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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015**

COURSE NAME : PHYSICS 1
COURSE CODE : DAS 14103
PROGRAMME : 2 DAU / 3 DAU
EXAMINATION DATE : JUNE 2015/ JULY 2015
DURATION : 2 ½ HOURS
INSTRUCTION : ANSWER ALL QUESTIONS IN
PART A
ANSWER **TWO (2)** QUESTIONS
ONLY IN **PART B**

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

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PART A

Q1 (a) Define the principle of Hooke's law.

(04 marks)

(b) A 200g block connected to a light spring for which the force constant is 5N/m is free to oscillate on a horizontal, frictionless surface. The block is displaced 5cm from equilibrium and released from rest, as in **Figure Q1 (b)**.

- (i) Determine the period of its motion.
- (ii) Determine the maximum speed of the block.
- (iii) Determine the maximum acceleration of the block.
- (iv) Express the position, speed, and acceleration as functions of time.

(21 marks)

Q2 (a) Define the instantaneous power.

(04 marks)

(b) A 4kg particle moves along the x axis. Its position varies with time according to $x = t + 2.0t^3$, where x is in meters and t is in seconds. Calculate the following:

- (i) The kinetic energy as function of time, t .
- (ii) The acceleration of the particle and the force acting on it at time, t .
- (iii) The power being delivered to the particle at time, t .
- (iv) The work done on the particle in the interval $t = 0$ to $t = 2$ s.

(21 marks)

PART B

- Q3** (a) A sphere with its radius is 400mm is float in density of oil 0.78g/cm^3 under gravity.
- Convert the density of oil in SI unit.
 - Determine the buoyancy force of the sphere in SI unit.
- (08 marks)
- (b) A pack of five wolves are fighting over the carcass of a dead polar bear. A top view the magnitude and direction of the three forces are shown in **Figure Q3 (b)**.
- Calculate the force along horizontal motion.
 - Calculate the force along vertical motion.
 - Determine the net force acting upon the carcass.
 - Determine the direction of the net force acting upon the carcass.
 - Calculate the acceleration of the 750kg polar bear carcass.
- (17 marks)
- Q4** (a) Analyze the concept of projectile at horizontal and vertical component.
- (06 marks)
- (b) In **Figure Q4 (b)** a rescue plane flies at 198km/h and constant height $h = 500\text{m}$ toward a point directly over a victim, where a rescue capsule is to land.
- Calculate the time taken by a rescue capsule is to land.
 - Determine the angle of the pilot's line of sight to the victim when the rescue capsule release is made.
 - Determine the velocity in unit-vector notation as the rescue capsule reaches the water.
- (19 marks)

- Q5** (a) Differentiate three types of Newton's law. (09 marks)
- (b) Two objects are connected by a light string that passes over a frictionless pulley, as in **Figure Q5 (b)**. If the incline is frictionless and if $m_1 = 2\text{kg}$, $m_2 = 6\text{kg}$, and $\theta = 55^\circ$.
- (i) Draw free body diagrams of both objects.
 - (ii) Determine the acceleration of the objects.
 - (iii) Calculate the tension of the string.
 - (iv) Analyze the speed of each object 2s after being released from rest. (16 marks)
- Q6** (a) Define the following term and state its SI unit:
- (i) Angular acceleration.
 - (ii) Tangential acceleration.
 - (iii) Centripetal acceleration. (09 marks)
- (b) Derive the relationship of the tangential and centripetal accelerations. (04 marks)
- (c) A 90cm radius roulette wheel is initially turning at 3rev/s then slows down uniformly and finally stops after turning 26 revolutions.
- Determine the following:
- (i) Time taken for the wheel to stop.
 - (ii) Angular acceleration of the wheel.
 - (iii) Initial tangential speed of the wheel.
 - (iv) Initial centripetal acceleration of the wheel. (12 marks)

- END OF QUESTIONS -

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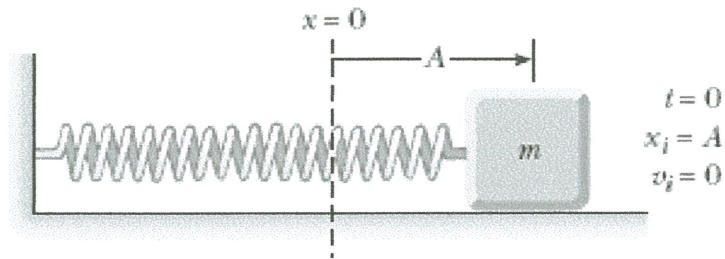


FIGURE Q1 (b)

