KATHMANDU UNIVERSITY
End Semester Examination [C]
June, 2018

Marks Scored:

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

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

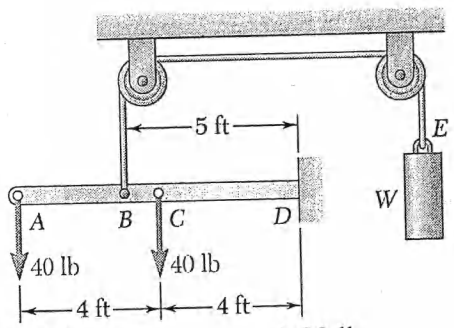
Registration No .:
Date JUN 18 2018

SECTION "A"
[20 Q. × 1 = 20 marks]

Tick the most appropriate answer.

1. The point, through which the whole weight of the body acts, irrespective of its position, is known as
   a) moment of inertia
   b) centre of mass
   c) centre of precussion
   d) centre of gravity

2. For the beam and loading shown, what is the minimum values of W for which the magnitude of the couple at D does not exceed 40 lb. ft.



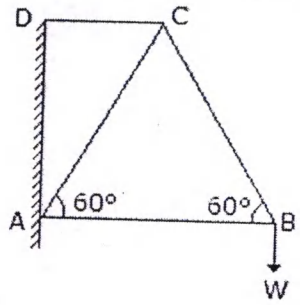
   a) 28 lb
   b) 48 lb
   c) 88 lb
   d) 108 lb

3. According to the principle of transmissibility of forces, the effect of force upon a body is
   a) maximum when it acts at the center of gravity of a body
   b) minimum when it acts at the center of gravity of a body
   c) same at point in its line of action
   d) different at different points in its line of action

4. Equilibrium of rigid body occurs when
   a) $\sum F_X = 0$
   b) $\sum F_y = 0$
   c) $\sum F_x = 0,\ \sum F_y = 0$
   d) $R = 0\ ,\ \sum M = 0$

5. For a two dimensional 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 instability of the structure is
   a) $m + r > 2j$
   b) $m + r < 2j$
   c) $m - r = 2j$
   d) $m + 2r = 2j$

6. In a framed structure, as shown in the below Figure, the force in the member *BC* is



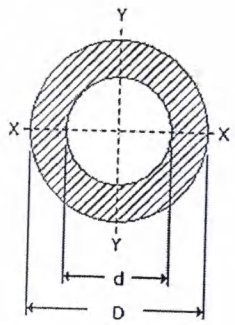
a) $W/\sqrt{3}$ (compression)
b) $W/\sqrt{3}$ (tension)
c) $2W/\sqrt{3}$ (compression)
d) $2W/\sqrt{3}$ (tension)

7. The term second moment of area strictly applicable for
a) a line
b) any plane geometry Figure
c) both a line and any geometric Figure
d) volume element only

8. Limiting force of friction is the
a) tangent of angle between normal reaction and the resultant of normal reaction and limiting friction
b) ratio of limiting friction and normal reaction
c) the friction force acting when the body is just about to move
d) the friction force acting when the body is in motion

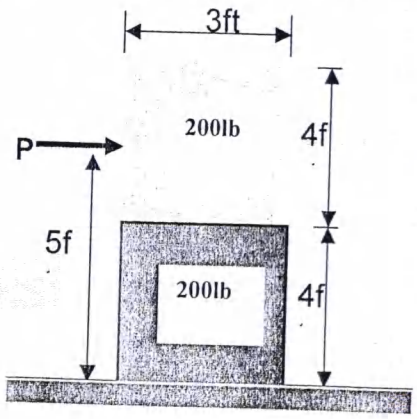
9. Moment of inertia of a hollow circular section, as shown in the below Figure about an axis perpendicular to the section, is _____ than that about *X-X* axis.

a) two times
b) same
c) half
d) none of these



10. Two uniform boxes each with weight of 200 lb are simply stacked as shown. If the coefficient of static friction between the boxes is $\mu_s = 0.8$ and between the boxes and the floor is $\mu_{s'} = 0.5$, the force P if the both the boxes tip over together.

a) 160 lb.
b) 200 lb.
c) 120 lb.
d) 300 lb.

