FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**April 2020**
Programme	:	Diploma in Mechanical Engineering (DMEN)
Course	:	**EGM1181: Engineering Dynamics**
Date of Examination	:	5 August 2020 (Wednesday)
Time	:	4.00pm – 6.15pm Reading Time : Nil
Duration	:	2 Hours 15 Minutes

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions. All questions carry equal marks.

Material permitted :

Non-Programmable Scientific Calculator

Materials provided :

Nil

Examiner(s)	:	**Mr Phua Chin Lai, Mr Tham Chan Seng**
Chief Moderator	:	Mr Soo Swee Yoong

*This paper consists of **6** printed pages, including the cover page*

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
EGM1181: ENGINEERING DYNAMICS
FINAL ALTERNATIVE ASSESSMENT: APRIL 2020 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions. All questions carry equal marks.

Question 1

a) A particle motion is defined by $x = t^4 - 10t^2 + 8t + 12$, where *x* and *t* are expressed in m and seconds. Determine,

(i) the position, velocity and acceleration of the particle when *t* =1s.

(ii) if the acceleration is negative, what does it means?

(7 marks)

b) In Figure Q1(b), the uniform rod *AB* of weight *W* N and length *L* m is released from rest when β = 70°. Assuming that the friction force between end *A* and the surface is large enough to prevent sliding, determine immediately after release,

(i) the angular acceleration of the rod in term of *L*,

(ii) the normal reaction at *A* in term of *W*, and

(iii) the friction force at *A* in term of *W*.

(18 marks)

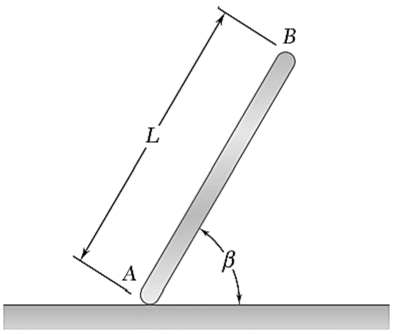

Figure Q1(b)

Question 2

(a) In Figure Q2(a), a volleyball player serves the ball with an initial velocity v_0 of magnitude 13.40 m/s at an angle of 20° with the horizontal. Determine,

(i) if the ball will clear the top of the net, and

(ii) how far from the net the ball will land.

(iii) The volleyball is now replaced with a more heavy basketball which is twice the mass of the volleyball, but all the initial conditions remain the same, what will be the impact to your answer at (i) and (ii)?

(15 marks)

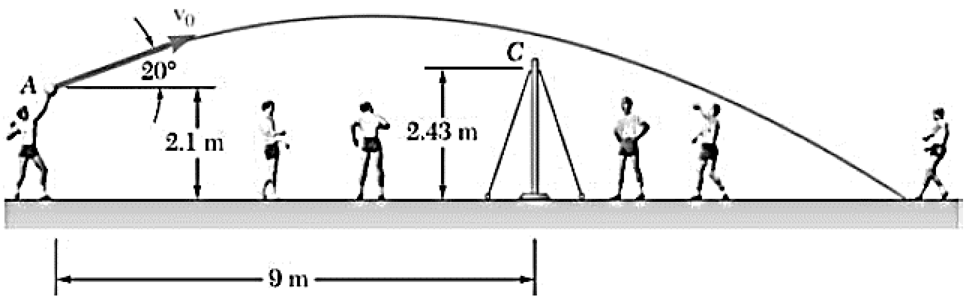

Figure Q2(a)

(b) In Figure Q2(b), the load *L* is 10kg. The motor *M* reels in the cable at a constant rate of 100 mm/s. Determine,

(i) the velocity of load *L* and the velocity of the pulley *B*.

(ii) Will the velocity of load *L* change if the load is now increase to 50kg?

(10 marks)

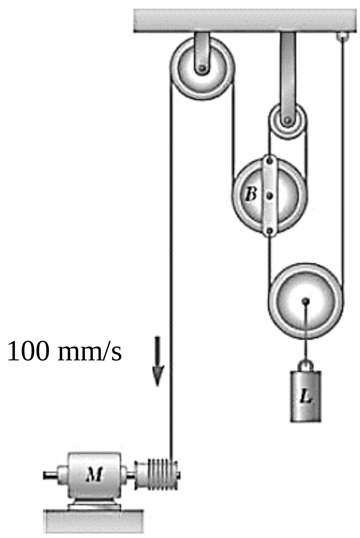

Figure Q2(b)

Question 3

(a) In Figure Q3(a), the car *B* is towing car *A* at a constant speed of 10 m/s on an uphill grade when the brakes of car *A* are fully applied causing all four wheels to skid. The driver of car *B* does not change the throttle setting or change gears. The masses of the cars *A* and *B* are 1400 kg and 1200 kg respectively, and the coefficient of kinetic friction is 0.8. Neglecting air resistance and rolling resistance, determine,

(i) the distance traveled by the cars before they come to a stop, and

(ii) the tension in the cable.

