 0.7$, determine the velocity of each ball just after the collision. Neglect the size of the balls. [4]

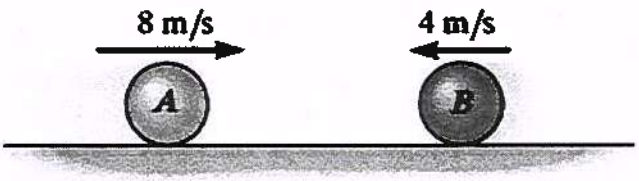


Figure 10

7. An automobile travel to the right at a constant speed of 30 m/s. If the diameter of a wheel is 60 cm, determine the velocities of points B, C, D, and E on the rim of the wheel. [6]

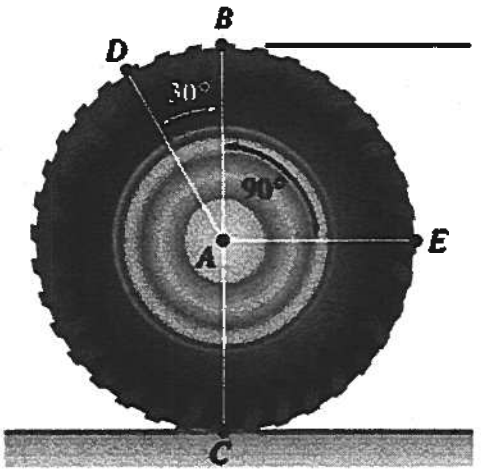


Figure 11

8. Write short notes on *ANY TWO*: [4]
   a. Equilibrium of a rigid body
   b. Principle of work and energy
   c. General Plane Motion