EE417 Name: _____

Fall 2006

Supplementary Chapter 1 Problems

DUE at the start of class on Friday 22 September

(1) The drive element of a dynamic speaker is described by the following parameters:

mass (voice coil, cap, cone) (m): 10 grams
stiffness (s): 1750 N/m
damping (R_m): 0.9 N·s/m

(a) Find the damped natural frequency (ω_d), the decay time constant (τ) and the mechanical resonant frequency (ω_0).

(b) Determine and sketch a plot of the mechanical impedance magnitude $Z_m = \sqrt{R_m^2 + X_m^2}$ for an interesting range of frequency.

(2) A simple mechanical oscillator (i.e., negligible damping) has mass=0.5 kg. If the mass is displaced from its equilibrium position by 5 cm, the force required to hold it there is found to be 26 N.

The mass is released from its 5cm displacement, and triggers a clock when it passes the equilibrium position. In other words, the mass is at x=0 when t=0, but its velocity is *not* zero at t=0.

(a) Find the natural oscillation frequency in Hz (f_0), for the resulting oscillation.

(b) Find the mechanical stiffness (s) of the system.

(c) Find the velocity (u_0) at t=0.

(d) Find the mathematical expression for the displacement, $x(t)$, for $t \geq 0$.