

**FINAL  
ALTERNATIVE ASSESSMENT**

(COVER PAGE)

Session : January 2021

Programme : Diploma in Mechanical Engineering (DMEN)

Course : **EGM1181: Engineering Dynamics**

Date of Examination : 9 March 2021 (Tuesday)

Time : 12.00noon – 2.15pm 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) : **Phua Chin Lai**

Chief Moderator : Tham Chan Seng

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

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)  
EGM1181: ENGINEERING DYNAMICS  
FINAL ALTERNATIVE ASSESSMENT: JANUARY 2021 SESSION

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

**Question 1**

(a) The angular acceleration of the disk as shown in Figure Q1(a) is defined by  $\alpha = 3t^2 + 12$  rad/s<sup>2</sup>, where  $t$  is in seconds. If the disk is originally rotating at  $\omega_0 = 12$  rad/s, determine

(i) the magnitude of the velocity of point  $A$  on the disk when  $t = 2$  s, (6 marks)

(ii) the  $n$  and  $t$  components of acceleration of point  $A$  on the disk when  $t = 2$  s.

(4 marks)

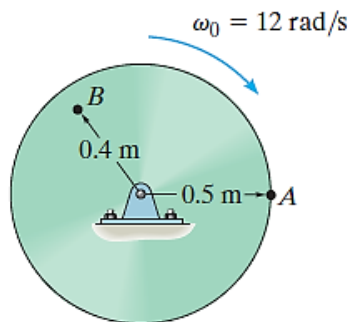


Figure Q1(a)

(b) At the instant  $\theta = 50^\circ$  as shown in Figure Q1(b), the slotted guide is moving upward with an acceleration of  $3$  m/s<sup>2</sup> and a velocity of  $2$  m/s. Determine

(i) the angular acceleration and (8 marks)

(ii) angular velocity of link  $AB$  at this instant. (7 marks)

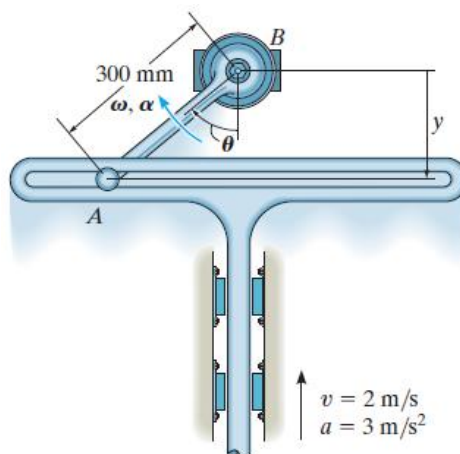


Figure Q1(b)

## Question 2

- (a) In Figure Q2(a), the assembly is made of the slender rods that have a mass per unit length of 3 kg/m. Determine the mass moment of inertia of the assembly about an axis perpendicular to the page and passing through point  $O$ .

(10 marks)

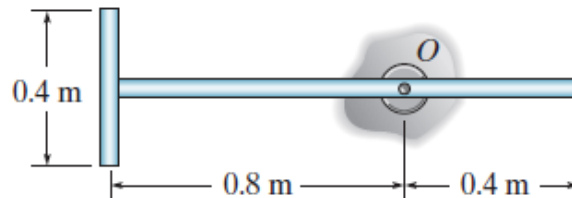


Figure Q2(a)

- (b) A force of  $P = 300$  N is applied to the 60 kg cart as shown in Figure Q2(b). Given the mass center of the cart is at  $G$ , determine

- (i) the reactions at both the wheels at  $A$  and both wheels at  $B$ ,
- (ii) the acceleration of the cart.

