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

Uva Wellassa University

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

1. a. What is a simple harmonic motion (SHM).

(5 marks)

b. Obtain expressions for the velocity $v\ (t)$, acceleration $a\ (t)$ and the total energy E of an object undergoing a SHM.

(10 marks)

c. A solid rectangular shaped object whose mass m is 480 g is fastened to a spring which is fixed at one end. The spring constant k is 45 N/m. The whole system lies horizontally on a frictionless surface. Then the object is pulled a distance $x = 15\ cm$ from its equilibrium position at $x = 0$ and released from the rest at $t = 0$. Find the angular frequency ω, the frequency f, the amplitude, the maximum speed and the maximum acceleration of the resulting motion.

(10 marks)

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

(5 marks)

b. Two sinusoidal waves travelling perpendicular to each other with displacements x_1 and x_2 and phase angles ϕ_1 and ϕ_2 (where $\phi_2 > \phi_1$) superpose with each other. Both waves have the same angular frequency (ω) but different amplitudes, a_1 and a_2.

i. Write the wave equations for displacements x_1 and x_2 in the sine form.

ii. Simplify the two wave equations to obtain a general expression

iii. Show that when $\phi_2 - \phi_1$ is equal to $\pi/2$, the general expression you obtained in (i) represents the equation of an ellipse.

iv. Describe the situation when $\phi_1 - \phi_2 = 0, 2\pi$ and 4π.

(20 marks)

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3. a. Explain the following phenomena of light

(i) diffraction, (ii) interference, (iii) dispersion and (iv) scattering

(10 marks)

b Give one practical example from nature for each phenomena you mentioned above.

(10 marks)

c. Suggest an experiment to find the speed of light at your home

(5 marks)

4.

a. Explain Young's double slit experiment. What property of light is demonstrated by this experiment?

(10 marks)

b. Derive an expression for θ to locate the 3^{nd} order bright fringes in the interference pattern produced in a double slit experiment.

(5 marks)

c. In a typical double slit experiment, the light of wavelength of 657 nm is used to illuminate the first slit. If the double slit separation is 1.2 mm and the double slit-and the screen separation is 55 cm, what is the distance on screen between adjacent maxima near the center of the interference pattern?

(5 marks)

d. Explain how does Michelson Interferometer work with a diagram showing the instrument and the path of the light rays inside the instrument.

(5 marks)