CONFIDENTIAL

UNIVERSITI KUALA LUMPUR

MALAYSIA INSTITUTE OF INFORMATION TECHNOLOGY

FINAL EXAMINATION

JANUARY 2016 SEMESTER

SUBJECT CODE	:	IBB11304
SUBJECT TITLE	:	ENGINEERING PHYSICS
LEVEL	:	BACHELOR
TIME / DURATION	:	2.00 PM – 4.30 PM (2 ½ HOURS)
DATE	:	25 MAY 2016

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. This question paper consists of ONE (1) section, Section A.
4. Answer FOUR (4) questions ONLY in Section A.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English.

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE AND APPENDIX.

SECTION A (TOTAL: 100 MARKS)

INSTRUCTION: Answer FOUR (4) questions ONLY.
Please use the answer booklet provided.

Question 1

(a) Calculate each of the following speeds in ms^{-1}:

i. 100 kilometers per hour (2 marks)

ii. 2.5 kilometers per minute (2 marks)

(b) What is constant acceleration? (3 marks)

(c) A ship leaves port P and travels 30km due north. Then it changes course and travels 20km in a direction 30° east of north to reach port R. Calculate the displacement from P to R.

(7 marks)

(d) i. For a projectile motion, why the horizontal motion is unchanged?

(3 marks)

ii. A projectile is launched from the top of a tower of height 30 m with an initial speed of 20 ms-1 at an angle of 30° above the horizontal. Calculate the time of flight to the ground and speed before it touches the ground.

(8 marks)

Question 2

Figure 1

(a) A jet engine moves along an experimental track; x axis as shown in Figure 1. Its position as a function of time is given by the equation $x = At^2 + B$, where $A = 2.10$ m/s^2 and $B = 2.80$ m.

i. Draw graph x vs. t provided with a correct x-axis and y-axis scale. (4 marks)

ii. Determine the displacement of the engine during the time interval from $t_1 = 3.00$ s to $t_2 = 5.00$ s. (4 marks)

iii. Determine the average velocity during this time interval. (3 marks)

(b) i. Define inertia and give **ONE (1)** example. (4 marks)

ii. Explain free-body diagram. (2 marks)

iii. Draw a free-body diagram of a box slides down shown in Figure 2. (4 marks)

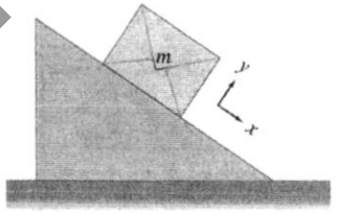

Figure 2

(c) A rocket of mass 100 kg is launched from the surface of the Earth. It produces a steady thrust of 2500 N. Calculate the acceleration at the start. (4 marks)

Question 3

(a) i. State **TWO (2)** principles of conversation of energy. (4 marks)

ii. Give **TWO (2)** differences between gravitational potential energy and elastic potential energy. (4 marks)

(b) How fast should a man of mass 62.5kg run, so that his kinetic energy is 625 J? (4 marks)

(c) A 14 300kg airplane is flying at an altitude of 497m at a speed of 214 km/h. Determine the airplane's total mechanical energy. (5 marks)

(d) A glider with mass m = 0.2 kg sits on a frictionless horizontal air track, connected to a spring with force constant k = 5 N/m. You pull on the glider, stretching the spring 0.1m and then release it with no initial velocity. The glider begins to move back toward its equilibrium position (x = 0). What is its velocity when x = 0.08 m? (8 marks)

