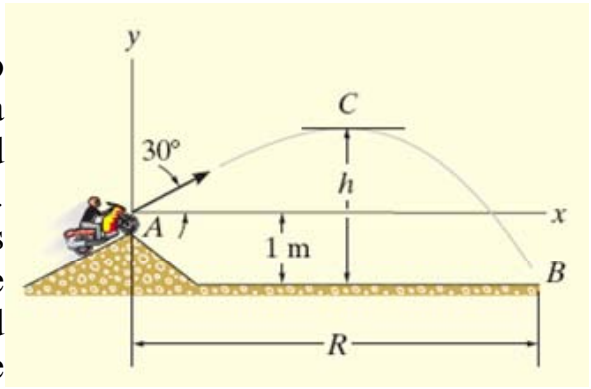
Alexandria Higher Institute of Engineering & Technology (AIET)		
All Departments		0th Year
ME002	Mechanics II	Final, June, 25, 2011
Examiners:	Dr. Rola Afify and committee	Time: 3 hours

Answer the following questions:

Question one (12 marks)

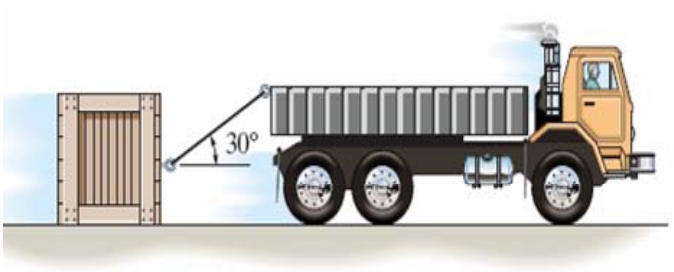
a) Derive the Cartesian equation for a projectile.

b) The track for this racing event was designed so that riders jump off the slope at 30°, from a height of 1 m. During a race it was observed that the rider remained in mid air for 1.5 s. Determine the speed (v_o) at which he was traveling off the slope, the horizontal distance (R) he travels before striking the ground, and the maximum height (h) he attains. Neglect the size of the bike and rider.



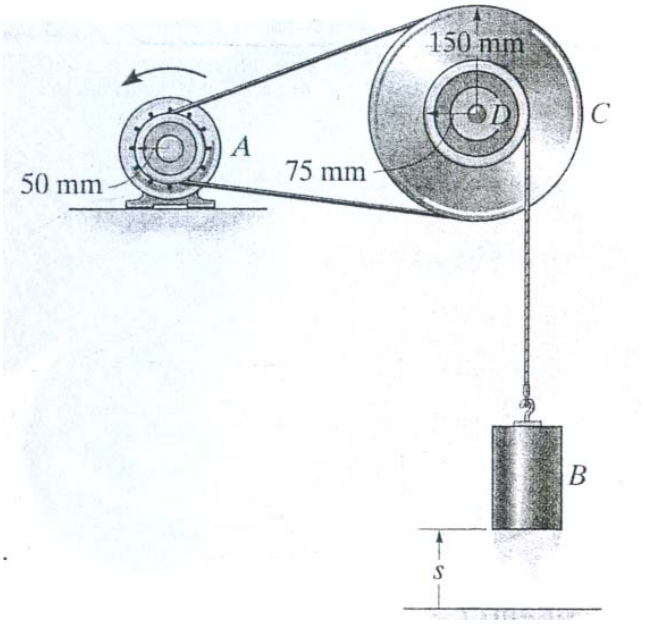
Question two (12 marks)

The driver attempts to tow the crate using a rope that has a tensile strength of 1 kN. If the crate is originally at rest and has a mass of 250 kg, determine the greatest acceleration it can have if the coefficient of static friction between the crate and the road is $\mu_s = 0.4$, and the coefficient of kinetic friction is $\mu_k = 0.3$.



Question three (12 marks)

Starting from rest when s = 0, pulley A is given an angular acceleration $\alpha_A = 6\theta_A$ rad/s^2, where θ is in radians. Determine the speed of block B when it has risen s_B = 6 m. The pulley has an inner hub D which is fixed to C and turns with it.



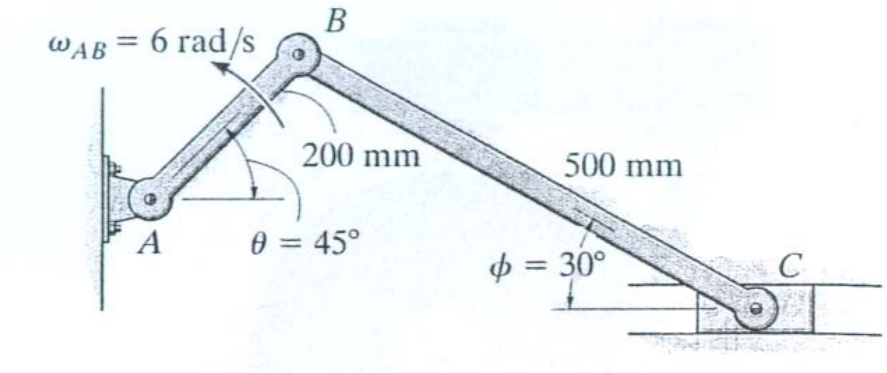
You may use this:

$$\alpha = \frac{d\omega}{dt} = \omega\frac{d\omega}{d\theta}$$

$$v = \omega r \;\; \& \;\; s = \theta r$$

Question Four (12 marks)

If the bar AB has an angular velocity $\omega_{AB} = 6\ rad/s$, determine the velocity of the slider block C at the instant shown.



Question Five (12 marks)

Determine the angular acceleration of link AB and BC at the instant $\theta = 90^0$. If the collar has a velocity of $v_c = 4$ m/s and an acceleration of $a_c = 3$ m/s^2, as shown in figure. The angular velocity of link AB and BC $\omega_{AB} = \omega_{BC} = 4\sqrt{2}$ rad/sec and both are clockwise.