

PHYS205 Assignment 7

Due Monday 7th May 2018 5 pm to the PHYS205 assignment Dropbox

Question 1 [7 marks]

A lightly damped oscillator is set in motion with initial conditions of zero displacement and speed V at time $t = 0$. Show that the subsequent motion is given by:

$$x(t) = \frac{V}{\omega_d} e^{-\frac{\gamma}{2}t} \sin \omega_d t$$

Question 2 [6 marks]

A 5.0 mH inductor is connected in series to a charged capacitor and a switch. It is found that after the switch is closed the circuit oscillates at a frequency of 1 kHz but that an oscilloscope show that 0.1 seconds after the switch was closed the amplitude of the current has fallen by 7% of its initial value.

- What is the value of the capacitor?
- What is the value of the total resistance in the circuit?

Question 3 [7 marks]

The general solution for the time dependence of the displacement from equilibrium of a heavily damped oscillator is:

$$x(t) = C_1 e^{-\beta_1 t} + C_2 e^{-\beta_2 t}$$

Determine the coefficients C_1 and C_2 when the system is displaced a distance D from its equilibrium position and the timing is started as the system is projected with speed v in the direction towards the equilibrium position.

[Total Marks: 20]