KATHMANDU UNIVERSITY
End Semester Examination
March, 2025

Marks Scored:

Level : B.E.
Year : II
Course : MEEG 216
Semester : I

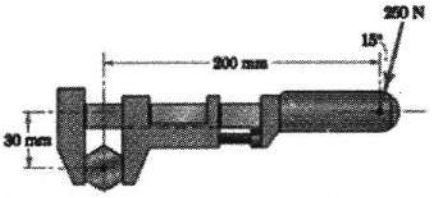
Exam Roll No. :
Time: 30 mins.
F. M. : 20

Registration No.:
Date : March-16,025

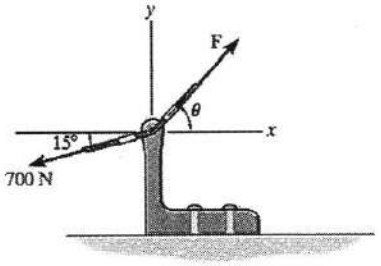
SECTION "A"
[20 Q. × 1 = 20 marks]

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

1. Find the moment of the force (250N) about the center of the bolt applied on the handle of the wrench
   a. 46.4 N-m clockwise
   b. 46.4 N-m Counter-clockwise
   c. 50 N-m clockwise
   d. 50 N-m Counterclockwise



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. 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. $\frac{\Pi R^4}{8}$

4. 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

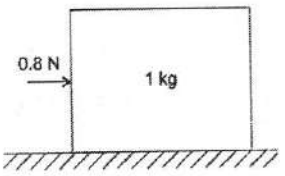
5. The moment of inertia of a rectangular lamina with respect to its base is ..... Take width of rectangle as 150 mm and height as 200mm.
   a. 2.6×10^8 mm^4 b. 4.0×10^8 mm^4 c. 3.6×10^8 mm^4 d. 2.4×10^8 mm^4

6. In a statically determinate plane truss, the number of joints (n) and number of members (m) are related by
   a. m =2n + 3 b. m =2n - 3 c. n=2m+3 d. n=2m-3

7. In the method of sections for the analysis of trusses, the section line should
   a. cut not more than 3 members and separate them into two independent parts
   b. cut 3 members and separate them into two independent parts
   c. cut only three members
   d. cut at least 3 members

8. The coefficient of friction depends upon
   a. the normal reaction
   b. the surface roughness
   c. the tangential force applied
   d. the speed of movement

9. A 1 kg block is resting on the surface with a coefficient of friction of 0.1. A force of 0.8N is applied to the block as shown in the figure. The friction force is



   a. 0 N
   b. 0.4 N
   c. 0.8 N
   d. 1 N

10. Starting from rest, a particle moving in a straight line has an acceleration of $a = (2t - 6)$ m/s^2, 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

11. Ball A is thrown straight up. Which of the following statements about the ball are true at the highest point in its path?
   a. The velocity and acceleration are both zero.
   b. The velocity is zero, but the acceleration is not zero.
   c. The velocity is not zero, but the acceleration is zero.
   d. Neither the velocity nor the acceleration is zero.

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

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

14. The work done by a 2 N force directed at a 30° angle to the vertical to move a 500 gram box to a horizontal distance of 400 cm across a rough floor at a constant speed of 0.5 m/s is
   a. 7 J
   b. 4 J
   c. 2 J
   d. 0

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

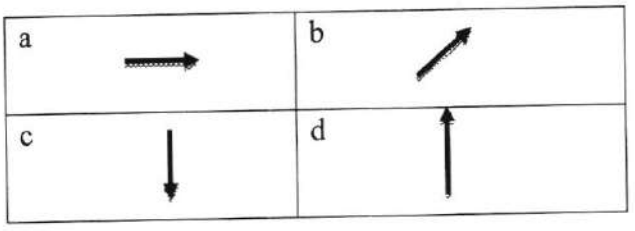
16. The force for which work done is independent of _____ is called as conservative force.
   a. distance
   b. path
   c. time
   d. all of the above

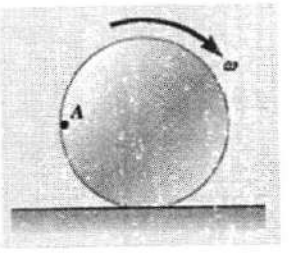
17. A car is traveling down the road at a constant speed. What is the velocity of the front of the car relative to the rear of the car?
   a. Zero
   b. The same as the speed of the car
   c. Half the speed of the car
   d. Twice the speed of the car

18. If the momentum of the given particle is doubled, the its kinetic energy will be
a. doubled b. quadrupled c. halved d. unaffected

19. Impulse is equal to
a. Change in velocity
b. Change in momentum
c. Change in force
d. Change in mass

20. The ball rolls without slipping on the fixed surface as shown. What is the direction of the resultant velocity of point A?