(13 marks)

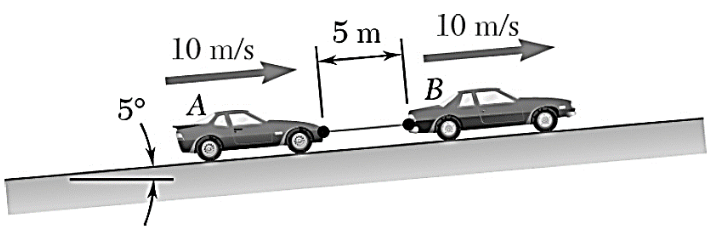

Figure Q3(a)

(b) In Figure Q3(b), the spring is unstretched and a 3 kg block rests on top of a 2 kg block supported by the spring, but not attached to it. The spring constant is 40 N/m. The upper block is suddenly removed. Determine the maximum speed reached by the 2 kg block.

(12 marks)

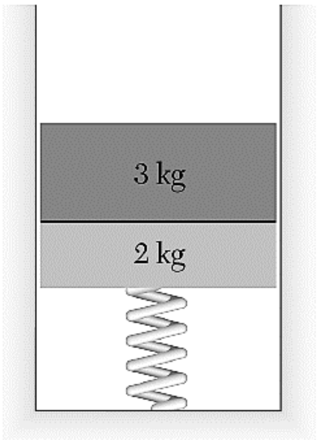

Figure Q3(b)

Question 4

(a) In Figure Q4(a), a 40 kg flywheel is rigidly attached to a shaft, flywheel radius R = 0.5 m and shaft radius r = 0.05 m that can roll parallel along the inclined rail. A cord is attached as shown and pulled with a force P of magnitude 150 N. Knowing the centroidal radius of gyration of flywheel with shaft, k = 0.4 m. Determine,

(i) the angular acceleration of the flywheel, and

(ii) the velocity of the center of gravity after 5 s.

(11 marks)

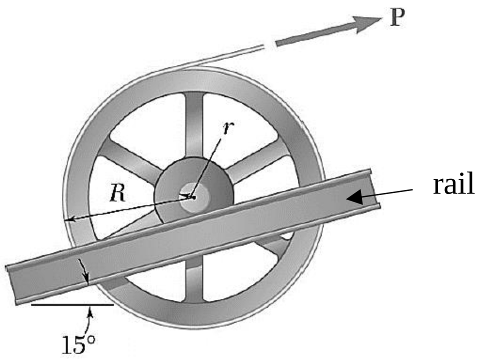

Figure Q4(a)

(b) In Figure Q4(b), knowing that at the instant shown, bar AB has a constant angular velocity of 4 rad/s clockwise, determine the angular acceleration of

(i) bar BD, and

(ii) bar DE.

(14 marks)

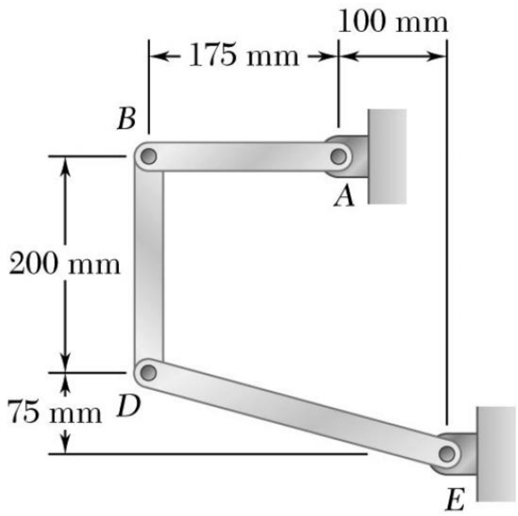

Figure Q4(b)

Formula Sheet:

Curvilinear motion:

$a_n = \dfrac{v^2}{\rho}$

$a_t = \dfrac{dv}{dt}$

Polar Coordinate System or r-θ

$v_r = \dot{r} = \dfrac{dr}{dt}$ v_r =radial component of velocity

$a_r = \ddot{r} - r\left(\dot{\theta}\right)^2$ a_r =Radial acceleration

$v_\theta =$ r$\dot{\theta} = r\dfrac{d\theta}{dt}$ v_θ = transverse component

$a_\theta = r\ddot{\theta} + 2\left(\dot{r}\right)\left(\dot{\theta}\right)$ a_θ = transverse acceleration

Work-Energy Equation:

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

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

Impulse-Momentum Equation:

$Ft = mv - mu$

$\int_{t1}^{t2} Fdt = m(v-u)$

Kinetic Energy (Rotation)

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

Moment of Inertia

$M = I_m\alpha$ Where M = moment

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

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

-THE END –