Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	APPLIED PHYSICS
COURSE CODE	:	DAM 10503
PROGRAMME CODE	:	DAM
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	**SECTION A)** ANSWER **ALL** QUESTIONS **SECTION B)** ANSWER **TWO (2)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

SECTION A

Q1 (a) A 1400 kg car enters a passing zone and accelerates from 70 to 95 km/h. Calculate:

(i) work is done on the car.

(ii) work is done when the car brakes to stop.

(5 marks)

(b) Suppose that you push on the 30 kg package in **Figure Q1 (b)** with a constant force of 120 N through a distance of 0.8 m, and that the opposing friction force averages 5 N. Determine the followings;

(i) the net work done on the package by finding the work done by each force that contributes to the net force.

(ii) kinetic energy when the roller belt conveyor system is moving at 0.500 m/s.

(iii) speed of the package at the end of the push, using work and energy concepts.

(iv) distance of the package coast after the push, assuming friction remains constant.

(12 marks)

(c) Riding a 14 kg bicycle at a steady 18 km/h with 30 N force from air resistance. If your mass is 68 kg, Calculate the power you must supply on level ground and going incline up to 5^0?

(3 marks)

(d) A toy gun was used as shown in **Figure Q1 (d)** to hit toy at amusement park using spring mechanism. Calculate the followings;

(i) the energy stored in the spring of a tranquilizer gun that has a force constant of 50 N/m and is compressed 0.15 m?

(ii) speed of a 2 g projectile ejected from the gun. Neglect friction and mass of the spring.

(5 marks)

Q2 (a) The equation of a wave is given by:

$$y(x,t) = 0.05 \sin\left[\frac{\pi}{2}(10x - 40t) - \frac{\pi}{4}\right] \text{m}$$

Solve:

(i) the amplitude, the wavelength, the frequency, and the wave velocity.

(ii) the particle velocity and acceleration at $x = 0.5$ m and $t = 0.05$ s.

(15 marks)

(b) A vertical pipe open at both ends is partially submerged in water. A tuning fork vibrating at unknown frequency is placed near the top of the pipe. The length L of the air column can be adjusted by moving the pipe vertically. The sound waves generated by the fork are reinforced when L corresponded to one of the resonance frequencies of the pipe. For a certain tube, the smallest value of L for which a peak occurs in the sound intensity is 9.0 cm. Given the speed of sound in air is 343 m/s. Calculate:

(i) the frequency and wavelength of the tuning fork.

(4 marks)

(ii) the value of L for the next two resonance frequencies.

(6 marks)

SECTION B

Q3 (a) Define Newton's First Law.

(3 marks)

(b) Give an example of the application of Newton's First Law.

(1 mark)

(c) Two objects are connected by a light string that passes over a frictionless pulley,as shown in **Figure Q3 (c).**

(i) Draw free-body diagrams of both objects.

(4 marks)

(ii) If the incline plane is frictionless and if $m_1 = 2.00$ kg, $m_2 = 6.00$ kg, and $\theta = 55.0°$, calculate the acceleration of the objects.

(8 marks)

(iii) Calculate the tension of the string.

(2 marks)

(iv) If there is a frictional force of 10 N actinng on a $\mathbf{m_2}$, calculate the acceleration of the system.

(7 marks)

Q4 (a) A particle starts from the origin at $t = 0$ and moves along the positive x axis. A graph of the velocity of the particle as a function of the time is shown in **Figure Q4 (a)**

(i) Find the coordinate of the particle at t=5.0 s.

(ii) Calculate the velocity of the particle at t=5.0 s.

(iii) Calculate the acceleration of the particle at t=5.0 s.

(iv) Calculate average velocity of the particle between t=1.0 s and t=5.0 s.

(v) Determine average acceleration of the particle between t=1.0 s and t=5.0 s.

(10 marks)

(b) A rock is dropped from a 100-m-high cliff. Calculate the time taken for the rock to fall:

(i) the first 50 m.

(ii) the second 50 m.

(4 marks)

(c) **Figure Q4(c)** shows a pirate ship 560 m from a fort defending a harbor entrance. A defence cannon, located at sea level, fires balls at initial speed v_0 =82 m/s.

