KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
COLLEGE OF COMPUTER SCIENCES & ENGINEERING
COMPUTER ENGINEERING DEPARTMENT
COE-341 – Data and Computer Communication
Matlab Programming Assignment #1: Fourier Series Expansion & Filtering – Due Date March 31st, 2009 – In Class.

Consider the <u>full-wave rectified cosine function</u> shown in Appendix A (page 838) of textbook. For the given periodic signal do the following:

a) Write a mathematical representation for s(t) and derive the Fourier Series Expansion (FSE) for the periodic signal?

b) Write a Matlab code to evaluate s(t) and s_e(n=k) for any k =0, 1, …, ∞. Use the code to plot the original s(t) and also the s_e(n=0), s_e(n=1), s_e(n=2) all on the same plot. Use different line styles and colors (as in class notes) for each curve of the plot and identify the individual curves using the "legend" command of Matlab. The code should be general and takes the values of T, A, and k as inputs. Add the proper labels (x and y) as well.

c) Develop an expression for the power spectral density function for s(t).

d) Extend the Matlab code done for (b) to evaluate the PSD function for s(t) as well. On a separate figure plot the PSD function for some large k.

e) Extend the Matlab code done for (d) to generate a plot whose x-axis is k = 0, 1, 2, …, ∞, while the y-axis is the power for the signal represented by s_e(n=k). Find n* such that s_e(n*) contains at least 95% of the total power for s(t).

For the derivation work in parts (a) and (c), you must show all required steps.

The developed Matlab code should be very organized and well documented. Use variable names identical or very close to the mathematical variable used in this problem statement. The documentation should clearly specify the sections of the code that correspond to each part of this programming assignment.

Students are encouraged to cooperatively discuss the problem and the Matlab know-how, however, when it comes to writing the code, each student must write and submit his own code. The submitted codes will be inspected for similarities.