



UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
SEPTEMBER 2016 SEMESTER

COURSE CODE : LGB 21903
COURSE NAME : DYNAMICS
PROGRAMME NAME : BACHELOR OF ENGINEERING TECHNOLOGY(HONS) IN
(FOR MPU: PROGRAMME LEVEL) MARINE ENGINEERING
DATE : 19 JANUARY 2017
TIME : 09.00 AM – 12.00 AM
DURATION : 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer THREE (3) questions only.
6. Answer all questions in English.
7. Formulae sheet has been appended for your reference.

THERE ARE 4 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

A particle move along the X axis with an initial velocity, $v_x = 90 \text{ km/hr}$ at the origin when $t = 0$. For the first 4 seconds, it has no acceleration and thereafter it is acted upon by a retarding force which gives it a constant acceleration $a_x = -10 \text{ m/s}^2$.

- (a) Calculate the velocity as at $t = 5$ seconds and $t = 9$ seconds (8 marks)
- (b) Determine the X coordinate of the particle as at $t = 5$ seconds and $t = 9$ seconds (8 marks)
- (c) Find the maximum positive X coordinate reached by the particle. (4 marks)

Question 2

The rod OA is rotating in the horizontal plane such that $\theta = t^3 \text{ rad}$ has shown in Figure 1. At the same time, the collar B is sliding outward along OA so that $r = 100t^2 \text{ mm}$. If in both cases t is in seconds, determine the velocity and acceleration of the collar when $t = 1 \text{ s}$.

(20 marks)

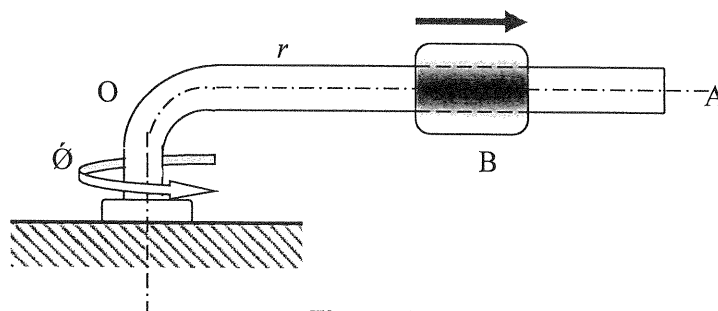


Figure 1

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only THREE (3) questions.

Please use the answer booklet provided.

Question 3

A 10-kg collar slides without friction along a vertical rod as shown in Figure 2. The spring attached to the collar has an un-deformed length of 100mm and a spring constant of 600 N/m. If the collar is released from rest in position 1, determine its velocity after it has moved 150mm to position 2. (20 marks)

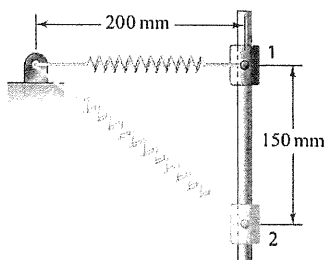


Figure 2

Question 4

The 50-g bullet travelling at 600 m/s strikes the 4-kg block centrally and is embedded within it as shown in Figure 3(a). If the block is sliding on a smooth horizontal plane with a velocity of 12 m/s in the direction shown in Figure 3(b) just before the impact,

- (a) Determine the velocity v of the block and bullet combined after impact. (16marks)
- (b) Calculate its direction θ immediately after impact. (4 marks)

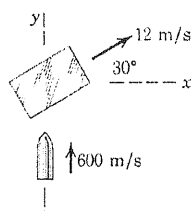


Figure 3 (a)

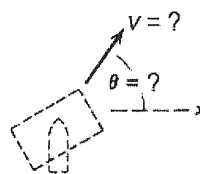


Figure 3 (b)

Question 5

The pinion A of the hoist motor drives gear B which is attached to the hoisting drum as shown in Figure 4. The load L is lifted from its rest position and acquires an upward velocity of 2 m/s in a vertical rise of 0.8 m with constant acceleration. As the load passes as at this position;

- (a) Calculate the acceleration of point C on the cable in contact with the drum. (9 marks)
- (b) Determine the angular velocity and angular acceleration of the pinion A. (11 marks)

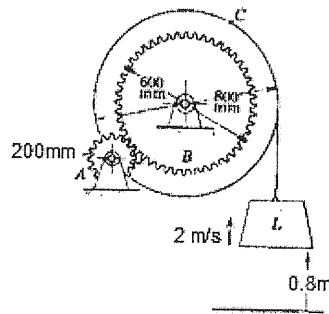


Figure 4

Question 6

The mass on two rotors in planes B and C has shown in Figure 5 are unbalanced weight for the shaft. Determine the masses to be added on the rotor in planes A and D at radius 50mm which will produce static and dynamics balance. Given the mass of B is 5.5kg and C is 2.5kg.

