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1. Which of the following statements is not one of Newton’s Laws of Motion?

   A) The acceleration of a body is proportional to any unbalanced force acting on the body.

   B) The forces between two bodies in contact are equal, opposite, and have the same line of action.

   C) The force acting on a rope must always be such that the rope is in tension and cannot vary along the rope.

   D) A body remains at rest, or in a straight line at constant velocity, unless acted upon by an unbalanced force.
2. At what angle ($\theta$) should the 60 N force act for the resultant (R) of the three forces shown to be along the x-axis?

A) 40°  B) 50°  C) 60°  D) 70°
3. What is the moment of the 300 N force acting at point C of the beam shown about the pin support at point A?

\[ 300 \text{ N} \]

\[ 20^\circ \]

A) 305 N·m  
B) 825 N·m  
C) 1130 N·m  
D) 1950 N·m
4. Determine the force (F) needed to hold the 500 N cylinder shown in equilibrium on the frictionless inclined surface.

A) 375 N  
B) 500 N  
C) 625 N  
D) 835 N
5. Determine the reaction at the roller support at point A for the loading on the beam shown.

A) 120 N          B) 255 N          C) 330 N          D) 445 N
6. What value of the force \( P \) in terms of the weight \( W \) is necessary for the pulley system shown to be in equilibrium?

A) \( W \)  
B) \( W \div 2 \)  
C) \( W \div 4 \)  
D) \( W \div 8 \)
7. Identify, if any, the zero force members of the truss shown. There are downward loads (P) acting only at joints F and H.

A) CH  B) CH, DG  C) CH, DG, DH  D) None
8. Determine the force in member EF of the truss shown.

A) 5 kN  
B) 10 kN  
C) 21 kN  
D) 25 kN  

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9. Locate the centroid of the composite area shown relative to the given xy coordinate system.

A) \( \bar{x} = 1.2 \text{ cm}, \bar{y} = 4.5 \text{ cm} \)  
B) \( \bar{x} = 1.9 \text{ cm}, \bar{y} = 5.4 \text{ cm} \)  
C) \( \bar{x} = 2.4 \text{ cm}, \bar{y} = 5.0 \text{ cm} \)  
D) \( \bar{x} = 3.0 \text{ cm}, \bar{y} = 4.5 \text{ cm} \)
10. Determine the moment of inertia of the Tee section shown about its horizontal centroidal axis, which has been located.

A) 173 cm\(^4\)  
B) 343 cm\(^4\)  
C) 533 cm\(^4\)  
D) 753 cm\(^4\)
11. What is relationship between the maximum angle ($\theta$) for impending slipping of the block on the incline and the coefficient of static friction ($\mu_s$).

A) $\sin \theta_{\text{max}} = \mu_s$

B) $\cos \theta_{\text{max}} = \mu_s$

C) $\tan \theta_{\text{max}} = \mu_s$

D) $\sec \theta_{\text{max}} = \mu_s$
12. Determine an algebraic expression that relates the width \( x \) of the triangular block to its height \( h \) and the coefficient of static friction \( \mu_s \) for the block to as likely slip as it is to tip.

\[
x = \mu_s h
\]

A) \( x = \mu_s h \)  
B) \( x = 2 \mu_s h \)  
C) \( x = 3 \mu_s h \)  
D) \( x = 4 \mu_s h \)
E 490 Course Topics

**Statics**
- Newton’s Laws of Motion
- Resultant Force Systems
- Moment of Forces and Couples
- Equilibrium
- Pulley Systems
- Trusses
- Centroid of an Area
- Area Moment of Inertia
- Friction

**Dynamics**
- Kinematics
- Rectilinear Motion
- Projectile Motion
- Curvilinear Motion
- Application of 2nd Law (F = ma)
- Work / Energy / Power
- Impulse / Momentum
- Impact
- Simple Harmonic Motion
1. Which of the following statements best describes the area of study in Dynamics called Kinematics?

A) Kinematics is the study of how forces and couples act on rigid bodies.

B) Kinematics is the study of the interaction between multiple bodies to form more complex mechanisms.

C) Kinematics is the study of the geometry of motion.

D) Kinematics is the study of rigid bodies in 2D motion, whereas Kinetics is the study of bodies in 3D motion.
2. An object is moving to the right at 18 m/sec. Suddenly, the object is subjected to a force that causes an acceleration of 3 m/sec$^2$ to the left. How far has the object traveled in 10 sec after the application of the sudden force?

A) 24 m  B) 30 m  C) 54 m  D) 78 m
3. A rifle aimed $5^\circ$ above the horizon is fired. Neglecting air resistance and using 750 m/sec as the speed of the bullet as it leaves the rifle, to what altitude will the bullet reach during its flight?

A) 220 m  B) 440 m  C) 880 m  D) 1,760 m
4. For a wheel rolling without slipping on a horizontal surface, determine its angular speed ($\omega$) if the velocity of the top of the wheel is a constant 2 m/sec.

$$\omega$$

2 m/sec

A) 20 rpm        B) 40 rpm        C) 60 rpm        D) 80 rpm

0.5 m
5. What is the acceleration \( (a) \) of a box that is placed onto a moving conveyor until the box reaches the speed of the conveyor. The box weighs 200 N. The coefficient of static friction is 0.4 and the coefficient of dynamic friction is 0.2. (use \( g = 9.8 \text{ m/sec}^2 \))

A) 1 m/sec\(^2\) \quad B) 2 m/sec\(^2\) \quad C) 3 m/sec\(^2\) \quad D) 4 m/sec\(^2\)
6. If a mass of 5 kg is rotating in a horizontal plane at the end of a cable at a constant 100 rpm, then what is the tension in the cable?

A) 1,100 N       B) 3,650 N       C) 8,300 N       D) 10,750 N
7. If a 5 kg object is dropped from a height of 10 m, what is its velocity just before it hits the ground? (use \( g = 9.8 \text{ m/sec}^2 \))

A) 7 m/sec       B) 14 m/sec       C) 21 m/sec       D) 28 m/sec
8. What is the impulse imparted to a 200 gram baseball if the velocity the baseball arrives from the pitcher is 40 m/sec and leaves the bat towards the pitcher at 60 m/sec?

A) 4 N·sec    B) 10 N·sec    C) 16 N·sec    D) 20 N·sec
9. If a 45 gram golf ball is dropped from a height of 1.50 m onto a grassy surface and bounces back upward 0.06 m, then determine the coefficient of restitution between the golf ball and the surface. (use \( g = 9.8 \text{ m/sec}^2 \))

A) 0.04  
B) 0.08  
C) 0.1  
D) 0.2
10. What is the natural period of the spring-mass system shown? The mass \( m \) is 2 kg and the spring constant \( k \) is 10 N/m. The static deflection \( \delta_{st} \) is 2 m. (use \( g = 9.8 \text{ m/sec}^2 \))

\[
\text{(use } g = 9.8 \text{ m/sec}^2 \text{)}
\]

\[
\begin{align*}
\text{A)} & \ 2.8 \text{ sec} & \text{B)} & \ 3.8 \text{ sec} & \text{C)} & \ 4.8 \text{ sec} & \text{D)} & \ 5.8 \text{ sec}
\end{align*}
\]