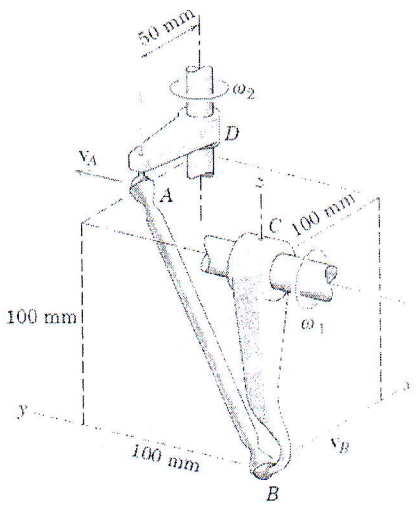
Menofia University Faculty of Engineering Shebien El-kom Basic Engineering Sci. Department. Academic Year : 2016-2017 Date : 7 / 6 / 2017	Subject: Engineering Mechanics Code: BES 714 Time Allowed: 3 hours Year: Doctor Total Marks: 100 Marks

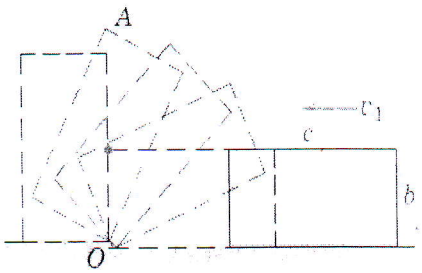
Answer all the following questions: [100 Marks]

Q.1 Crank CB rotates about the horizontal axis with an angular velocity $\omega_1 = 6$ rad/sec which is constant for a short interval of motion which includes the position shown. The link AB has a ball-and-socket fitting on each end and connects crank DA with CB. For the instant shown, Determine [20]

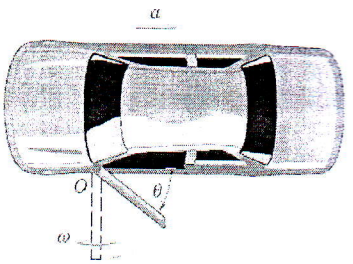


1) The angular velocity ω_2 of crank DA
2) The angular velocity ω_n of link AB.
3) The angular acceleration of crank AD in for the conditions cited.
4) Find the angular acceleration of link AB.

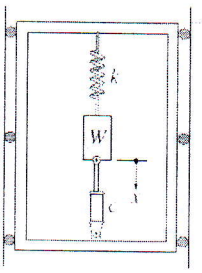
Q.2 The uniform rectangular block of dimensions shown is sliding to the left on the horizontal surface with a velocity v_1 when it strikes the small step at O. Assume negligible rebound at the step and compute the minimum value of v_1 which will permit the block to pivot freely about O and just reach the standing position A with no velocity. Compute the percentage energy loss n for $b = c$. [20]



Q.3 A car door is inadvertently left slightly open when the brakes are applied to give the car a constant rearward acceleration a. Derive expressions for the angular velocity of the door as it swings past the 90° position and the components of the hinge reactions for any value of θ. The mass of the door is m, its mass center is a distance from the hinge axis O, and the radius of gyration about O is k_o. [15]



Q.4 The block of weight W is connected in a rigid frame between a linear spring and a viscous damper. The frame is subjected to the time-dependent vertical displacement $y(t) = Y\ sin\ \omega t$. The displacement x of the block is measured from its static equilibrium position (with support stationary at $y = 0$). [15]



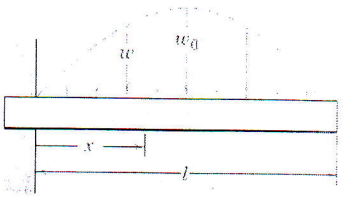
Determine the steady state solution for

1) The relative displacement $z = x - y$;
2) The absolute displacement x.

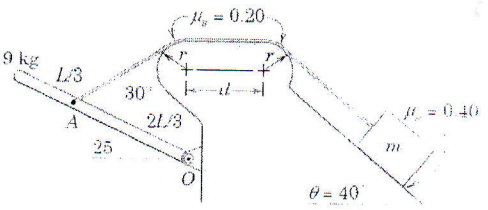
Use: $Y = 40\ mm, \omega = 400 \frac{rad}{s}, M = 3\ kg,$

$k = 2.63 \times 10^5 \frac{N}{m}$ and $c = 585\ N.s/m.$

Q.5 The cantilever beam is subjected to the load intensity (force per unit length) which varies as $w = w_o\ sin\ (x/l)$. Determine the shear force V and bending moment M as functions of the ratio x/l. [15]



Q.6	Determine the range of mass m over which the system is in static equilibrium. The coefficient of static friction between the cord and the upper curved surface is 0.20, while that between the block and the incline is 0.40. Neglect friction at the pivot O.	[15]



This exam measures the following ILOs								
Question Number	Q1-a	Q1-b	Q3-b	Q4-a	Q1-c	Q2-a	Q3-a	Q4-c
	Q4-b				Q2-b	Q2-c	Q3-c	
	Knowledge &understanding skills				Intellectual Skills		Professional Skills	

With our best wishes

Dr. Ramzy M. Abumandour