KATHMANDU UNIVERSITY
End Semester Examination
March, 2025

Level : B.E.
Year : II
Time : 2 hrs. 30mins.

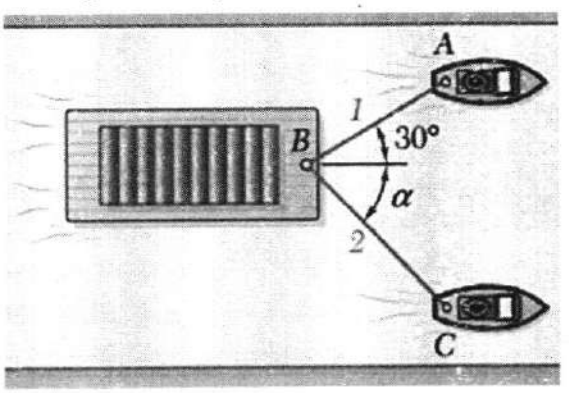
16 - March - 025

Course : MEEG 216
Semester : I
F. M. : 55

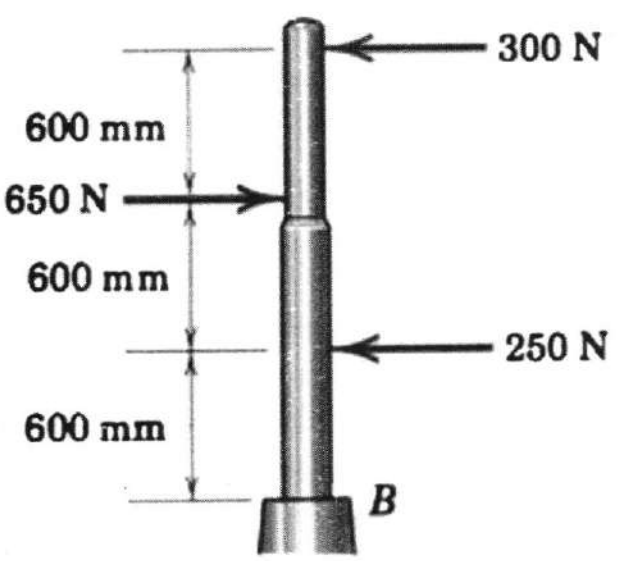
SECTION "B"
[55 marks]

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

1. a. Two tugboats are pulling a barge. If the resultant of the forces exerted by the tugboats is a 3500 N force directed along the axis of the barge, determine (*a*) the tension in each of the ropes, given that $\alpha = 50°$, (*b*) the value of α for which the tension in rope *2* is minimum. [4]



b. Determine the height h above the base B at which the resultant of the three forces acts. [4]

