Uva Wellassa University, Sri Lanka
Faculty of Science and Technology
Science and Technology Degree program
1st Semester Examination – March/ April 2013

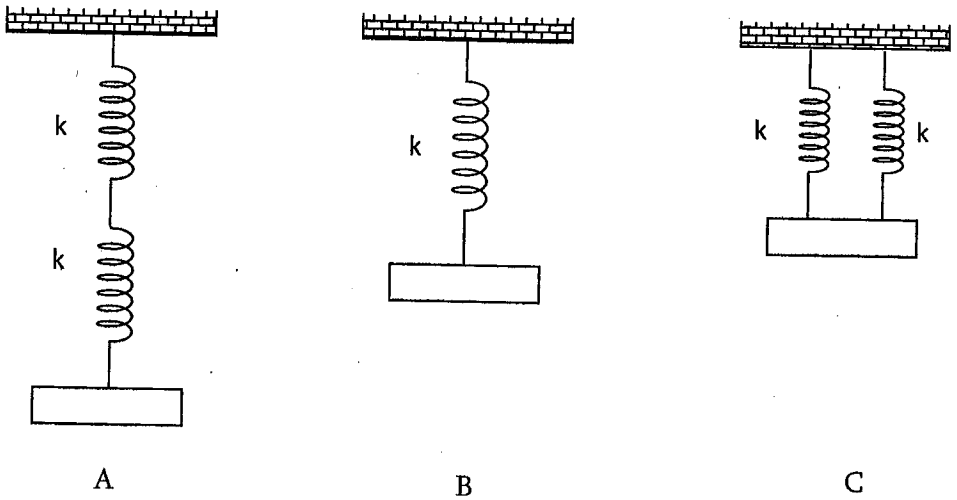
Uva Wellassa University

SCT 252-2
Physics II

Time: Two (02) hours

Number of questions: Four (04)
Answer all the questions
Time allocation: Two (02) hours
Total marks allocated: 100 marks

01. *a.* Show that the values of ω^2 for the three simple harmonic oscillations A, B, C in Figure Q1 are in the ratio 1:2:4



A B C

Figure Q1

b. The simple harmonic oscillator shown in Figure Q1(B) oscillates with amplitude a. If its starting point from rest is at $+a, -a/2, -a$, find the different values of the phase constant for the solutions $x = a\ cos\ (\omega t - \emptyset)$

c. The coordinates of the displacement of a particle of mass m are given by $x = 2\cos(\omega t)$ and $y = 2\cos(2\omega t + \frac{\pi}{4})$. Construct the Lissagous figures of the combined motion.

(25 Marks)

02. a. The equation $m\ddot{x} + kx + b\dot{x} = 0$ discribes the motion of a damped oscillator. Give the under-damped state solution for the displacement.

b. Obtain an expression for the logarithmic decrement of the amplitude.

c. A weight of mass 0.1kg is attached to the lower end of a helical spring and upper end is fixed to a rigid support. The period of small vertical oscillations of the weight is found to be 1 s. Calculate the magnitude of the damping resistance which would be necessary to cause the amplitude of the oscillations to fall by 10% per complete cycle.

(25 Marks)

03. a. i. Give the "Principle of superposition of waves".

ii. Assume that two waves with equal angular frequency (ω) and different amplitudes (a_1, a_2), travel in the same direction. Use the above principle to obtain the resultant wave of those waves.

iii. Obtain an expression for the amplitude of the resultant wave and hence the intensity.

iv. What are the maximum and minimum intensities for the waves have the same amplitudes ?

b. Explain the following.

i. Concept of optical path

ii. Coherent light sources

iii. Interference of light waves

iv. Diffraction grating

(25 Marks)

04. a. Explain the term diffraction and give the differences between Fraunhofer's and Fresnel's diffraction.

b. Obtain an expression for the intensity of the diffraction pattern formed due to Fraunhofer's diffraction by a double slit.

c. Obtain the condition for getting diffraction minima.

(25 Marks)