INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**April 2019**
Programme	:	Diploma In Mechanical Engineering (DMEN)
Course	:	**EGM1181 : Engineering Dynamics**
Date of Examination	:	July 28, 2019 (Sunday)
Time	:	11:00 am – 1:00 pm Reading Time: Nil
Duration	:	2 Hours
Special Instructions	:	

This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Formula Sheet

Examiner (s)	:	**Tham Chan Seng**
Moderator	:	Associate Professor Dr Seyed Amirmostafa Jourabchi

*This paper consists of **8** printed pages, including the cover page.*

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
EGM1181: ENGINEERING DYNAMICS
FINAL EXAMNINATION: APRIL 2019 SESSION

Instructions: This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) A car starts from rest and with constant acceleration achieves a velocity 15 m/s when it travels a distance of 200m.Determine the acceleration of the car and the time required.

(6 marks)

(b) Determine the maximum constant speed a race car can have if the acceleration of the car cannot exceed 7.5 m/s^2 while rounding a track having a radius of curvature of 200 m.

(6 marks)

(c) An aircraft carrier is traveling forward with a velocity of 50 km/h. At the instant shown, the plane at A has just taken off and has attained a forward horizontal airspeed of 200 km/h, measured from still water. If the plane at B is traveling along the runway of the carrier at 175 km/h in the direction shown, determine the velocity of A with respect to B.

(13 marks)

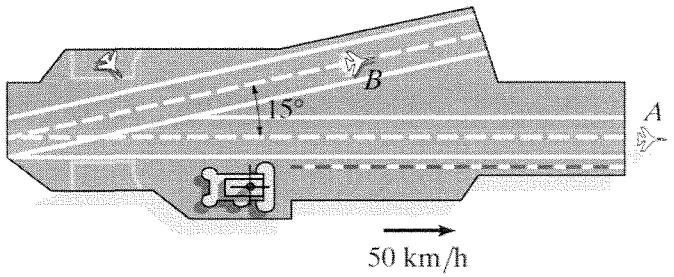

Figure Q1 (c)

Question 2

(a) The fireman holds the hose at an angle $\Theta=30°$ with horizontal, and the water is discharged from the hose at A with a speed of $v_A=12$ m/s. If the water stream strikes the building at B, determine his two possible distances s from the building.

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(15 marks)

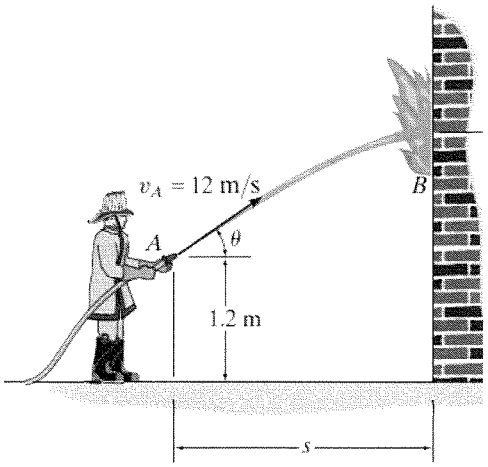

Figure Q2 (a)

(b) The cable at B is pulled downwards at 2 m/s , and the speed is decreasing at 1 m/s^2. Determine the velocity and acceleration of block A at this instant. Remember to draw the FBD.

(10 marks)

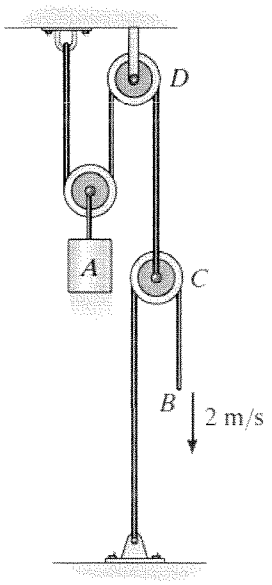

Figure Q2 (b)

Question 3

(a) The The15-kg suitcase A is released from rest at C. After it slides down the smooth ramp, it strikes the10-kg suitcase B, which is originally at rest. If the coefficient of restitution between the suitcases is 0.3 and the coefficient of kinetic friction between the floor DE and each suitcase is u_k=0.4, determine

(i) the velocity of A just before impact,

(ii) the velocities of A and B just after impact, and

(iii) the distance B slides before coming to rest.

