Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2018

Level: B. E./B.Tech.
Year : II

Course : MEEG 216
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

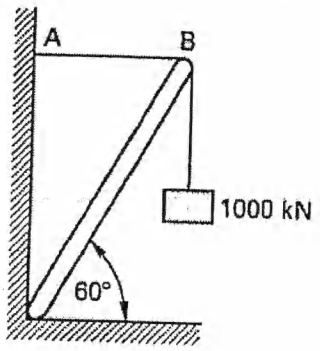
Date : MAR 04 2018

SECTION "A"
[20 Q. × 1 =20 marks]

Circle the most appropriate answer.

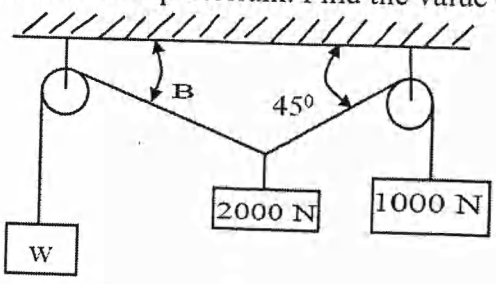
1. The forces, which meet at one point, but their lines of action do not lie in a plane, are called
   a. coplanar non-concurrent forces
   b. non-coplanar concurrent forces
   c. non-coplanar on concurrent forces
   d. interesting forces

2. The boom shown has negligible weight, but it has sufficient strength to support the 100 kN load without buckling. What is most nearly the tension in the support cable between points A and point B?



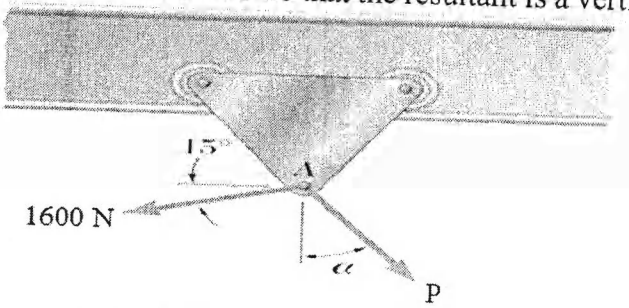
   a. 230 kN b. 430 kN c. 580 kN d. 680 kN

3. The system shown is in static equilibrium. Find the value of W.



   a. 1472 N b. 1372 N c. 1042 N d. 848 N

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



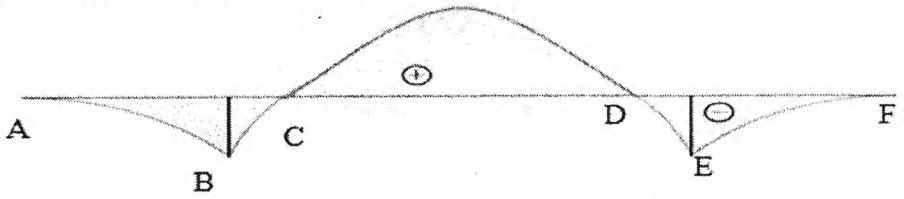
   a. 1800 N b. 2000 N c. 2200 N d. 2600 N

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

6. For a two dimension truss structure, if m is the number of member j is the number of joint, and r is the number of reactions, the condition for perfect truss is
a. $m + 2 > 2j$ b. $m + 3 < 2j$ c. $m = 2j - 3$ d. $m + 1 = 2j$

7. When shear force at a point is zero, then bending moment at that point will be
a. zero b. infinity c. minimum d. maximum

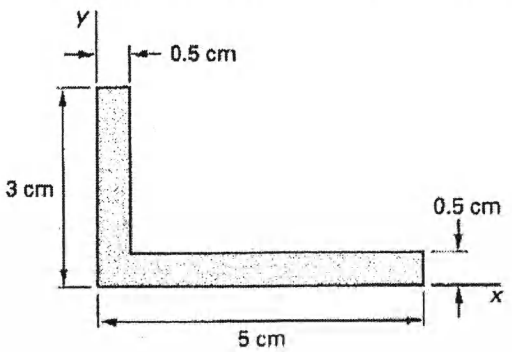
8. The bending moment diagram for an overhanging beam is shown in Figure. The point of contra-flexure would include



a. A and F b. B and E c. C and D d. A and D

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. For the given Figure, what is the x- coordinate of the centroid of the perimeter line?



