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 27th, 2010 – In Class.

 [100 points] Consider the underlined periodic signal $s(t)$ shown in figure below. The corresponding Fourier series expansion and power spectral density function (PSD(f)) are computed as part of Assignment #1 (Problem 3).

a) **[35 points]** Write a Matlab code to evaluate $s(t)$ and $s\_e(n = k)$ for any $k = 1, …, \infty$. The code prompts the user to enter a specific value for k. The code should plot the original $s(t)$ and also the $s\_e(n = k)$ on the same plot. Use different line styles and colors (as in class notes) for each of the two curves 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.

b) **[30 points]** Using the expressions for the total power of $s(t)$ and power of $s\_e(n = k)$, the code should print out the total power of $s(t)$ as computed from the original expression of s(t), the total power as computed from the developed $s\_e(n=k)$, and the percentage of the latter relative to the former quantity. You should observe that the percentage approaches 100% as k increases.

c) **[35 points]** 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 the specified k. Utilize the "stem" Matlab command for plotting and label your axes properly.

For the derivation work in parts (a) and (b), you must show all required steps. These should be copied from Assignment #1 (Problem 3). This work will be included before the plots (a) and (c) and program output required in (b).

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.

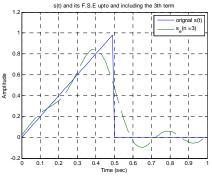Student must show the outputs for values of $k = 1, 3, 5, 10,$ and 20.

Generate the required output and import them into a Microsoft word file (see the sample below). Zip the word file together with the Matlab code and submit the zipped file by email to: g200802800@kfupm.edu.sa (Our TA Eng. Irfan Khan) and ashraf@kfupm.edu.sa (The instructor). The name of the zipped file should be according to the following pattern: `sXXXXXX_LastName_FirstName_ProgAssig1.zip.` s$XXXXXX$ is the student number.

To import figures into your word document, go to the Matlab figure Edit menu and select "copy figure". Paste (special) the figure into the word file as "Picture (Enhanced Metafile)". Please do not paste as any other format.
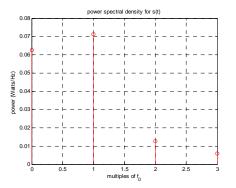
Students must ALSO submit a hardcopy of the programming assignment solution and the used Matlab code.

Below is a sample of the plots and code output for *k* = 3:

```
>> ProgAssign_1


Enter value for k = 3
Total power in s(t) =    0.167 Watts
Total in s_e(n =  3) =    0.152 (or 91.3%)
>>
```


Plot for *s*(*t*) and *s_e*(*n*=3) for one period.

PSD plot for *s*(*t*) using *k* = 3.