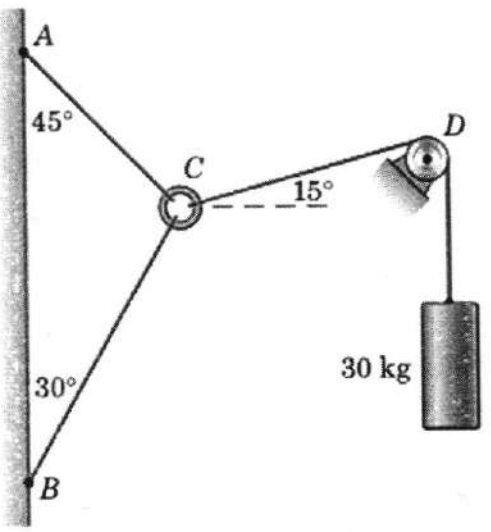


OR

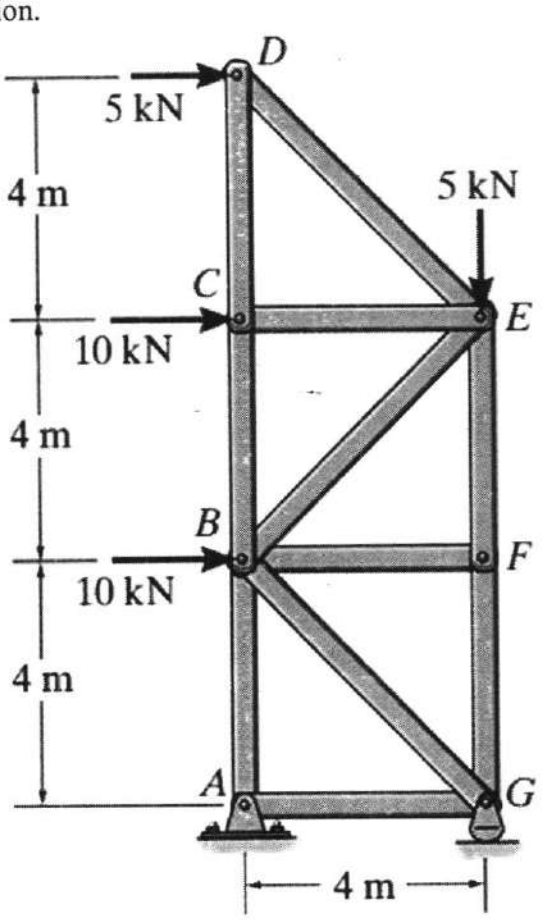
Define equilibrium of rigid body. Also, mention the necessary and sufficient conditions for the equilibrium of a rigid body.

P.T.O.

c. Three cables are joined at the junction ring C. Determine the tensions in cables AC and BC caused by the weight of the 30-kg cylinder. [3]



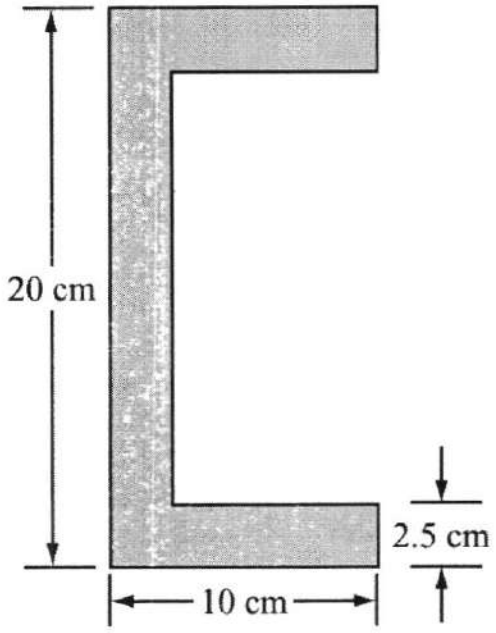
2. Determine the force in members *BE*, *EF*, and *CB*, and state if the members are in tension or compression. [4]



3. Write short notes on (***ANY TWO***): [4]
   a. Principle of transmissibility of force
   b. Parallel Axis Theorem
   c. Coefficient of restitution

4. a. Determine the distance $\bar{h}$ from the base of a triangle of altitude h to the centroid of its area. [4]

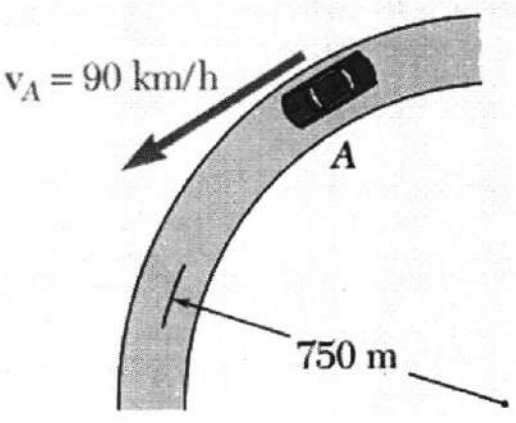
b. Find the moment of inertia of a channel section shown in about the centroidal axes. [4]



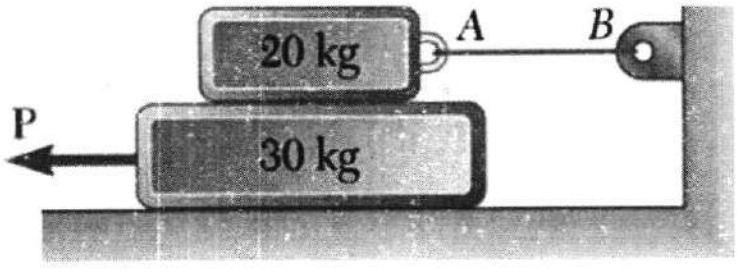
5. a. The acceleration of a particle is defined by the relation $a = 25 - 3x^2$, where a is expressed in mm/sec^2 and x in mm. The particle starts with no initial velocity at the position x = 0. Determine [4]

   a. the velocity when x = 2 mm
   b. the position where the velocity is again zero
   c. the position where the velocity is maximum.