a. 1.50 cm b. 1.60 cm c. 1.70 cm d. 1.80 cm

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. kinematic friction

12. The velocity (in m/s) of a falling ball is described by the equation $v = 32 + t + 6t^2$. What is the acceleration at t = 2s?
a. 10 m/s^2 b. 15 m/s^2 c. 20 m/s^2 d. 25 m/s^2

13. The kinetic energy of a rigid body of mass m and velocity of mass centre V is moving such that the rotational velocity ω will be
a. $\frac{1}{2}mv^2$ b. $\frac{1}{2}I\omega^2$ c. $\frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$ d. $\frac{1}{2}mv^2 - \frac{1}{2}I\omega^2$

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
b. both have equal momentum d. it depends on the actual velocities

15. A 1 kg disk with a diameter of 10 cm and width if 4 cm is placed on the edge at the top of an inclined ramp 1 m high. The ramp is inclined at 10^0. At the bottom of the ramp is a spring whose spring constant is 2000 N/m. The disk rolls down the ramp and compresses the spring while coming to a complete stop. What is the maximum compression of the spring?

a. 0.099 m b. 1.99 m c. 2.99 m d. 3.59 m

16. A 1500 kg car travelling at 100 km/h is towing a 250 kg trailer. The coefficient of friction between the tires and the road is 0.8 for both the car and trailer. How much energy is dissipated by the brakes if the car and trailer are braked to a complete stop?

a. 276 kJ b. 375 kJ c. 576 kJ d. 675 kJ

17. For which of the following situations is the net force acting on a particle necessarily equal to zero?

a. the particle is travelling at constant velocity around a circle
b. the particle has a constant linear momentum
c. the particle has a constant kinetic energy
d. the particle has constant angular momentum

18. "If a number of co-planer forces are acting simultaneously on a particle, the algebraic sum of the moments of all the forces about any point is equal to the moment of their resultant force about the same point". This principle is known as

a. Lami's theorem b. Verignon's principle
c. D' Alermbert's principle d. Principle of transmissibility of forces

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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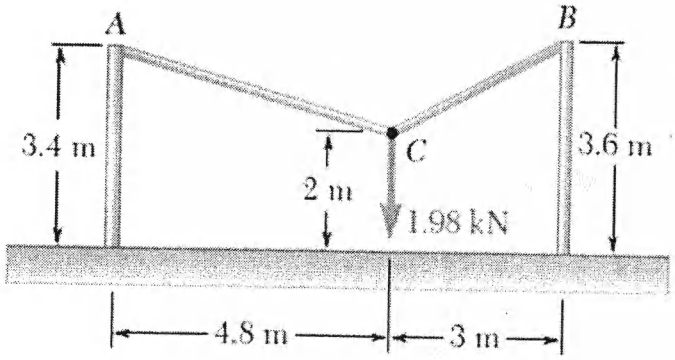
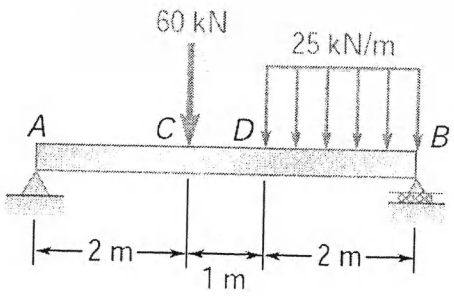
SECTION "B"

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

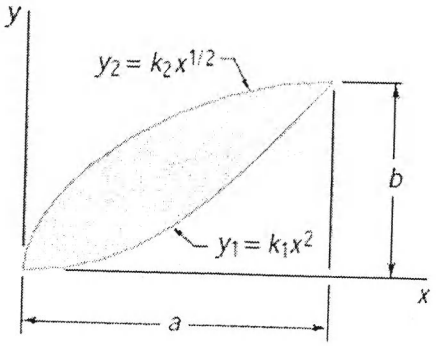
1. Two cables are tied together at C and loaded as shown. Determine the tension (a) in cable AC, (b) in cable BC. [3]



