EE 321  Homework 11  Due Friday, April 26
(No late homework submissions accepted)
Consider the periodic signal, \( x(t) \), shown below.

\[
\begin{array}{cccccccc}
-5 & -4 & -3 & -2 & -1 & 0 & 1 & 2 & 3 & 4 & 5 & 6 \\
\hline
5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 \\
\end{array}
\]

\( t, \text{ ms} \)

a) Find the period, \( T = \)

b) Find the fundamental frequency, \( \omega_0 = \)

c) Find the sine/cosine Fourier series

d) Find the power in \( x(t) \).

e) Find the percentage power in the 1st harmonic. In the 2nd harmonic.

f) Find the smallest integer \( N \) such that the truncated Fourier series \( x(t) = a_0 + \sum_{n=1}^{N} a_n \cos(n\omega_0 t) + b_n \sin(n\omega_0 t) \) has normalized MSE of no more than

i) 10%,

ii) 5%,

iii) 1%.

g) The signal \( x(t) \) is a voltage applied as input to the circuit below.

\[
\begin{array}{c}
V(t) \\
\hline
-5000 \text{ V} \\
\hline
V(t) \\
\hline
+ \\
C \\
\hline
y(t) \\
\hline
\text{1 mF} \\
\hline
\end{array}
\]

i) Find an expression for the Fourier series for \( y(t) \).

ii) What percent of the power in the 1st harmonic of \( x(t) \) is in the 1st harmonic of \( y(t) \)?