(i) Find the angle in order the cannon able to hit the pirate ship

(ii) Determine the maximum range possible of firing the cannon

(6 marks)

(d) When startled, a cat will leap upward. Suppose it rises 0.544 m in the first 0.200 s.

(i) Find its initial speed as it leaves the ground.

(ii) Calculate the maximum height it will reach.

(5 marks)

Q5 (a) Differentiate between tangential acceleration and centripetal acceleration.

(4 marks)

(b) Define centripetal force and centripetal acceleration.

(4 marks)

(c) A blade of a ceiling fan has a radius of 0.400 m is rotating about a fixed axis with an initial angular velocity of 0.150 rev s^{-1}. The angular acceleration of the blade is 0.750 rev s^{-2}. Determine;

(i) the angular velocity after 4.00 s

(4 marks)

(ii) the number of revolutions for the blade turns in this time interval

(3 marks)

(iii) the tangential speed of a point on the tip of the blade at time, t =4.00 s

(3 marks)

(iv) the magnitude of the resultant acceleration of at the tip of the blade at t =4.00 s.

(7 marks)

Q6 (a) An areas of land in the hectare, defined as 10^4 m^2. An open-pit coal mine consumes 75 hectares of land, down to a depth of 26 m, each year.

(i) Calculate the volume of earth, that has been mined?

(ii) Convert the unit in cubic kilometer?

(6 marks)

(b) An athlete measures his heart rate by counting the number of beats in 30 s . If 40 beats are counted in 30.0 s , calculate the heart rate beats per minute?

(3 marks)

(c) Four vectors A,B, C and D is given by:

$$\vec{A} = 2.00\ m\ \boldsymbol{i} + 3.00\ m\ \boldsymbol{j}$$
$$\vec{B} = 4.00\ m\ at + 65°$$
$$\vec{C} = -4.00\ m\ \boldsymbol{i} + -6.00 m\ \boldsymbol{j}$$
$$\vec{D} = 5.00\ m\ at - 235°$$

Calculate sum of the following four vectors in

(i) unit-vector notation.

(ii) magnitude

(iii) angle direction

(8 marks)

(d) A runner run across track given by the graph present in **Figure Q6 (c)**. Calculate the final distance covered.

(5 marks)

(e) In a rainy day, raindrops fall 1700 m from a cloud to the ground. Consider the raindrop did not get slowed by air resistance, calculate its speed when it struck the ground.

(3 marks)

-END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020
COURSE NAME : APPLIED PHYSICS
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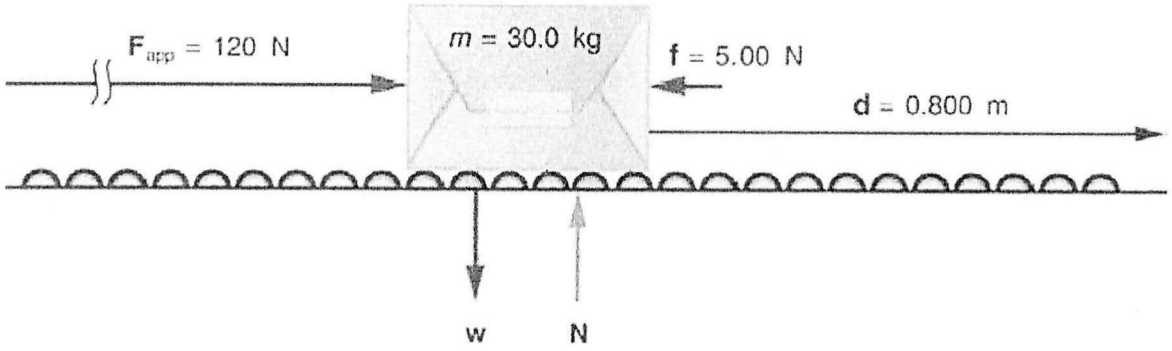

Figure Q1 (b)

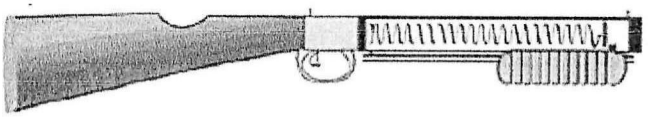

Figure Q1 (d)