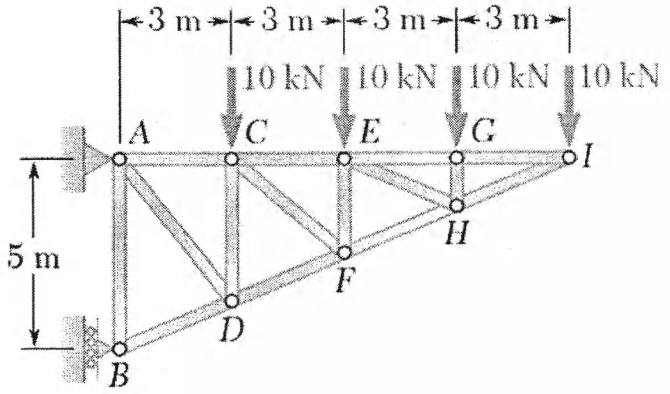
2. Draw the shear force and bending moment diagram for the beam loaded and supported as shown in Figure [8]



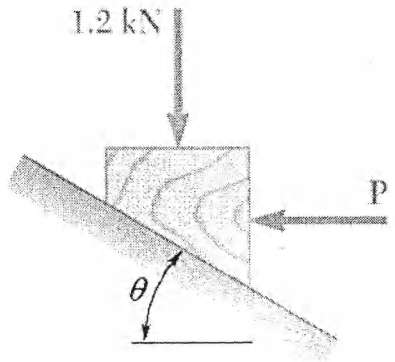
3. Determine the moment of inertia and the radius of gyration of the shaded area shown with respect to the x axis. [8]



4. Determine the force in members *CD* and *DF* of the truss shown. [8]

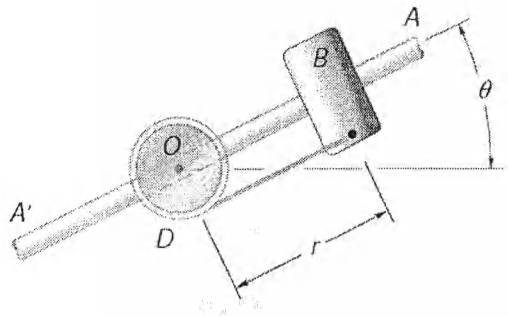


5. The coefficient of static and kinetic friction between the block and inclined plane are 0.35 and 0.25 respectively. Determine whether the block shown is in equilibrium and also find the magnitude and direction of the friction force when $\theta = 30^0$ and $P = 150$ N. [4]



6. The acceleration of a particle is defined by the relation$a = -k\sqrt{v}$, where k is a constant. Knowing that $x = 0$ and $v = 81$ m/s at $t = 0$ and that $v = 36$ m/s when $x = 18$ m, determine (*a*) the velocity of the particle when $x = 20$ m, (*b*) the time required for the particle to come to rest. [8]

7. The 3 kg collar B slides on the frictionless arm AA′. The arm is attached to drum D and rotates about O in a horizontal plane at the rate $\dot{u} = 0.75t$, where $\dot{u}$and t are expressed in rad/s and seconds, respectively. As the arm-drum assembly rotates, a mechanism within the drum releases cord so that the collar moves outward from O with a constant speed of 0.5 m/s. Knowing that at t = 0, r = 0, determine the time at which the tension in the cord is equal to the magnitude of the horizontal force exerted on B by arm AA′. [8]



8. The dumb-waiter D and its load have a combined weight of 300 kg, while the counter weight C weighs 400 kg. Determine the power delivered by the electric motor M when the dumb-waiter (a) is moving up at a constant speed of 2.5 m/s, (b) has an instantaneous velocity of 2.5 m/s and an acceleration of 1 m/s^2, both directed upward. [8]