

PHYS 306 Spring 2010
Wave Motion and Electromagnetic Radiation

Homework Assignment

HW#2

Assignment Date: Feb. 2, 2010

Due Date: Feb. 09, 2010

1. (Adopted from Problem 8.1 in Ghatak book). Consider a periodic force of the form:

$$F(t) = \begin{cases} F_0 \sin \omega t & \text{for } 0 < t < T/2 \\ 0 & \text{for } T/2 < t < T \end{cases}$$

and

$$F(t + T) = F(t)$$

where

$$\omega = 2\pi/T$$

(1) Show that

$$F(t) = \frac{1}{\pi} F_0 + \frac{1}{2} F_0 \sin \omega t - \frac{2}{\pi} F_0 \left(\frac{1}{3} \cos 2\omega t + \frac{1}{15} \cos 4\omega t + \dots \right)$$

(2) Plot the Fourier series in (1) for the summation of the components up to $n=5$.

Note: For the plotting, you may use your favorite software, whatever it is. One simple option is to use the online grapher at http://www.walterzorn.com/grapher/grapher_e.htm. You may use the screenshot to save the plot. Please print the plot and attach to the homework.

2. (Adopted from Example 8.2 in Ghatak book, P. 113, but there is a minor difference)

Consider the following periodic function

$$f(t) = \begin{cases} +A & \text{for } -\frac{T}{2} < t < 0 \\ -A & \text{for } 0 < t < \frac{T}{2} \end{cases}$$

and

$$f(t + T) = f(t)$$

(1) Derive the Fourier series for this periodic function

(2) Plot the derived Fourier series for the summation of the components up to $n=5$