(15 marks)

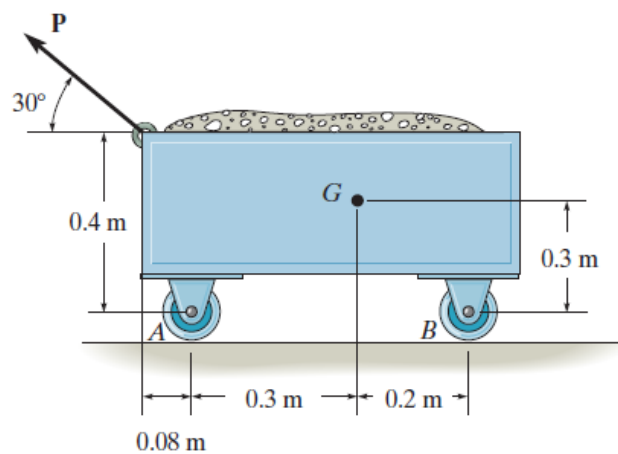


Figure Q2(b)

**Question 3**

(a) Figure Q3(a) shows a 10 kg wheel with a radius of gyration  $k_A = 200$  mm. If the wheel is subjected to moment  $M = (5t)$  Nm, where  $t$  is in seconds, determine

- (i) its angular velocity when  $t = 3$  s starting from rest.
- (ii) the reactions which the fixed pin A exerts on the wheel during the motion.

(12 marks)

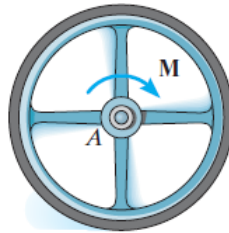


Figure Q3(a)

(b) Figure Q3(b) shows a wheel made from a 5 kg thin ring and two 2 kg slender rods. If the torsional spring attached to the wheel's center has a stiffness  $k = 2$  Nm/rad, and the wheel is rotated until the torque  $M = 25$  Nm is developed, determine the maximum angular velocity of the wheel if it is released from rest.

(13 marks)

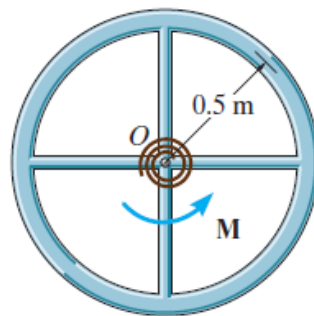


Figure Q3(b)

**Question 4**

The assembly shown in Figure Q4 consists of a 3 kg pulley *A* and 10 kg pulley *B*. If a 2 kg block is suspended from the cord, determine the block's speed after it descends 0.5 m starting from rest. Neglect the mass of the cord and treat the pulleys as thin disks. No slipping occurs.

(25 marks)

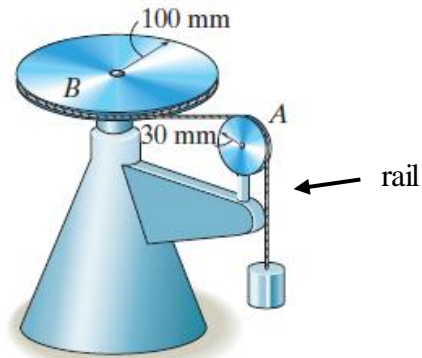


Figure Q4

**Formula Sheet:****Curvilinear motion:**

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

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

**Polar Coordinate System or r- $\theta$** 

$$v_r = \dot{r} = \frac{dr}{dt} \quad v_r = \text{radial component of velocity}$$

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

$$v_\theta = r\dot{\theta} = r \frac{d\theta}{dt} \quad v_\theta = \text{transverse component}$$

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

**Work-Energy Equation:**

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

Work done by spring force

$$W_s = \frac{1}{2}kx^2$$

**Impulse-Momentum Equation:**

$$Ft = mv - mu$$

$$\int_{t_1}^{t_2} F dt = m(v - u)$$

**Kinetic Energy (Rotation)****For Disc:**

$$E_k = \frac{1}{2}I_m \omega^2$$

$$I_m = \frac{1}{2}mr^2$$

**Moment of Inertia**

$$M = I_m \alpha$$

Where M = moment

$$V = \omega r$$

$$a = \alpha r$$

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

**~THE END~**