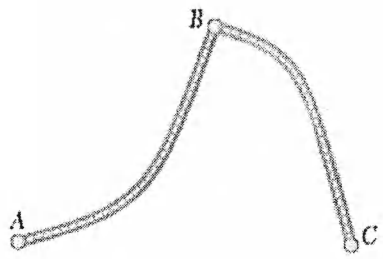


11. Step change in shear force diagram is equal to
    a) applied force
    b) internal force
    c) internal moment
    d) applied moment

12. Magnitude of area under load curve is equal to
    a) total shear force
    b) total bending moment
    c) both a and b
    d) none of above

13. In a simply supported beam, bending moment at the end
    a) is always zero if it does not carry couple at the end.
    b) is zero, if the beam has uniformly distributed load only
    c) is zero if the beam has concentrated loads only
    d) may or may not be zero

14. A bus travels the 100 miles between *A* and *B* at 50 mi/hr and then another 100 miles between *B* and *C* at 70 mi/hr. The average speed of the bus for the entire 200 mile trip is:

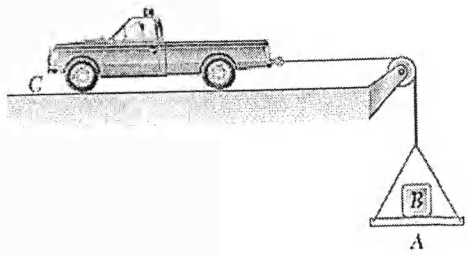


a) 50 mi/hr b) 60 mi/hr c) 58 mi/hr d) 70 mi/hr

15. Motorist is traveling at 54 km/h when she observes that a traffic light 240 m ahead of her turns red. The traffic light is timed to stay red for 24 s. If the motorist wishes to pass the light without stopping just as it turns green again, the required uniform deceleration of the car,
    a) 0.471 m/s^2 b) - 0.714 m/s^2 c) 0.147 m/s^2 d) - 0.417 m/s^2

16. A 1000-lb boulder *B* is resting on a 200-lb platform *A* when truck *C* accelerates to the left with a constant acceleration. Which of the following statements are true?

    a) the tension in the cord connected to the truck is 200 lb
    b) the tension in the cord connected to the truck is 1200 lb
    c) the tension in the cord connected to the truck is greater than 1200 lb
    d) the normal force between *a* and *b* is 1000 lb



17. For a curvilinear motion, the direction of the acceleration is given by
    a) normal component of acceleration
    b) tangential component of velocity
    c) normal component of velocity
    d) tangential component of acceleration

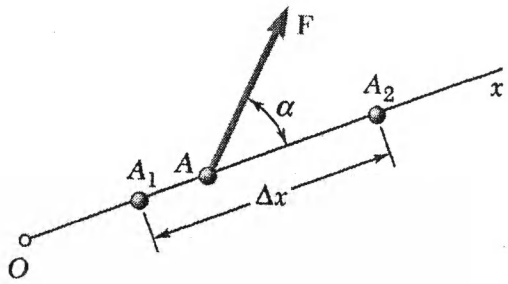
18. The rate of change of the angular momentum of the particle about point o is
a) rate of change of linear momentum about o
b) sum of moments about o
c) impulse of forces
d) none of above

19. What is the work of a constant force in rectilinear motion?
a) $U_{1\to 2} = F\,\Delta x$

b) $U_{1\to 2} = (F\cos\alpha)\,\Delta x$

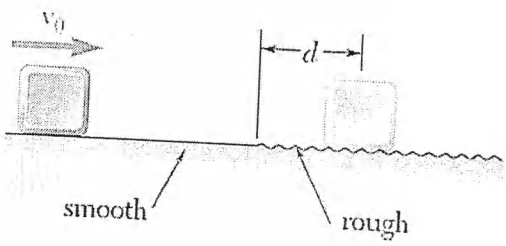
c) $U_{1\to 2} = (F\sin\alpha)\,\Delta x$

d) $U_{1\to 2} = 0$



20. Block A is traveling with a speed $v_0$on a smooth surface when the surface suddenly becomes rough with a coefficient of friction of μ causing the block to stop after a distance d. If block A were traveling twice as fast, that is, at a speed $2v_0$, how far will it travel on the rough surface before stopping?