(15 marks)

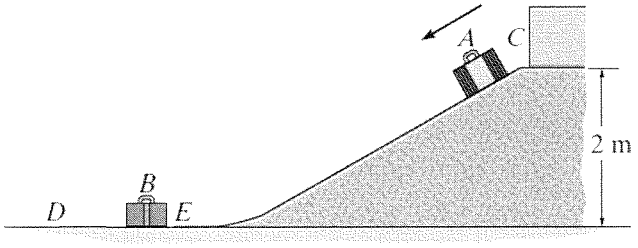

Figure Q3 (a)

(b) The spring is unstretched when s = 1 m and the 15-kg block is released from rest at this position. Determine the speed of the block when s = 3m.The spring remains horizontal during the motion,and the contact surfaces between the block and the inclined plane are smooth.

(10 marks)

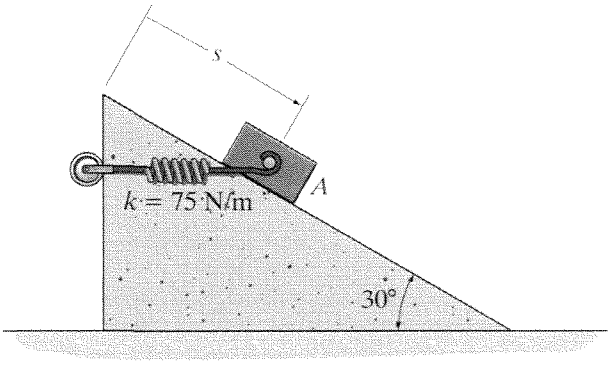

Figure Q3 (b)

Question 4

(a) If link AB rotates at ω_{AB} = 6 rad/s, determine the angular velocities of links BC and CD at the instant shown.

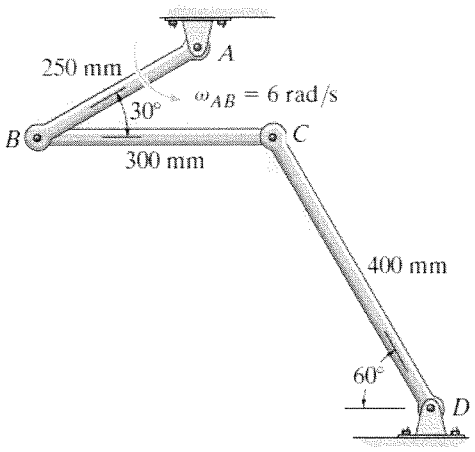

Figure Q4 (a)

(12 marks)

(b) The body and bucket of a skid steer loader has a mass of 1000 kg, and its center of gravity is located at G. Each of the four wheels has a mass of 50 kg and a radius of gyration about its center of gravity of 0.3 m. If the loader attains a speed of 6 m/s in 10 s, starting from rest, determine the torque M supplied to each of the rear drive wheels. The wheels roll without slipping.

(13 marks)

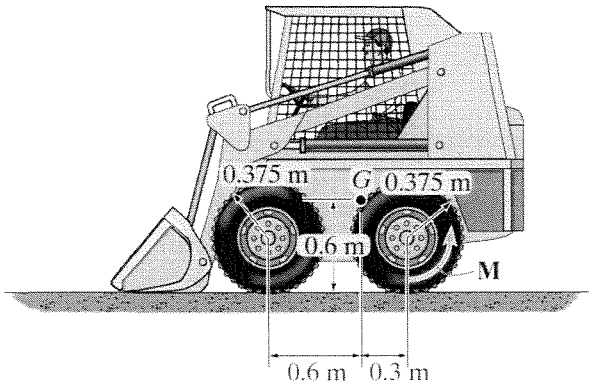

Figure Q4 (b)

Question 5

At a given instant, link CD has an angular acceleration α_{CD}= 5 rad/s^2 and an angular velocity ω_{CD} = 2 rad/s. Determine the angular velocity and angular acceleration of link AB at this instant.