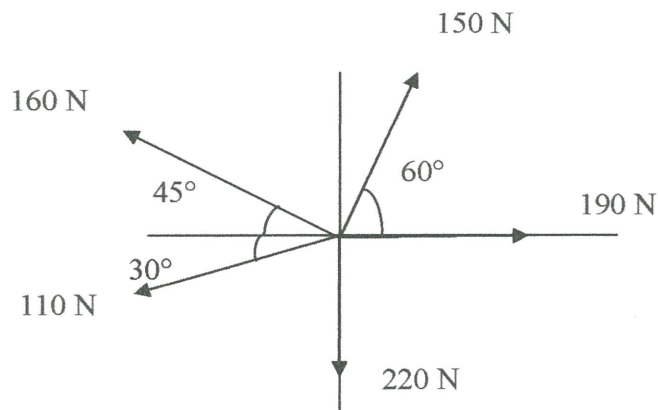


FIGURE Q3 (b)

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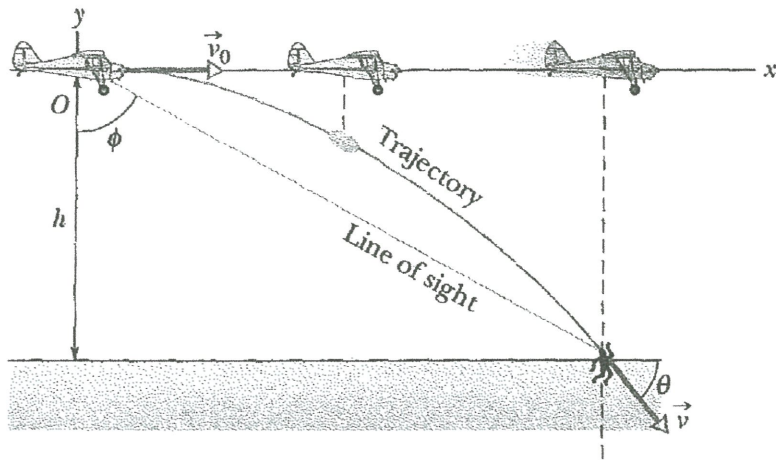


FIGURE Q4 (b)

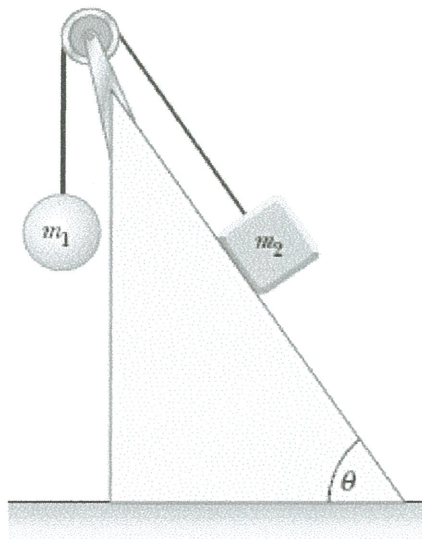


FIGURE Q5 (b)

FORMULAE

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Gravity acceleration, $g = 9.81 \text{ m/s}^2$	$V_{\text{sphere}} = 4/3 \pi r^3$	$F_b = \rho g V$
$W = F \cdot s = F_s \cos\theta$	$E_u = \frac{1}{2} kx^2 = \frac{1}{2} m\omega^2 x^2$	$s = r\theta$
$K = \frac{1}{2} mv^2$	$E_J = E_k + E_u = \frac{1}{2} m\omega^2 A^2$	$v = r\omega$
$U = mgh$	$R = \sqrt{R_x^2 + R_y^2}$	$a = r\alpha$
$\Delta K = -\Delta U$	$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right)$	$\omega = \frac{d\theta}{dt}$
$W_n = \Delta K$	$v = u + at$	$\alpha = \frac{d\omega}{dt}$
$\frac{1}{2} mv_2^2 - \frac{1}{2} mv_1^2 = -(mgh_2 - mgh_1)$	$s = ut + \frac{1}{2} at^2$	$a_c = \frac{v^2}{r} = \omega^2 r$
$a = -\omega^2 \cdot x$	$v^2 = u^2 + 2as$	$a = r\sqrt{\omega^4 + \alpha^2}$
$f = \frac{1}{T} = \frac{\omega}{2\pi}$	$\sum F = ma$	$\omega = \omega_o + \alpha t$
$v = \omega\sqrt{A^2 - x^2}$	$W = mg$	$\theta = \omega_o t + \frac{1}{2} \alpha \cdot t^2$
$E_k = \frac{1}{2} mv^2 = \frac{1}{2} m\omega^2 (A^2 - x^2)$	$f_k = \mu_k \cdot N; f_s = \mu_s \cdot N$	$\omega^2 = \omega_o^2 + 2\alpha \cdot \Delta\theta$