KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2019

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.:

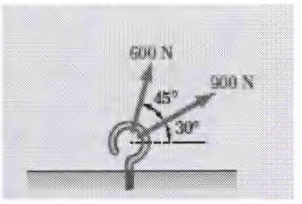
Date : FEB 2 1 2019

SECTION "A"
[20Q. × 1= 20 marks]

Tick the most appropriate answer.

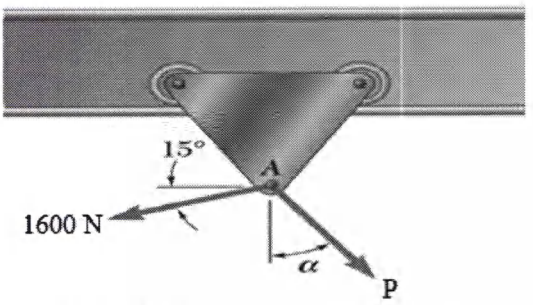
1. The forces, which meet at one point, but their lines of action do not lie in a plane, are called
   a. Coplanar non-concurrent forces
   b. Non-coplanar concurrent forces
   c. Non-coplanar non concurrent forces
   d. Parallel forces

2. Two forces are applied as shown to a hook. The resultant of these forces will be
   a. 1200 N
   b. 1290 N
   c. 1391 N
   d. 1245N



3. For a body to be in complete equilibrium, it should have
   a. Zero resultant forces
   b. Zero resultant moments
   c. Zero resultant forces and Zero resultant moments
   d. Body never achieves complete equilibrium

4. A trolley that moves along a horizontal beam is acted upon by two forces as shown. What is the magnitude of the force P so that the resultant is a vertical force of 2500 N.?



   a. 1800 N b. 2000N c. 2200N d. 2600 N

5. To solve a truss by the method of joints, the number of unknowns at join should not be
   a. less than two b. more than two c. less than three d. more than three

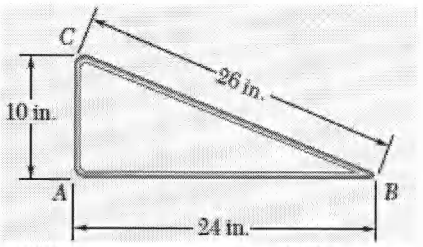
6. The joints of simple trusses are assumed to be _____ for plane trusses
   a. fixed joint b. ball and socket c. pin connection d. rivet joint

7. When number of unknowns is more than equilibrium equations the structure is
   a. statically determinate
   b. statically indeterminate
   c. statically equilibrium
   d. completely constrained

8. If a ball is thrown vertically upwards, the ball will reach highest elevation when
   a. acceleration is maximum
   b. velocity is maximum
   c. velocity is zero
   d. acceleration is zero

9. A cantilever of span (L) has a load P acting at the free end. The bending moment at the support end will be
   a. PL
   b. 2PL
   c. PL/2
   d. PL/4

10. The figure shown is made from a piece of thin, homogeneous wire. The location of its X coordinate of centre of gravity from origin A is



   a. 12 in
   b. 10 in
   c. 13 in
   d. 9 in

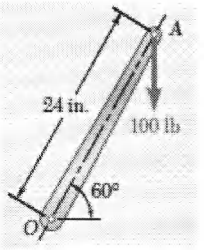
11. The maximum frictional force which comes into play when a body just begins to slide over another surface is called
   a. limiting friction
   b. sliding friction
   c. rolling friction
   d. kinetic friction

12. The displacement of a ball is described by the equation $X= 3t^3 + 6t^2+2$. What is the acceleration at t = 2s?
   a. 30 m/s^2
   b. 25 m/s^2
   c. 38 m/s^2
   d. 48 m/s^2

13. A 20-Mg railroad car moving at a speed of 0.5 m/s to the right collides with a 35-Mg car at rest. After the collision, the 35-Mg car moves to the right at a speed of 0.3 m/s. the velocity of the 20-Mg car after collision will be
   a. 0.025 m/s to the right
   b. 0.025 m/s to the left
   c. 0.035 to the right
   d. 0.035 to the left

14. If two bodies one light and other heavy have equal kinetic energies, which one has a greater momentum?
   a. Heavy body
   b. Light body
   c. Both have equal momentum
   d. It depends on the actual velocities

15. A 100-lb vertical force is applied to the end of a lever, which is attached to a shaft at O.



The moment of Force about O will be
   a. 1000 lb.in
   b. 1200 lb.in
   c. 1600 lb.in
   d. 2400 lb.in

16. Two small balls A and B with masses 2m and m, respectively, are released from rest at a height h above the ground. Neglecting air resistance, which of the following statements is true when the two balls hit the ground?
    a. The kinetic energy of A is the same as the kinetic energy of B.
    b. The kinetic energy of A is half the kinetic energy of B.
    c. The kinetic energy of A is twice the kinetic energy of B.
    d. The kinetic energy of A is four times the kinetic energy of B.