(20 marks)

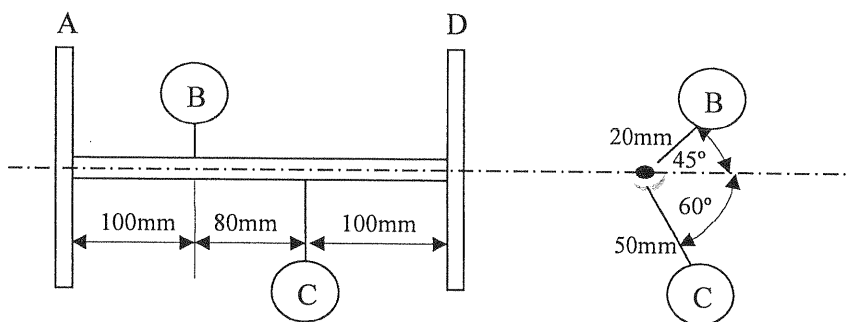


Figure 5

END OF EXAMINATION PAPER

Formulae in Dynamics Applications

1. Particle in Motion;

$$2 a s = \Delta v^2$$

$$v = r' u_r + r \dot{\theta} u_\theta$$

$$a = (r'' - r\dot{\theta}^2) a_r + (r\ddot{\theta} + 2r'\dot{\theta}') a_\theta$$

2. The force action at Block A;

$$\sum F_A = m a_A;$$

3. Total power, $P = F \cdot v$;

4. Conservation of Momentum;

$$\text{the } n\text{- direction gives; } m_1(v_1)_n + m_2(v_2)_n = m_1(v_1')_n + m_2(v_2')_n$$

$$\text{the } t\text{-direction; } m_1(v_1)_t = m_1(v_1')_t$$

$$\text{The coefficient of restitution relationship; } e = \frac{(v_2')_n - (v_1')_n}{(v_1)_n - (v_2)_n}$$

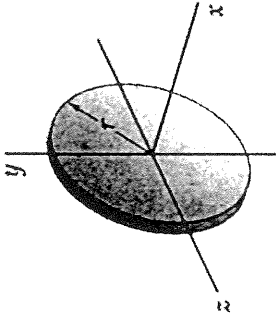
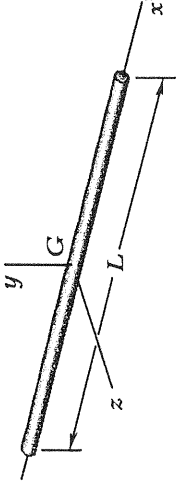
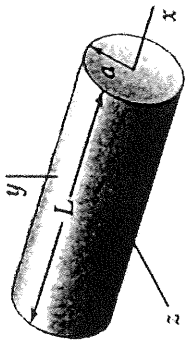
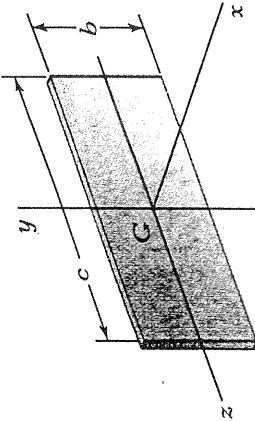
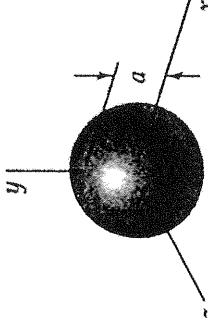
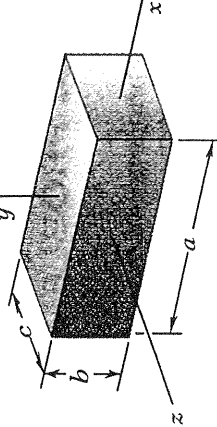
5. The kinetic energy; $T = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$

6. The potential energy; $V_e = \frac{1}{2}k\delta_x^2$; $V_g = mgh$

7. Conservation of Work & Energy; $T_1 + V_1 = T_2 + V_2$

8. Principle of Work & Energy; $T_1 + U_{1-2} = T_2$

Moments of Inertia of Common Geometric Shapes

	$I_x = \frac{1}{2} mr^2$ $I_y = I_z = \frac{1}{4} mr^2$		$I_y = I_z = \frac{1}{12} mL^2$
	$I_x = \frac{1}{2} ma^2$ $I_y = I_z = \frac{1}{12} m(3a^2 + L^2)$		$I_x = \frac{1}{12} m(b^2 + c^2)$ $I_y = \frac{1}{12} mc^2$ $I_z = \frac{1}{12} mb^2$
	$I_x = I_y = I_z = \frac{2}{5} ma^2$		$I_x = \frac{1}{12} m(b^2 + c^2)$ $I_y = \frac{1}{12} m(c^2 + a^2)$ $I_z = \frac{1}{12} m(a^2 + b^2)$