Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
100 Level 1st Semester Examination – July/August-2016
SCT 151-1 Physics I

Uva Wellassa University

Instructions to candidates
Duration: One (01) hour
Number of questions: Two (02) Essays
Answer all questions
Mark allocation: 100
All symbols carry their usual meaning.

1. a. By considering the motion of an objecct in two dimensions ($i.e., xy$ plane), define the following terms.

   i. Position vector

   ii. Displacement vector

   iii. Average velocity vector

   iv. Average acceleration vector, of the object.

(20 marks)

b. A motor car is driven on a oily slippery road in a rainy day to avoid a traffic jam. The coordinates of the position (in meters) of the motor car as a function of time t is given by

$$x = -0.31t^2 + 7.2t + 28 \text{ and } y = 0.22t^2 - 9.1t + 30$$

i. At $t = 2.5\ s$, what are the motor car's position vector $\vec{r}$, its magnitude and the angle it makes with the x-axis.

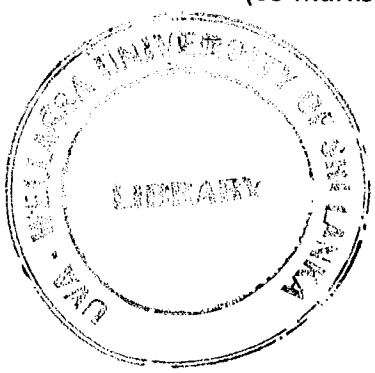
ii. Graph the motor car's position from $t = 0$ to $t = 25\ s$.

iii. Find the velocity vector $\vec{v}$ of the car at time $t = 20\ s$.

(15marks)

c. i. What is a projectile?

(05 marks)



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ii. Neglecting the effects of air, obtain expressions for horizontal (x) and vertical (y) displacememts of a projectile fired at an angle θ_0 with respect to x axis with an initial velocity v_0.

(05 marks)

iii. Hence or otherwise, obtain the equation of the path for the projectile.

(05 marks)

2.

a. By considering an object undergoing a circular motion, write equations for its acceleration a and period of revolution T identifying all terms in the equations.

(10 marks)

b. An Earth satellite moves in a circular orbit 640 km above Earth's surface with a period of 98.0 mn. What are the (i) speed, and (ii) magnitude of the centripetal acceleration of the satellite?

(10 marks)

c. The centripetal force *F* acting on an object undergoing a circular motion is universal (common) and occurs regardless of the location where the particular circular motion takes place. Give three (03) examples from the real world to support this.

(10 marks)

d.

i. What is gravitation? What must the separation be between a 5.2 kg particle and a 2.4 kg paticle for their gravitational attraction to have a magnitude of 2.3 x 10^{-12} N?

ii. At what altitude above the Earth surface would the gravitational acceleration be 4.9 m/s^2.

(15 marks)

e. What is Coulomb law? Compare it with gravitational law

(05 marks)