INTI International University & Colleges

FINAL

Examination Paper

(COVER PAGE)

Session	:	**April 2017**
Programme	:	Diploma in Mechanical Engineering (DMEN)
Course	:	**PHY1121 : Physics**
Date of Examination	:	August 2, 2017 (Wednesday)
Time	:	8:00 am – 10:00 am Reading Time : Nil
Duration	:	2 Hours
Special Instructions	:	

This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-programmable Scientific Calculator

Material provided :

Physics Booklet

Examiner	:	**Mr Manickampraslad M. Sambasivam,** Ms Chong Mee Teng
Moderator	:	Dr Chong Tet Vui

This paper consists of 8 printed pages, including the cover page.

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
PHY1121: PHYSICS
FINAL EXAMINATION: APRIL 2017 SESSION

Instructions: This paper consists of **FIVE (5)** questions. Answer any **FOUR** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) A carpet is to be installed in a room of length 12.71 m and width 3.46 m. Find the area of the room, retaining the proper number of significant figures.

(3 marks)

(b) If a car is traveling at a speed of 28.0 m/s, find whether the driver exceeding the speed limit of 55.0 mi/h.

(3 marks)

(c) The traffic light turns green, and the driver of a high-performance car slams the accelerator to the floor: The accelerometer registers 22.0 m/s^2. Convert this reading to km/min^2.

(3 marks)

(d) A person measures the height of a building by walking out a distance of 46.0 m from its base and shining a flashlight beam toward the top. When the beam is elevated at an angle of 39.0° with respect to the horizontal, as shown in Figure Q1 (d), the beam just strikes the top of the building. Find the height of the building and the distance the flashlight beam has to travel before it strikes the top of the building.

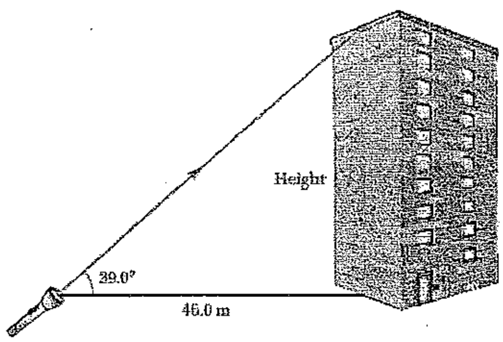

Figure Q1 (d)

(4 marks)

(e) A turtle and a rabbit engage in a footrace over a distance of 4.00 km. The rabbit runs 0.500 km and then stops for a 90.0 min nap. Upon awakening, he remembers the race and runs twice as fast. Finishing the course in a total time of 1.75 h, the rabbit wins the race. Assume the rabbit runs with constant velocity before and after the nap.

(i) Calculate the average speed of the rabbit.

(3 marks)

(ii) Calculate his average speed before he stopped for a nap.

(3 marks)

(f) Answer following questions referring to Figure Q1 (f).

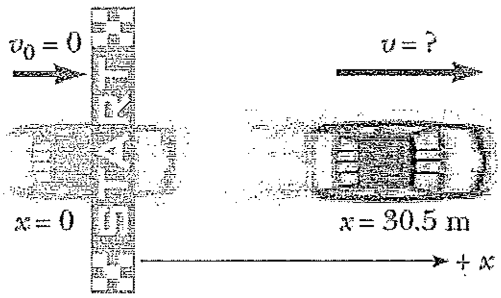

Figure Q1 (f)

(i) A race car starting from rest accelerates at a constant rate of 5.00 m/s^2. Calculate the velocity of the car after it has traveled 30.5 m.

(3 marks)

(ii) Calculate the time has elapsed.

(3 marks)

Question 2

(a) When a body is moving at constant velocity, justify does it need a force to maintain its state of motion.

(4 marks)

(b) Figure Q2 (b) shows the 2.0 kg block is being pushed along a rough horizontal plane by a force F = 10 N at an angle 30° from the horizontal.

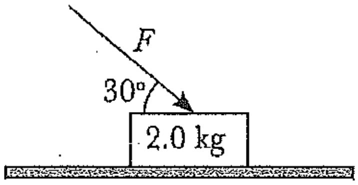

Figure Q2 (b)

(i) Sketch a free body diagram for the block.

(2 marks)

(ii) The block moves at a constant acceleration of 0.8 ms^{-2}, calculate the coefficient of kinetic friction between the block and the plane surface.

(6 marks)

(c) In Figure Q2 (c), a car moves around a banked track with a banking angle of 14.0°. This angle is optimal for a car travelling with a speed of 50 ms^{-1}. The mass of the car is 1980 kg. The normal force on the car is 20,000 N.

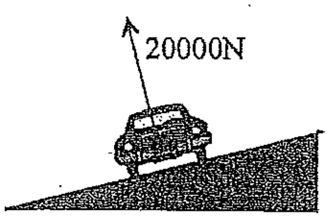

Figure Q2 (c)

(i) Calculate the horizontal and vertical components of the normal force.

(3 marks)

(ii) Calculate the acceleration of the car.

(2 marks)

(iii) Calculate the radius of the bend.