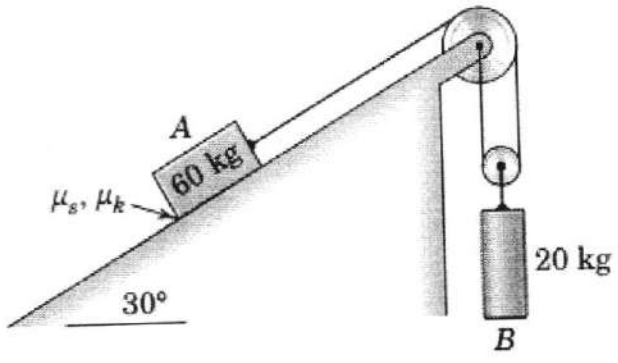
b. A motorist is traveling on a curved section of highway with a radius of 750 m at a speed of 90 km/h. The motorist suddenly applies the brakes, causing the automobile to slow down at a constant rate. If the speed has been reduced to 72 km/h after 8 s, determine the acceleration of the automobile immediately after the brakes have been applied. [4]



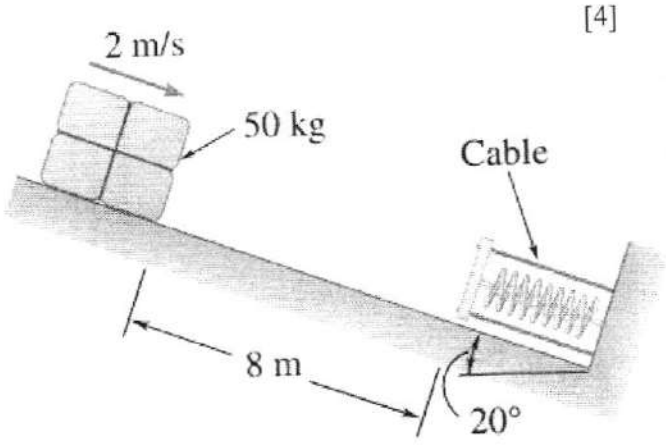
6. The coefficients of friction are $\mu_s = 0.4$ and $\mu_k = 0.3$ between all surfaces of contact. Determine the smallest force ***P*** required to start the 30-kg block moving. [4]



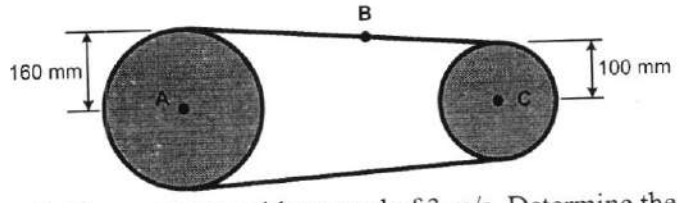
7. a. The system is released from rest with the cable taut for the friction coefficients $\mu_s = 0.3$ and $\mu_k = 0.25$, calculate the acceleration of each body and the tension T in the cable. Neglect the small mass and friction of the pulleys. [4]



b. A spring is used to stop a 50-kg package that is moving down a 20° incline. The spring has a constant $k = 30$ kN/m and is held by cables so that it is initially compressed 50 mm. Knowing that the velocity of the package is 2 m/s when it is 8 m from the spring and neglecting friction, determine the maximum additional deformation of the spring in bringing the package to rest. [4]



8. a. The belt shown moves over two pulleys without slipping. At the instance shown the pulleys are rotating clockwise and the speed of point B on the belt is 4 m/s, increasing at the rate of 32 m/s^2. Determine, at this instant, (a) angular velocity and angular acceleration of each pulley, (b) the acceleration of a point on the rim (edge) of pulley C. [4]



Block D shown in Figure moves with a speed of 3 m/s. Determine the angular velocities of links BD and AB, at the instant shown. [4]