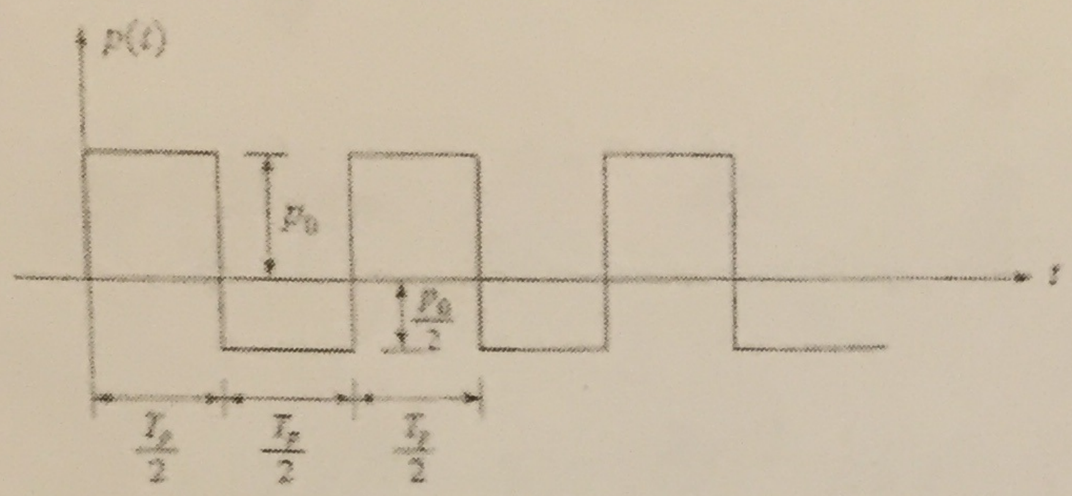
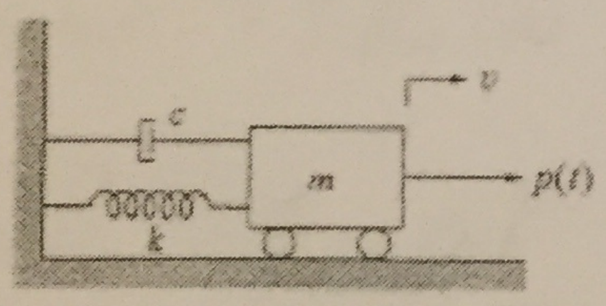
EM 633
H.W #4

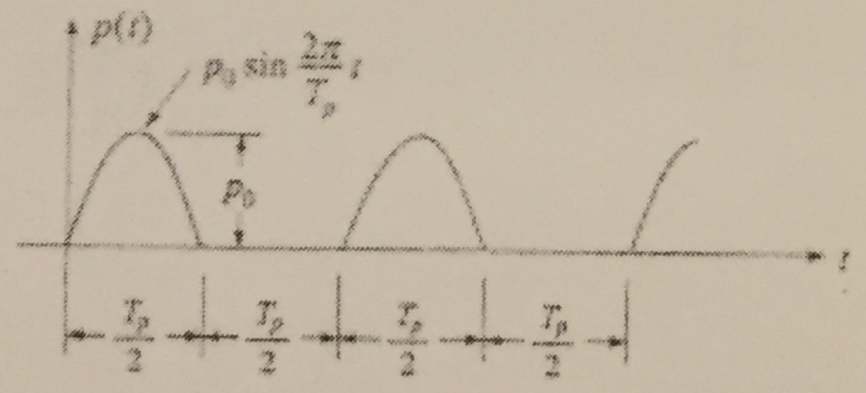
1. Express the periodic loading shown below in a Fourier series.



2. Consider the periodic loading shown below. Calculate the steady-state response assuming that the structure is 10% critically damped.



(a)



(b)

$$a_0 = \frac{1}{T_p} \int_0^{T_p/2} p_0 \sin \frac{2\pi t}{T_p}\, dt = \frac{p_0}{\pi}$$

$$a_n = \frac{2}{T_p} \int_0^{T_p/2} p_0 \sin \frac{2\pi t}{T_p} \cos \frac{2\pi n t}{T_p}\, dt = \begin{cases} 0 & n \quad \text{odd} \\ \frac{p_0}{\pi}\left[\frac{2}{1-n^2}\right] & n \quad \text{even} \end{cases}$$

$$b_n = \frac{2}{T_p} \int_0^{T_p/2} p_0 \sin \frac{2\pi t}{T_p} \sin \frac{2\pi n t}{T_p}\, dt = \begin{cases} \frac{p_0}{2} & n = 1 \\ 0 & n > 1 \end{cases}$$

$$p(t) = \frac{p_0}{\pi}\left(1 + \frac{\pi}{2} \sin \varpi_1 t - \frac{2}{3} \cos 2\varpi_1 t - \frac{2}{15} \cos 4\varpi_1 t - \frac{2}{35} \cos 6\varpi_1 t + \cdots\right)$$