a) d/2
b) d
c) √2d
d) 4d



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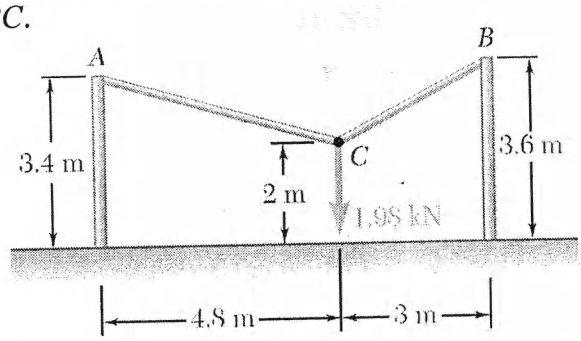
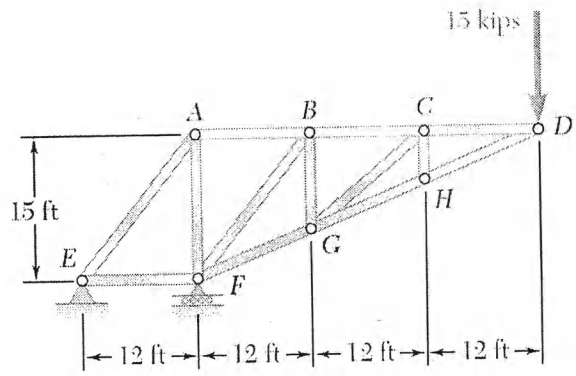
SECTION "B"

Attempt *ALL* the questions.

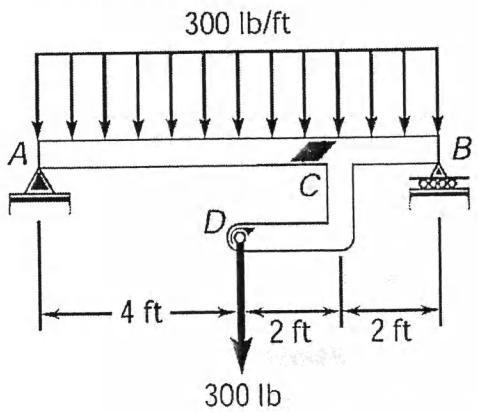
Q. 1 Two cables are tied together at *C* and loaded as shown. Determine the tension (*a*) in cable *AC*, (*b*) in cable *BC*. [6]



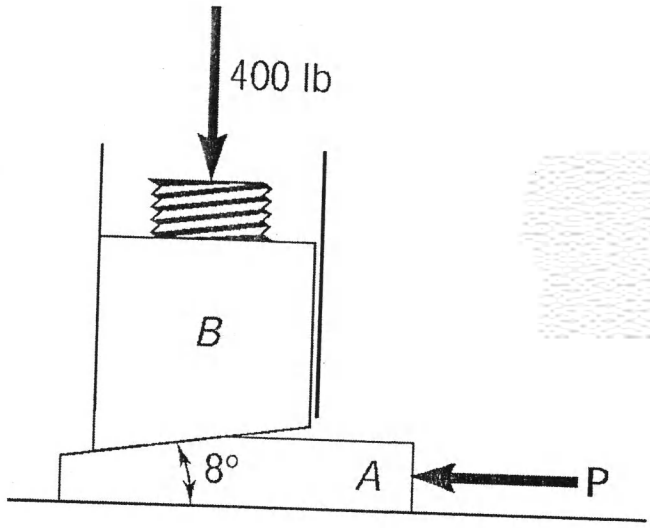
Q. 2 Determine the force in each member of the truss shown. State whether each member is in tension or compression. [7]