(25 marks)

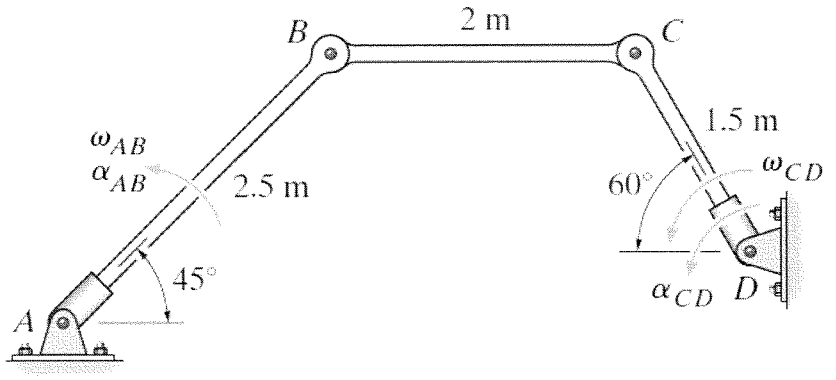

Figure Q5

Question 6

(a) The car, having a mass of 1.40Mg and mass center at G_c, pulls a loaded trailer having a mass of 0.8Mg and mass center at G_t. Determine the normal reactions on both the car's front and rear wheels and the trailer's wheels if the driver applies the car's rear brakes C and causes the car to skid. Take μ_c =0.4 and assume the hitch at A is a pin or ball-and-socket joint. The wheels at B and D are free to roll with no slip. Neglect their mass and the mass of the driver.

(15 marks)

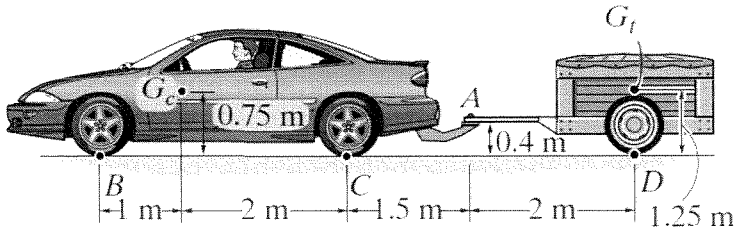

Figure Q6 (a)

(b) A motor supplies a constant torque M = 2 N.m to a 50-mm-diameter shaft O connected to the center of the 30-kg flywheel. The resultant bearing friction F, which the bearing exerts on the shaft, acts tangent to the shaft and has a magnitude of 50 N. Determine how long the torque must be applied to the shaft to increase the flywheel's angular velocity from 4 rad/s to 15 rad/s. The flywheel has a radius of gyration $k_O = 0.15$m about its center O.

(10 marks)

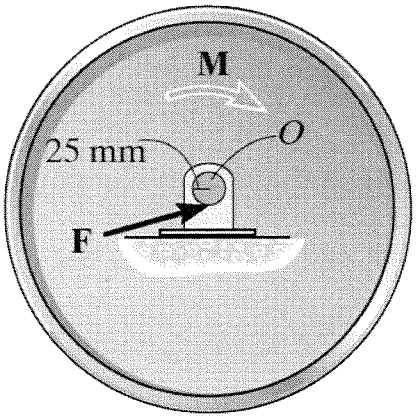

Figure Q6 (b)

Formula Sheet:

Curvilinear motion:

$a_n = \frac{v^2}{\rho}$ $\qquad$ $a_t = \frac{dv}{dt}$

Polar Coordinate System or r-θ

$v_r = \dot{r} = \frac{dr}{dt}$ v_r =radial component of velocity $\qquad$ $a_r = \ddot{r} - r\left(\dot{\theta}\right)^2$ a_r =Radial acceleration

$v_\theta = r\dot{\theta} = r\frac{d\theta}{dt}$ v_θ = transverse component $\qquad$ $a_\theta = r\ddot{\theta} + 2\left(\dot{r}\right)\left(\dot{\theta}\right)$ a_θ = transverse acceleration

Work-Energy Equation:

$$W = \frac{1}{2}m(v^2 - u^2)$$

Work done by spring force $\qquad$ $W_s = \frac{1}{2}kx^2$

Impulse-Momentum Equation:

$Ft = mv - mu$ $\qquad$ $\int_{t1}^{t2} F dt = m(v - u)$

Kinetic Energy (Rotation)

For Disc: $\qquad$ $E_k = \frac{1}{2}I_m\omega^2$ $\qquad$ $I_m = \frac{1}{2}mr^2$

Moment of Inertia

$M = I_m\alpha$ $\qquad$ Where M = moment

$V = \omega r$ $\qquad$ $a = \alpha r$

Radius of Curvature $\rho = \frac{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2}}{\left|\frac{d^2y}{dx^2}\right|}$

-THE END –