KATHMANDU UNIVERSITY
End Semester Examination
March/April, 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 : 17 April-025

SECTION "A"
[20Q. × 1 = 20 marks]

Choose the most appropriate answer and **mark [X]**. Assume the value of acceleration due to gravity (g) = 9.8 m/sec^2 wherever it is required to use.

1. When there is no relative force between touching surfaces, which of the following force is developed?
   [ ] Dry Friction
   [ ] Dynamic Friction
   [ ] No Friction
   [ ] Static Friction

2. Which of the following is valid if two forces are represented by two sides of a triangle in order?
   [ ] The equilibrant of two forces is represented by the third side in the same sequence
   [ ] The equilibrant of two forces is represented by the third side in the reverse sequence
   [ ] The resultant magnitude is zero
   [ ] The equilibrant is zero

3. Which of the following forces do not cause the rotation?
   [ ] Non-parallel force
   [ ] Non-concurrent force
   [ ] Parallel force
   [ ] Concurrent force

4. We often use the centre of mass of the composite area to calculate the moment of inertia. The centre of mass for these composite bodies is in the ratio of
   [ ] The product of centroid and mass to the total weight
   [ ] The addition of centroid and mass to the total weight
   [ ] The product of centroid and mass to the total mass
   [ ] The addition of centroid and mass to the total mass

5. If two objects of 30 kg and 10 kg move with equal kinetic energy, then what is the ratio of magnitudes for linear momentum?
   [ ] $\sqrt{3}$: 1
   [ ] 1: $\sqrt{3}$
   [ ] 3:1
   [ ] 1:3

6. Which of the following statements about friction is **true**?
   [ ] Kinetic friction is always greater than static friction
   [ ] Static friction is always greater than or equal to kinetic friction
   [ ] Kinetic friction increases with velocity
   [ ] Friction is independent on the magnitude of the applied force

7. A 5 kg block is sliding on a rough horizontal surface with a kinetic friction coefficient of 0.3. What is the acceleration of the block due to friction?
[ ] 2.94 m/s^2 [ ] 3.21 m/s^2 [ ] 4.10 m/s^2 [ ] 5.00 m/s^2

8. A projectile is launched with an initial velocity of 20 m/s at an angle of 30° with the horizontal. What is its maximum height?
[ ] 5 m [ ] 10 m [ ] 15 m [ ] 20 m

9. A ball is projected with a velocity of 40 m/s at 37° above the horizontal. What is its velocity at the highest point?
[ ] 0 m/s [ ] 40 m/s [ ] 32 m/s [ ] 24 m/s

10. A 10 kg block is placed on a 30° inclined plane. The coefficient of static friction is 0.4. Will the block slide?
[ ] Yes [ ] No
[ ] Only if an external force is applied [ ] cannot be determined

11. An object moving with constant acceleration covers distances in successive equal time internals. The distance covered in each successive interval:
[ ] Remains constant [ ] Increases
[ ] Decreases [ ] First increases, then decreases

12. A car moving at 40 m/s applied brakes, and its deceleration is given by $a = -0.5\ v\ m/s^2$. How long will it take for the car to come to rest?
[ ] 20 sec [ ] 40 sec [ ] 60 sec [ ] 80 sec

13. Which of the following has the greatest inertia?
[ ] A 5kg object moving at 10 m/s [ ] A 10 kg object at rest
[ ] A 2 kg object moving at 20 m/s [ ] A 1 kg object moving at 50 m/s

14. A 0.2 kg ball moving at 20 m/s strikes a rigid wall perpendicularly and bounces back with the same speed. The ball is in contact with the wall for 0.01 seconds. What is the average force exerted by the wall on the ball?
[ ] 400 N [ ] 800 N [ ] 1000 N [ ] 1200 N

15. Find the centroid coordinates of a right-angled triangle with base 6 m and height 4 m, considering the right angle at the origin.
[ ] (2, 1) [ ] (3, 2) [ ] (4, 2) [ ] (2, 3)

16. Find the moment of inertia of a rectangle with base 6 m and height 4 m about its centrodial horizontal axis.
[ ] 32 m^4 [ ] 16 m^4 [ ] 72 m^4 [ ] 24 m^4

17. A rectangle ABCD has sides AB = CD = 80 mm and BC = DA = 60 mm. Forces of 150 N each act along AB and CD, and forces of 100 N each act along BC and DA. The resultant moment of the force system is
[ ] 8000 Nmm [ ] 9000 Nmm [ ] 1000 Nmm [ ] 17000 Nmm

18. A stone tied to the end of a string 100 cm long is whirled in a horizontal circle with a constant speed. If the stone makes 15 revolutions in 30 seconds, the acceleration of the stone is closest to

[ ] 315 cm/s^2 [ ] 630 cm/s^2 [ ] 985 cm/s^2 [ ] 3950 cm/s^2

19. When two bodies move uniformly towards each other, the distance between them decreases by 6 m/sec. If both bodies move in the same direction, the distance between them increases by 4 m/sec. Then the speeds of two bodies are

[ ] 3 m/s and 3 m/s [ ] 4 m/s and 2 m/s
[ ] 5 m/s and 1 m/s [ ] 8 m/s and 5 m/s

20. A bullet of mass 0.04 kg moving with a speed of 90 m/sec enters a heavy wooden block and is stopped after a distance of 60 cm. The average resistive force exerted by the block on the bullet is.