17. If no external force is exerted on particles then the linear momentum of the particles is
    a. Increasing
    b. Conserved
    c. Impulsive force is maximum
    d. Particle will be at rest

18. Work done by Friction is
    a. Positive
    b. Negative
    c. Depends on the surface
    d. Depends on the coefficient of friction

19. A perfect sphere moves up a frictionless incline. Which of the following quantities increases?
    a. Total energy
    b. Potential energy
    c. Angular velocity
    d. Liner momentum

20. Which of the following statement is False?
    a. The time rate of change of the angular momentum about a fixed point is equal to the total moment of the external forces acting on the system about the point.
    b. The coefficient of restitution can be less than zero.
    c. The frictional force always acts to resist motion.
    d. Momentum is conserved during the elastic collision.

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SECTION "B"
[31 marks]

Attempt *ALL* questions. Assume any missing data with proper reasoning.

1. The overhanging beam is supported by a pin at A and the two-force strut BC. Determine the horizontal and vertical components of reaction at A and the reaction at B on the beam. As shown in Figure 1. [5]

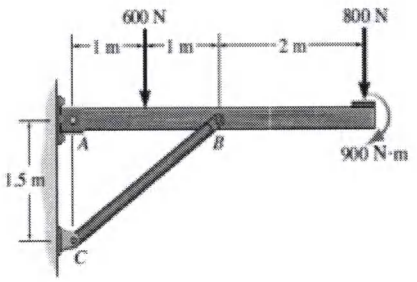

Figure 1

2. Determine the moment of inertia and the radius of gyration of the shaded area with respect to the x-axis. As shown in Figure 2. [8]

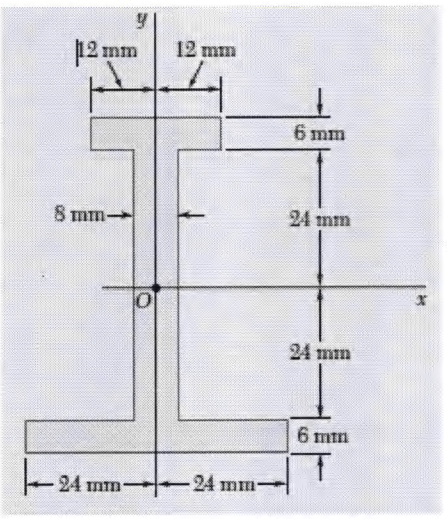

Figure 2

3. The position of the machine block B is adjusted by moving the wedge A.Knowing that the coefficient of static friction is 0.35 between all surfaces of contact, determine the force P required to (a) raise block B, (b) lower block B. As shown in Figure 3. [8]

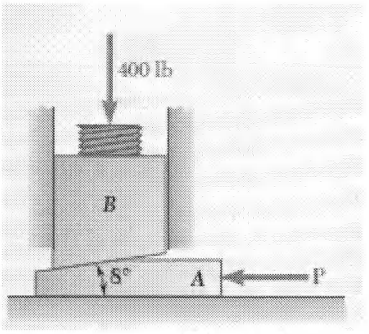

Figure 3

4. Calculate the forces induced in members KL, CL, and CB by the 200-kN load on the cantilever truss. As shown in Figure 4. [6]

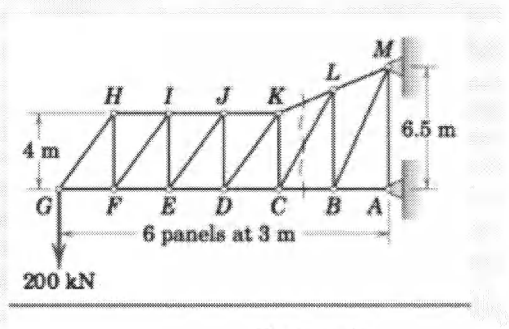

Figure 4

5. Locate the centroid of the shaded area. As shown in Figure 5. [4]

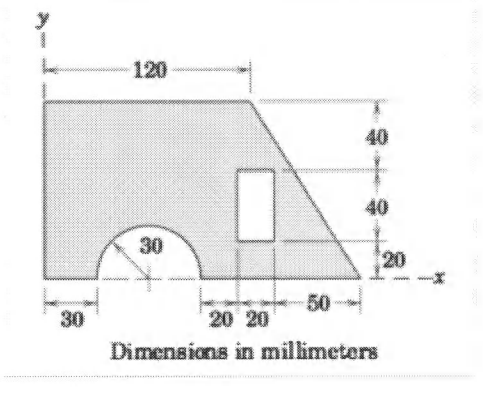

Figure 5

SECTION "C"

[4Q × 6 = 24 marks]

FEB 2 1 2019

Attempt *ALL* questions.

