Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
200 Level 1st Semester Examination – July/August-2016
SCT 252-2 Physics II

Instructions to candidates
Duration: Two (02) hours
Number of questions: Four (04) Essays
Answer all questions.
Mark allocation: 100
All symbols carry their usual meaning.

1. a. What is simple harmonic motion?

(05 marks)

b. Obtain expressions for the velocity $v\ (t)$, acceleration $a\ (t)$, and the total energy E of an object experiencing a simple harmonic motion.

(10 marks)

c. A mass m (= 380 g) is fastned to a spring where the spring constant k is 30 N/m. The whole system is kept on a frictionless surface and laying horizontally. The mass is then pulled a distance x = 8 cm from its equillibrium position at $x = 0$ and then released from the rest at $t = 0$. Find

i. the angular frequency,

ii. the frequency,

iii. the amplitude,

iv. the maximum speed, and

v. the maximum acceleration in the resulting motion.

(10 mark)

2. a. State the principle of superposition for two sinusoidal waves interacting with each other.

(05 marks)

b. A particle moves under the simultanious action of two sinusoidal waves acting perpendicular to each other. Waves are having equal frequencies (ω) but different phase angles (ϕ_1,and ϕ_2, $where\ \phi_2 > \phi_1$) and amplitudes ($a_1\ and\ a_2$).

i. Write the wave equations for the displacements (x and y) of each wave in sine form.

ii. Without solving the two wave equations written above, write an equation for the resultant of the two waves which descibes the path followed by the object.

iii. Describe the situation when $\phi_2 - \phi_1 = {}^{\pi}/_{2}$ and draw the shape of the resultant path of the object.

iv. Show that the object follows a circular path if the amplitudes of both waves are equal.

(20 marks)

3. a. Explain the following concepts in optics.

i. Optical path

ii. Coherent light sources

iii. Interference of light waves

iv. Diffraction grating

(10 marks)

b. One of the important properties of light is its speed which has a great significance in modern day physics. Imagine that you are asked to find a reasonable value for the speed of light at home using things and equipments available around you. Explain a possible way to do this using household things.

(10 marks)

c. Explain the term diffraction and state the differences between Fraunhofer's and Fresnel's diffractions.

(05 marks)

4. a. Describe the Young's double slit experiment with a diagram.

(10 marks)

b. Derive an expression for θ to locate the 1st order dark fringes in the interference pattern produced in a double slit experiment.

(10 marks)

c. In a double slit experiment, the wavelength of the incident light in the first slit is 645 nm and the slit separaion is 0.12 mm and the slit-screen separation is 55 cm. Assuming that θ is small enough for approximations, find the distance on screen between two adjacent minima near the centre of the interference pattern.

(05 marks)