[ ] 180 N [ ] 220 N [ ] 270 N [ ] 320 N

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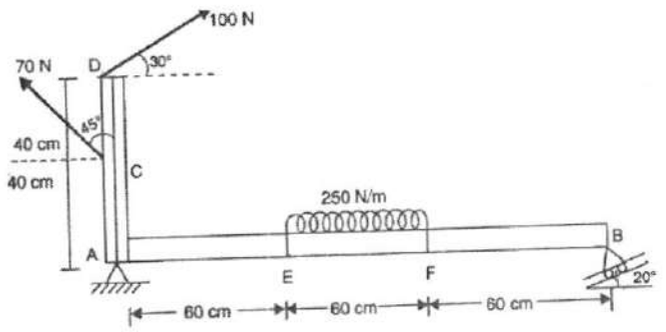
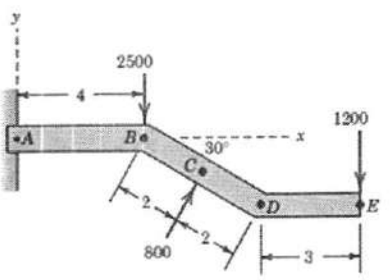
SECTION "B"

Answer ***ALL*** questions. Assume the value of acceleration due to gravity (g) = 9.8 m/sec^2 wherever it is required to use.

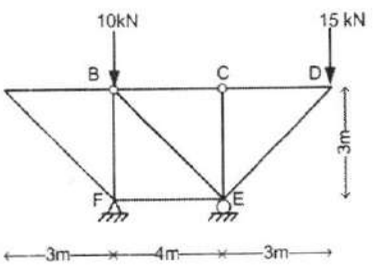
1. Find the reactions at supports of an L-bent shown in the figure below. [4]



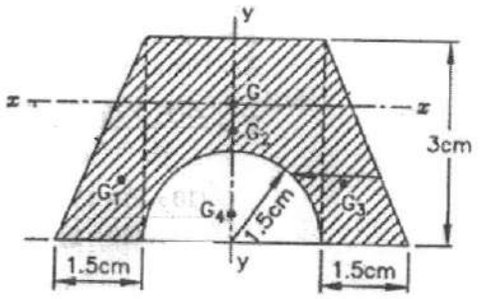
2. Replace the three forces 2500 N, 800 N and 1200 N acting at B, C and E respectively on the bent bar by a force couple system at the support point A. All dimensions are in cm. [3]



3. Compute the force in members BC, BE, FE and CD of the loaded truss as shown in the figure below. [5]



4. Locate the centroid of the area about the given axis x-x and y-y. [4]



5. Find the moment of inertia of the area from the question 3 about the x-x and y-y axis passing through its CG. Take the centroid data from the question number 3. [5]

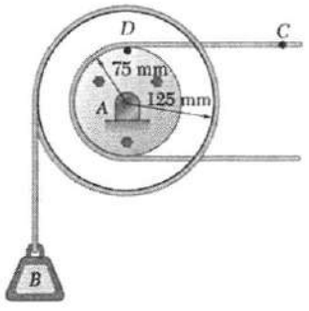
6. Find the force required to move a body of 30 N up a rough inclined plane, the force being applied parallel to the plane. The inclination of the plane is such that when the same body is kept on a perfectly smooth plane inclined at that angle, a force of 6 N applied at an inclination of 30° to the plane keeps the same in equilibrium. Assume coefficient of friction between the rough plane and the body is equal to 0.3. [6]

7. A bullet is fired from the top of a 30 m height building upward at an angle of 40° to the horizontal with an initial speed of 30 m/sec. Determine (a) horizontal and vertical distance from the point of projection to the point where the stone strikes the ground, (b) the greatest elevation reached by the projectile above the ground, (c) velocity when it strikes the ground, and (d) the total time of flight. [6]

8. A particle has travelled 396.9 m in three seconds, 392 m in next four seconds and 270 m in the next five seconds. Prove that the particle is moving with uniform acceleration. Also find the time before it comes to rest. [5]

9. A 10 kg block is pushed up a 6 m long rough incline plane which is inclined at 30° to the horizontal. The block is pushed with an initial velocity of 5 m/sec. If the coefficient of static friction and kinetic friction between the block and the inclined plane is 0.3 and 0.25 respectively, determine (a) using the work energy principle, how far up the inclined plane the block travels before coming to rest, (b) if the incline were frictionless, determine how far the block would travel before coming to rest, and (c) after coming to rest, does the block slide back down? Justify your answer by calculating the component of forces acting on it. [7]

10. Cable C has a constant acceleration of 225 mm/s^2 and an initial velocity of 300 mm/s, both directed to the right. Determine (a) the number of revolution of the pulley in 2 s, (b) the velocity and change in position of the load B after 2 s, and (c) the acceleration of the point D on the rim of the inner pulley at t=0. [5]



11. A man of mass 70 kg stands in an aluminum canoe of mass 35 kg moving with a certain initial velocity. He fires a bullet of mass 25 gm horizontally to hit a wooden block of mass 2.25 kg resting on smooth horizontal surface. The wooden block and bullet move together with a velocity of 5 m/sec after the impact. Find the initial velocity of canon with man and the velocity of a bullet. [5]