ELCT 222 Final Project

## Due: 11:59pm 11/22/16

Objective:

To become familiar with creating and analyzing signal in Matlab.

Requirements:

- **Each student works independently to solve the problem.**

- **Submit a report with the following items**

    o **Matlab code, with comments**

    o **Analysis and conclusion of the results**

- **Attach your Matlab code with report**

- **Grade is based on Matlab code (50%), and report with analysis and result (50%)**

Problem 1:

The square waveform periodic signal is shown below:
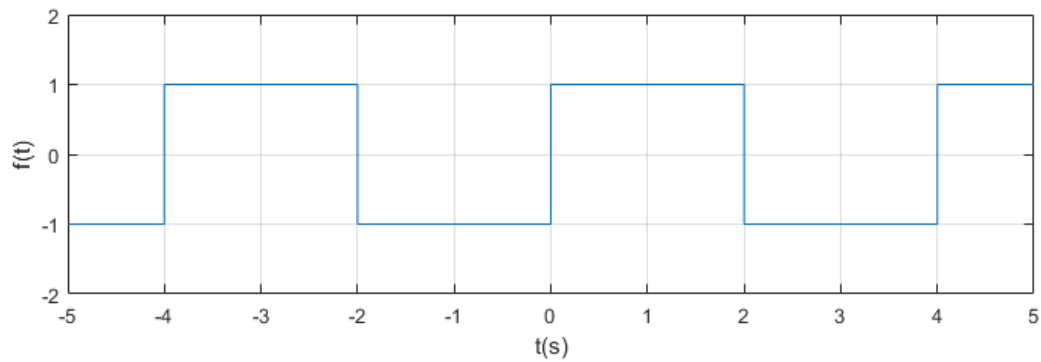
a. Derive the Fourier series for this periodic signal f(t)

b. Write a Matlab script code, compare the square wave with

- the first 3 harmonics summation $\sum_{k=-3}^{3} a_k e^{jk\omega_0 t}$,

- the first 10 harmonics summation $\sum_{k=-10}^{10} a_k e^{jk\omega_0 t}$,

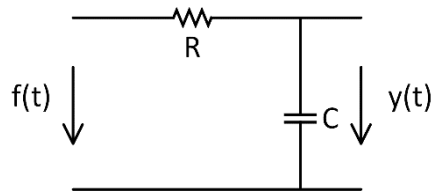- and the first 100 harmonics summation $\sum_{k=-100}^{100} a_k e^{jk\omega_0 t}$

Hint:

The commands may be used: square, linspace, exp, zeros, plot, subplot

Problem 2,

A RC circuit shown below works as a 1st-order low pass filter, in which R = 100 ohm, and C = 1mF. The input voltage signal is f(t), and the output voltage signal is y(t).

For an input signal

$$f(t) = \cos(5t) + \cos(100t)$$

a. Derive the system frequency response $H(j\omega)$.

b. Write a Matlab code, plot the magnitude and phase response of the low pass filter circuit, from $\omega = 0$ to $\omega = 100$.

c. Plot and compare the input f(t) and output signal y(t) in Matlab.

d. Plot the signal cos(5t) and y(t) at the same figure together, briefly analyze the low pass filter performance for the input signal f(t).

Hint:

The commands may be used: abs, angle, cos