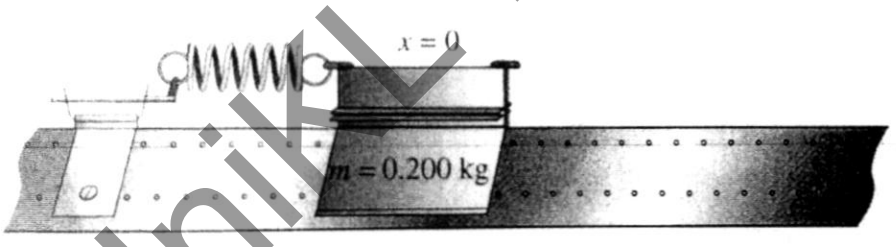

Figure 3

Question 4

(a) i. Find **TWO (2)** differences between forced oscillation and resonance. (4 marks)

ii. Give **TWO (2)** examples of resonance. (4 marks)

iii. Give **TWO (2)** examples of oscillating motion in every day life. (4 marks)

iv. Explain damped oscillations. (2 marks)

(b) A small mass attached to a spring oscillates with simple harmonic motion with amplitude of 35mm, taking 6.5 s to make 20 complete oscillations. Calculate its angular frequency. (4 marks)

(c) When a family of four with a total mass of 200 kg step into their 1200-kg car, the car's springs compress 3.0 cm.

i. What is the spring constant of the car's springs, assuming they act as a single spring? (4 marks)

ii. How far will the car lower if loaded with 300 kg rather than 200 kg? (3 marks)

Question 5

(a) List **FOUR (4)** characteristics of a wave motion. (4 marks)

(b) Radio waves travel through air at a speed of 3.0×10^8 m/s^{-1}. Calculate:

i. the wavelength in air for radio waves of frequency 105 MHz (4 marks)

ii. the frequency of radio waves of wavelength 1500m. (4 marks)

(c) State **TWO (2)** wave properties and explain each in brief. (4 marks)

(d) A car sounds its horn as it travels at a steady speed of 15 ms^{-1} along a straight road between two stationary observers X and Y. The observer at X hears a frequency of 538 Hz whilst the observer at Y hears a lower frequency.

i. Is the car travelling towards X or towards Y? (2 marks)

ii. What would be the frequency heard from the car by either X or Y if the car stopped and sounded its horn? (7 marks)

END OF QUESTIONS

APPENDIX

Kinematics equation

$v = v_0 + at$

$x = x_0 + v_0t + 1/2at^2$

$v^2 = v_0^2 + 2a\,(x-x_0)$

x-component (horizontal)

$v_x = v_{x0} + a_xt$

$x = x_0 + v_{x0}t + 1/2a_xt^2$

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

y-component (vertical)

$v_y = v_{y0} + a_yt$

$y = y_0 + v_{y0}t + 1/2a_yt^2$

$v_y^2 = v_{y0}^2 + 2a_y\,(y-y_0)$

Projectile equation

x-component (horizontal)

$a_x = 0$

$v_x = v_{x0}$

$x = x_0 + v_{x0}t$

y-component (vertical)

$a_y = -g$

$v_y = v_{y0} - gt$

$y = y_0 + v_{y0}t - 1/2gt^2$

$R = (v_0^2 \sin 2\Theta_0) / g$

$\sum F = ma$

$F_t = \sqrt{(F_{x2} + F_{y2})}$

$\sin\Theta = F_y/F_t$

$\cos\Theta = F_x/F_t$

$\tan\Theta = F_y/F_x$

$F = Gm_1m_2/r^2$

$G = 6.67 \times 10^{-11}\ Nm^2/kg^2$

$E = K + U = \frac{1}{2}\,mv^2 + mgy$

$E = K + U = \frac{1}{2}\,mv^2 + \frac{1}{2}\,kx^2$

$K_2 + U_2 = K_1 + U_1$

$v = \sqrt{(Ft/\mu)}$

$D(x,t) = A \sin(kx - \omega t)$

$\omega = 2\pi f$

$K = 2\pi/\lambda$

$\text{Sin}\,\Theta_2/\sin\Theta_1 = v_2/v_1$

$v = \lambda f$

static observer

$f' = f / (1 + v_{source}/v_{snd})$

$f' = f / (1 - v_{source}/v_{snd})$

moving observer

$f' = f * (1 + v_{obs}/v_{snd})$

$f' = f * (1 - v_{obs}/v_{snd})$