Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	PHYSICS I
COURSE CODE	:	DAS 14103
PROGRAMME CODE	:	1 DAA / DAU
EXAMINATION DATE	:	JUN 2017/ JULY 2017
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTIONS	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Explain the Newton's second law and state the related equation.

(4 Marks)

(b) A trolley of mass 2.0 kg moves to the right at a speed of 5.0 m/s. It collides with a table and rebounds to the left at a speed of 3.0 m/s. Determine,

(i) the momentum of the trolley before and after the collision.

(5 marks)

(ii) the change in momentum of the trolley after the collision.

(3 marks)

(c) The diagram in **Figure Q1(c)** shows two objects connected by a light string over a frictionless pulley. The object A has a mass of 25 kg resting on a wooden table with friction force 49 N, and object B has a mass of 15 kg. The system is released and the object **B** is falling down pulling object **A**.

(i) Draw a free-body diagram (FBD) for the forces acting on objects **A** and **B**.

(4 marks)

(ii) Calculate the acceleration on the system.

(6 marks)

(iii) Calculate the tension on the string.

(3 marks)

Q2 (a) Explain briefly angular displacement and angular velocity.

(7 marks)

(b) A pulley of 5.0 cm radius, on a motor, is turning at 30 rev/s and slows down uniformly to 20 rev/s in 2.0 s. Calculate;

(i) The angular acceleration of the motor.

(3 marks)

(ii) The number of revolutions it makes in this time.

(3 marks)

(c) On an amusement park ride, passengers are seated in a horizontal circle of radius 7.5 m. The seats begin from rest and are uniformly accelerated for 21 seconds to a maximum rotational speed of 1.4 rad/s.

(i) Compute the tangential acceleration of the passengers during the first 21 s of the ride

(6 marks)

(ii) Calculate the instantaneous tangential speed of the passengers 15 s after the acceleration begins

(6 marks)

Q3 (a) Define work and its equation

(3 marks)

(b) A boy and his sister are playing with a traditional cart. The boy drags his sister in an open box with a rope at an angle of 45° to the ground as shown in **Figure Q3(b)**. The tension of the rope is 75 N. Suppose the weight of his sister and the box is 350 N and the box is pulled 10 m along horizontally playground with constant speed. The friction force acted on the box is 53 N. Determine

(i) the work done by the boy.

(3 marks)

(ii) the work done by the gravitational force.

(3 marks)

(iii) the work done by the friction force.

(3 marks)

(iv) the net work done on the box by the forces.

(3 marks)

(c) A 15-kg block of ice is released from the top of frictionless incline plane. The plane is 5.0 m long and makes an angle 30^0 to the horizontal. Calculate

(i) the work done on the ice by the gravitational force from the top to the bottom of the plane

(4 marks)

(ii) the kinetic energy of the block at the bottom of the plane

(3 marks)

(iii) the velocity at the bottom of the plane

(3 marks)

Q4 (a) Define simple harmonic motion (SHM) and give **TWO (2)** examples of simple harmonic motion phenomena.

(5 marks)

(b) **Figure Q4(b)** shows a system of mass-spring on a horizontal frictionless surface. The spring is compressed at a distance 6.0 cm from equilibrium and then released from that point. If the spring constant, k equals 9.48 N/m, and the mass m is 0.035 kg, calculate.

(i) the initial acceleration of the mass

(3 marks)

(ii) the magnitude of force when the mass starts released

(3 marks)

(c) A mass at the end of a spring oscillates with an amplitude of 7.0 cm and a frequency of 1.80 Hz. Find

(i) its maximum speed and maximum acceleration

(7 marks)

(ii) its speed when it is 3.0 cm from its equilibrium position

(7 marks)

- END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2016/2017 PROGRAMME CODE : DAA/DAU

COURSE NAME : PHYSICS I COURSE CODE : DAS 14103

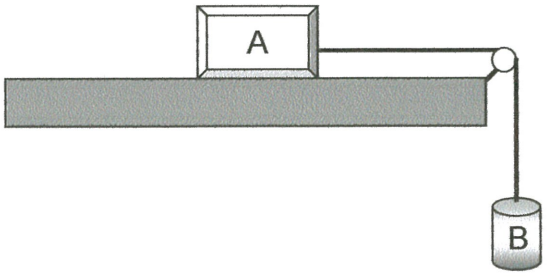

Figure Q1 (c)

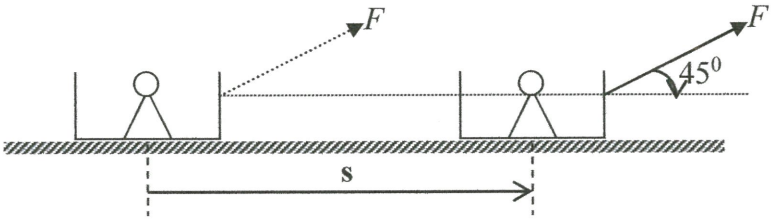

Figure Q3 (b)

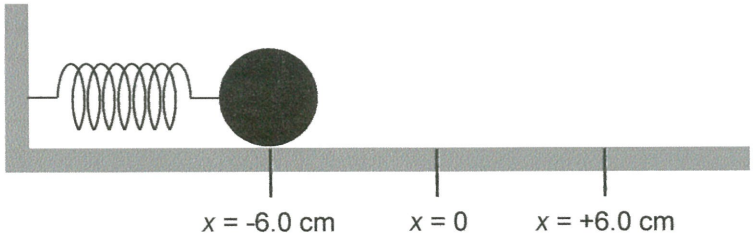

Figure Q4 (b)

FINAL EXAMINATION

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LIST OF FORMULA

$v_x = v_{0x} + a_x t$

$x = x_0 + v_{x0}t + \frac{1}{2}a_x t^2$

$v_x^2 = v_{x0}^2 + 2a_x(x - x_0)$

$\vec{a} = \frac{\sum \vec{F}}{m} = \frac{\vec{F}_{net}}{m}$

$T_K = T_C + 273.15$

$a_c = \frac{v^2}{r}$

$T_C = \frac{T_F - 32}{1.8}$

$\vec{p} = m\vec{v}$

$KE = \frac{1}{2}mv^2$

$\Delta E = W = F_{\parallel} = Fd\cos\theta$

$\omega = \omega_0 + \alpha t$

$U_s = \frac{1}{2}kx^2\sqrt{\frac{Y}{\rho}}$

$m_1v_1 + m_2v_2 = (m_1v_1)' + (m_2m_2)'$

$\rho = \frac{m}{V}$

$\omega = \omega_o + \alpha t$

$K = \frac{1}{2}mv^2$

$a_T = \alpha \cdot r$

$v_T = \omega \cdot r$

$\omega = 2\pi f$

$x = A\cos(\omega t)$

$F = ma$

$\Delta\theta = \theta_f - \theta_i$

$\Delta\theta = \frac{\Delta s}{r}$

$\omega = \frac{\Delta\theta}{\Delta t}$

$v = \omega r$

$T = \frac{2\pi r}{v}$

$a_c = \omega^2 r$

$E = K + U$

$P = Fv$

$\omega^2 = \frac{k}{m}$

$v = \omega A$

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