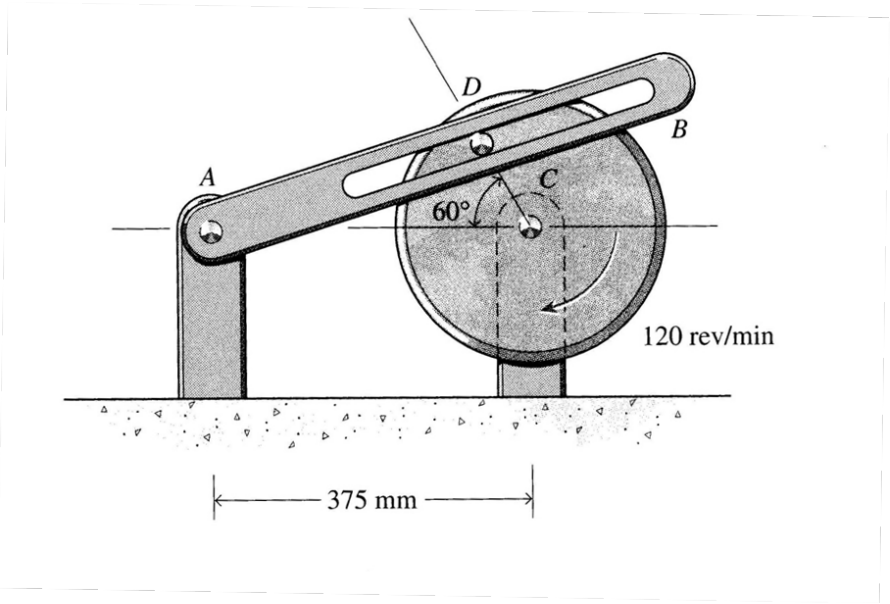
COURSE: Dynamics	**NUMBER** ENGR 243/4	**SECTION** T, V, X and Y	
Final Examination	**DATE: Saturday, April 21, 2012**	**TIME 9:00 – 12:00 hours**	**# OF PAGES **** **5**
INSTRUCTOR:			
MATERIALS ALLOWED	X **NO**		
CALCULATORS ALLOWED	**NO**	X **YES (ENCS Approved)**	

SPECIAL INSTRUCTIONS:

1. Answer all the questions. All questions carry equal marks.
2. Show relevant steps with intermediate results required in answering all the questions.
3. If you think that any data is missing, state your assumptions clearly and proceed with your Answers.

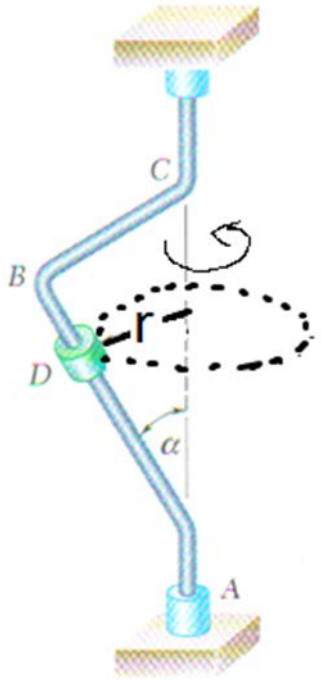
Question 1 :

The wheel shown rotates clockwise at 120 rpm. Pin D is welded to the wheel at a distance of 125 mm from the center, and it can slide without friction in the slot of member AB. Find the angular velocity and acceleration of the member AB at the instant shown.



Question 2:

A collar D of mass 0.4 kg can slide without friction on the member AB of the rotating frame shown. Knowing that the angle α is 40º and that the frame rotates about the vertical axis AC with a constant angular velocity of 4 rad/s, find the radius r at which the collar will not slide. (r being perpendicular to AC)



P.T.O.

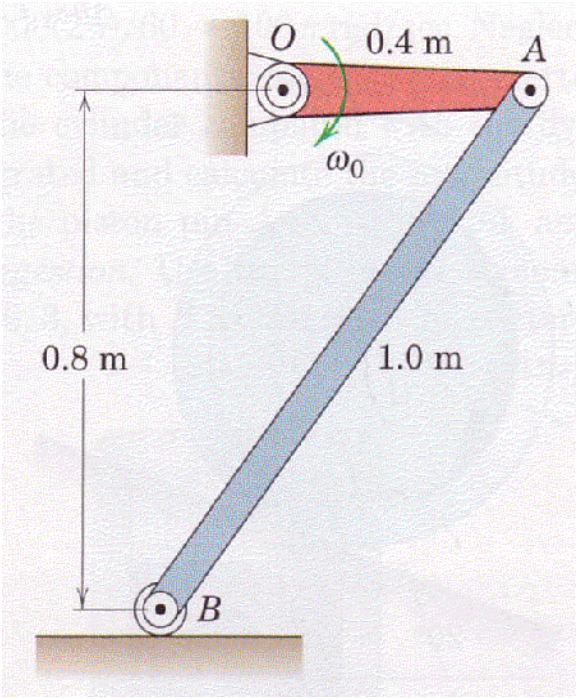
Question 3:

A massless member OA rotates in a vertical plane with a constant clockwise angular velocity

ω_0 = 4.5 rad/s. For the position where OA is horizontal, find:

a) The angular acceleration α_{AB}, and
b) The normal force under the roller B.

The mass of the member AB is 10 kg, and $\bar{I} = \frac{ml^2}{12}$.

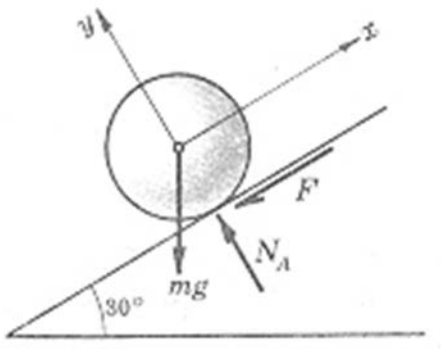


Question 4:

A mass M drops from rest through 1.75 m on a spring whose stiffness is 3.5 kN/m and causes a maximum shortening of 200 mm in the spring. Determine the value of the mass.

Question 5:

A sphere rolling with initial velocity 9 m/s, starts up an inclined (30°) plane. How far will it roll up the plane? Mass moment of inertia of the sphere is $\bar{I} = \frac{2}{5} mr^2$. The sphere rolls without sliding.



Question 6:

A 1 kg block B is pressed against a spring initially and released. Block B moves to the left towards the pendulum mass A, which is at rest when B hits it with a velocity of $v_0 = 2$ m/s. The pendulum mass A is 0.5 kg and is connected to a massless rod which is hinged at O. After the impact, mass A swings up to the left, and block B continues to move to the left on the surface. If the coefficient of kinetic friction between the block B and the horizontal surface is $\mu_k = 0.6$ and the coefficient of restitution between the block and the pendulum mass is e = 0.8, determine a) the maximum height h reached by the pendulum mass A after the impact, b) the distance x travelled by the block B after impacting A.