(2 marks)

(d)

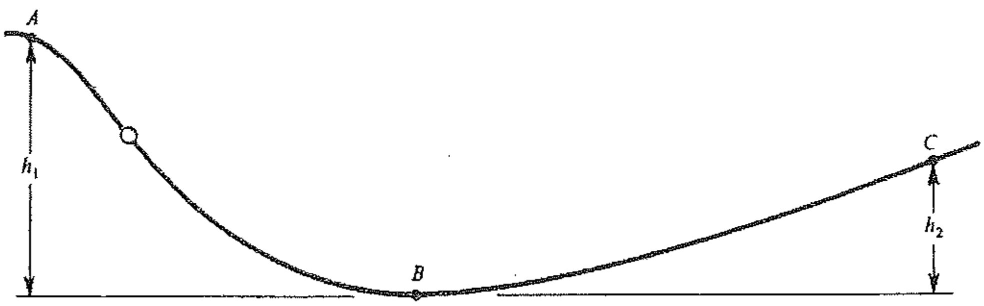

Figure Q2 (d)

(i) Figure Q2 (d) shows a bead sliding on a wire. Calculate the height h_1 be if the bead, starting at rest at **A**, is to have a speed of 200 cm/s at point **B**. (Ignore friction)

(3 marks)

(ii) Given that $h_1 = 50$ cm, $h_2 = 30$ cm, and the length along the wire from **A** to **C** is 400 cm. A 3.0 g bead released at **A** coasts to point **C** and stops. Calculate average friction force opposed its motion.

(3 marks)

Question 3

(a) A long jumper leaves the ground at an angle of 20.0° to the horizontal and at a speed of 11.0 m/s.

(i) Calculate the time taken for him to reach the maximum height.

(2 marks)

(ii) Calculate the maximum height.

(2 marks)

(iii) Calculate the distance does he jump.

(2 marks)

(b) A car of mass m is on an icy driveway inclined at an angle $\theta = 20.0°$.

(i) Draw free-body diagram for the situation above.

(2 marks)

(ii) Determine the acceleration of the car, assuming the incline is frictionless.

(2 marks)

(iii) If the length of the driveway is 25.0 m and the car starts from rest at the top, calculate the time taken for the car to travel to the bottom.

(2 marks)

(iv) Calculate the speed of the car at the bottom.

(2 marks)

(c) A shopper pushes a grocery cart 20.0 m at constant speed on level ground, against a 35.0 N frictional force. He pushes in a direction 25.0 ° below the horizontal.

(i) Calculate the work done on the cart by friction.

(2 marks)

(ii) Calculate the work done on the cart by the gravitational force.

(2 marks)

(iii) Calculate the work done on the cart by the shopper.

(2 marks)

(iv) Calculate the force the shopper exerts, using energy considerations.

(3 marks)

(v) Calculate the total work done on the cart.

(2 marks)

Question 4

(a) A spaceship orbits the moon at a height of 20 000 m. Assuming it to be subject only to the gravitational pull of the moon, find its speed and the time it takes for one orbit. For the moon, the mass $m_m = 7.34 \times 10^{22}$ kg and the radius $r = 1.738 \times 10^6$ m.

(5 marks)

(b) A 0.0250 kg bullet is accelerated from rest to a speed of 550 m/s in a 3.00 kg rifle. The pain of the rifle's kick is much worse if you hold the gun loosely a few centimeters from your shoulder rather than holding it tightly against your shoulder.

(i) Calculate the recoil velocity of the rifle.

(3 marks)

(ii) Calculate the kinetic energy does the rifle gain.

(2 marks)

(iii) Calculate the recoil velocity of the rifle if the effective mass 28.0 kg.

(3 marks)

(iv) Calculate the kinetic energy transferred to the rifle.

(2 marks)

(c) On a hot day, the temperature of an 80,000 liter swimming pool increases by 1.50°C. Calculate the net heat transfer during this heating. (Ignore any complications, such as loss of water by evaporation).

(4 marks)

(d) Explain the term "Latent Heat".

(3 marks)

(e) A piece of aluminum house siding is 3.66 m long on a cold winter day of -28 °C. Calculate how much longer is it on a very hot summer day at 39°C. ($\alpha = 25 \times 10^{-6}$/°C)

(3 marks)

Question 5

(a) Calculate the charge stored in a 180 μF capacitor when 120 V is applied to it.

(3 marks)

(b) What is the resistance of ten (10) of 275 Ω resistors connected:-

(i) in series

(2 marks)

(ii) in parallel

(6 marks)

(c) Calculate the maximum force on an aluminum rod with a 0.100 μC charge that pass between the poles of a 1.50 T permanent magnet at a speed of 5.00 m/s also identify the direction of the force.

(4 marks)

(d) Sketch the schematic diagram of half wave rectifier and also sketch the output waveform.

(6 marks)

(e) An electric fan is connected across a 120 V outlet in Japan. The fan dissipates 1320 W of power in the form of electromagnetic radiation and heat. Calculate the resistance of the fan.

(4 marks)

-THE END-