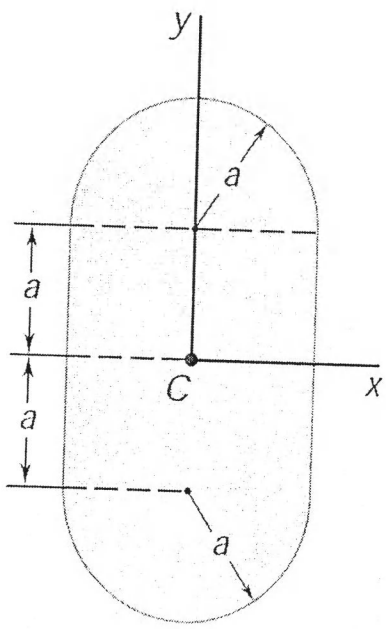
Q. 3 (*a*) Draw the shear and bending-moment diagrams for beam *AB*, (*b*) determine the magnitude and location of the maximum absolute value of the bending moment. [7]



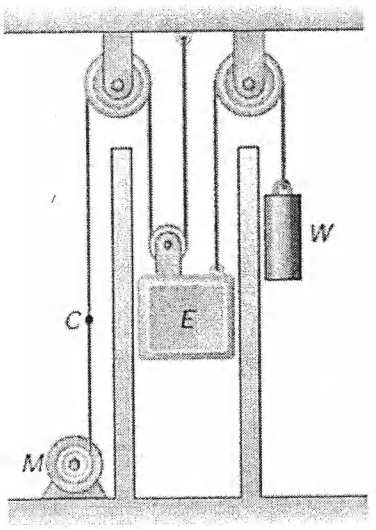
Q. 4 The position of the machine block B is adjusted by moving the wedge A. Knowing that the coefficient of static friction is 0.35 between all surfaces of contact, determine the force **P** required (*a*) to raise block B, (*b*) to lower block B. [8]



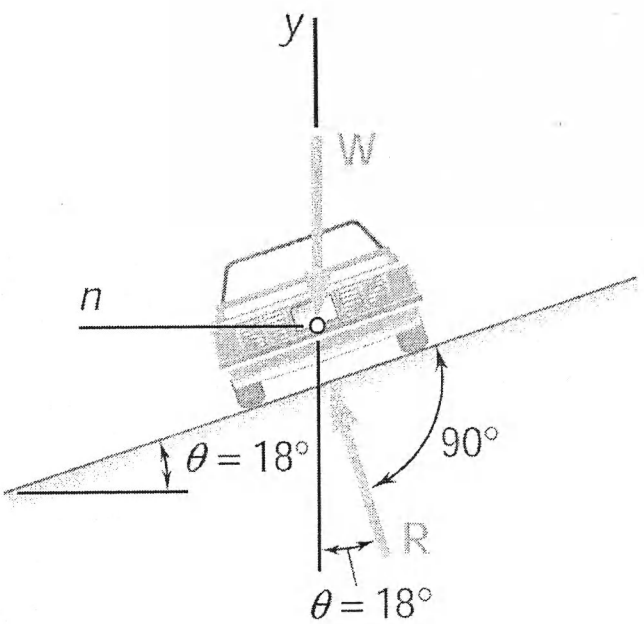
Q. 5 Determine the moments of inertia of the shaded area shown with respect to the x and y axes when $a = 20$ mm. [7]



Q. 6 The elevator shown in the Figure moves downward with a constant velocity of 4 m/s. Determine (*a*) the velocity of the cable *C*, (*b*) the velocity of the counterweight *W*, (*c*) the relative velocity of the cable *C* with respect to the elevator, (*d*) the relative velocity of the counterweight *W* with respect to the elevator. [7]



Q.7 Determine the rated speed of a highway curve of radius $r = 400$ ft. banked through an angle $\theta = 18^0$. The rated speed of a banked highway curve is the speed at which a car should travel if no lateral friction force is to be exerted at its wheels. [6]



Q8. A spring is used to stop a 60 kg package which is sliding on a horizontal surface. The spring has a constant $k = 20$ kN/m and is held by cables so that it is initially compressed 120 mm. Knowing that the package has a velocity of 2.5 m/s in the position shown and that the maximum additional deflection of the spring is 40 mm, determine (*a*) the coefficient of kinetic friction between the package and the surface, (*b*) the velocity of the package as it passes again through the position shown. [7]