6. The brakes of a car are applied, causing it to slow down at a rate of 10 ft/s2. Knowing that the car stops in 300 ft, determine (a) how fast the car was traveling immediately before the brakes were applied, (b) the time required for the car to stop. As shown in Figure 6.

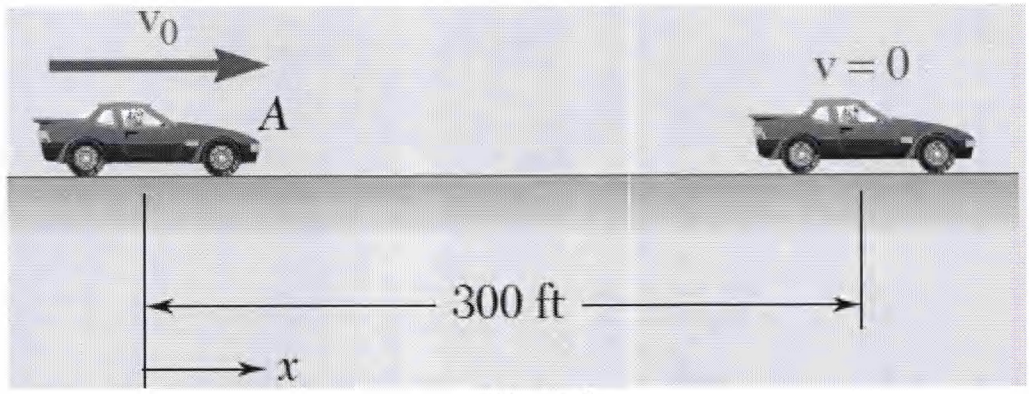

Figure 6

7. A volleyball player serves the ball with an initial velocity v_o of magnitude 13.40 m/s at an angle of 20° with the horizontal. Determine (a) if the ball will clear the top of the net, (b) how far from the net the ball will land. As shown in Figure 7.

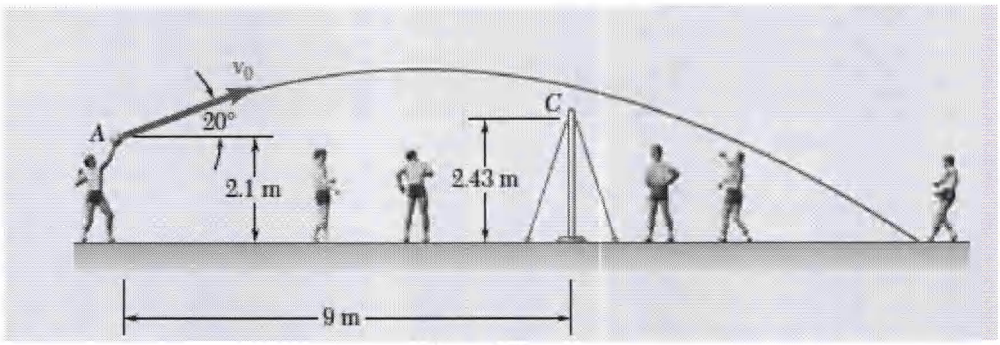

Figure 7

8. 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. As shown in Figure 8.

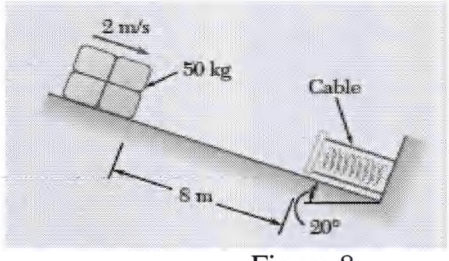

Figure 8

9. The double gear shown rolls on the stationary lower rack; the velocity of its center A is 1.2 m/s directed to the right. Determine (a) the angular velocity of the gear, (b) the velocities of the upper rack R and of point D of the gear. As shown in Figure 9.

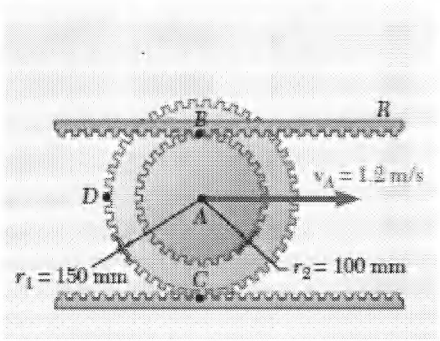

Figure 9