PHY 3221 : Intermediate Mechanics, Spring 2002

February 15^{th}, 2002

Assignment # 6

(due Friday February 22^{nd}, 2002, at the beginning of class)

1. Problem 3.2 of Marion and Thornton's book.

2. The total mechanical energy of a damped oscillator decreases with time. For the case of an underdamped oscillator:

(a) Derive the expression for the energy ($E = T + U$) and the energy loss (dE/dt) and show that dE/dt is proportional to the square of the velocity (*Hint*: using the equation of motion of the damped oscillator can be very helpful for the last part).

(b) Using *Maple*, show $U(t)$, $T(t)$, and $E(t)$ on the same plot, and dE/dt on a separate plot. Make sure that you can reproduce Fig. 3-7 in your book. Explain why you you can see from your plots that $dE/dt \propto v^2$.

3. Problem 3.13 of Marion and Thornton's book.

4. Problem 3.12 of Marion and Thornton's book.

5. Consider a damped harmonic oscillator with $m = 0.05\,Kg$ and $k = 5\,N/m$. Find its motion and graph it using the initial conditions $x_0 = 0.01$ and $v_0 = 0$, for the following three values of the damping constant (remember that the damping parameter is $\beta = \frac{b}{2\,m}$):

(a) $b = 0.1$,

(b) $b = 1.0$,

(c) $b = 5.0$,

6. For graduates (bonus for undergraduates)
Problem 3.10 of Marion and Thornton's book (*Hint*: assume the limit of large n).