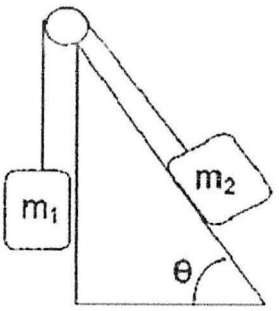

Figure Q3 (c)

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020
COURSE NAME : APPLIED PHYSICS
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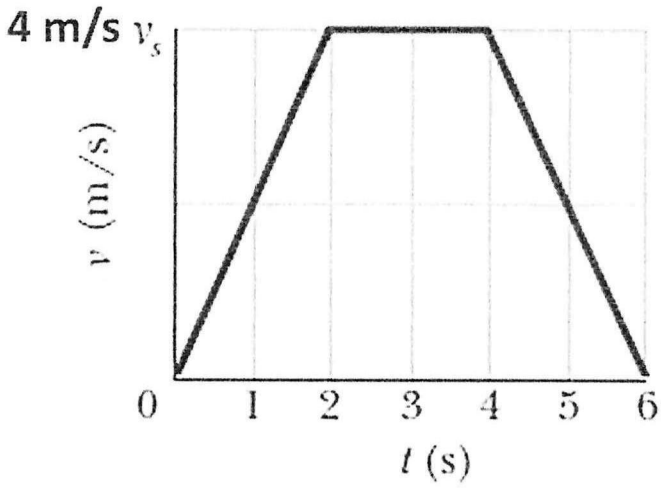

Figure Q4 (a)

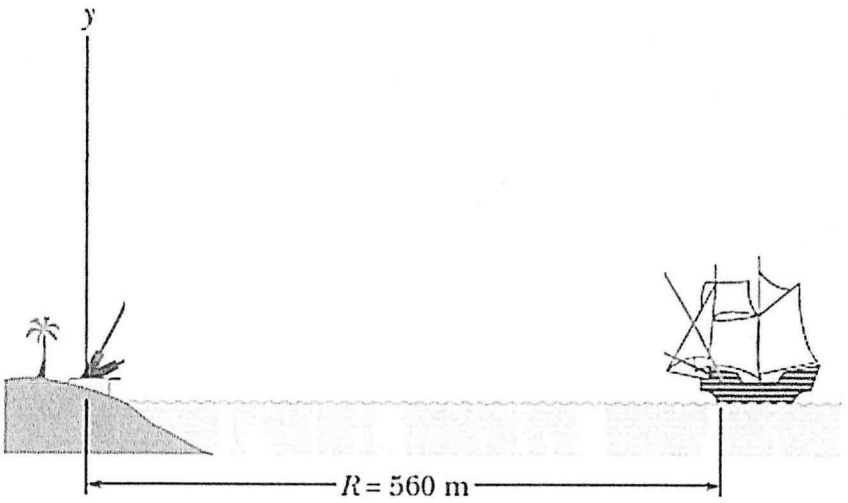

Figure Q4 (c)

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2019/2020
COURSE NAME : APPLIED PHYSICS
PROGRAMME CODE : DAM
COURSE CODE : DAM 10503

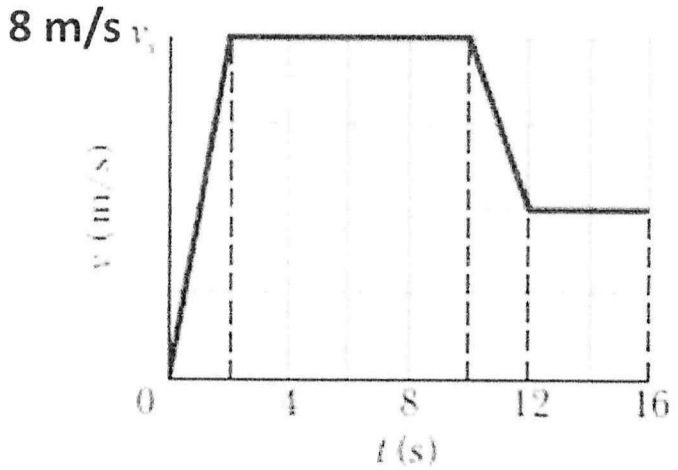

Figure Q6 (c)

FINAL EXAMINATION

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LIST OF FORMULA

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

$F_b = \rho g V$

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

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

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

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

$T_K = T_C + 273.15$

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

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

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

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

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

$\omega = \omega_0 + \alpha t$

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