PHYS205 Assignment 8
Due Monday 14th May 2018 5 pm to the PHYS205 assignment Dropbox 5th floor West (chem side)

Question 1

Consider the general solution for the displacement of a heavily damped oscillator. Mathematically, what restriction can be placed on the coefficients C_1 and C_2 (or some combination of them) in order that the displacement of the oscillator changes sign at some (positive) time.

[6 marks]

Question 2
An object of mass 0.2 kg is hung from a spring whose spring constant is 80 Nm^{-1}. The body is subject to a resistive force of $-bv$ where v is its velocity in ms^{-1} and b = 1 $Nm^{-1}s$.

(a) If the mass is initially displaced and allowed to move freely, show that it will oscillate about its equilibrium position.
(b) What is the period of these oscillations?
(c) What is the Q value of the system?
(d) The top of the spring is now subject to a driving force, $F(t) = F_0 \sin \omega t$ where F_0 = 2N and $\omega = 30\,s^{-1}$. In the steady state (after any initial transients have decayed away) what is the amplitude of the oscillation of the mass?
(e) How much power is being supplied by the driving force to maintain this oscillation?
(f) What would this amplitude of oscillation and the dissipated power be if the driving frequency was the same as the resonant frequency?
(g) If the driving frequency could be changed to any arbitrary value, sketch a graph of how the amplitude of oscillation depends on the angular driving frequency. Mark on your graph the frequencies at which the half maximum power is being delivered.

[14 marks]

[Total Marks: 20]