ECE 3337 Summer-3, 2016 Hebert, Homework 4 Due 6/21

Problem 1. Problem 3-3(a,c,d) in your book Signal & Systems - Ziemer

3-3. The uniqueness of the Fourier series means that if we can somehow find the Fourier series of a waveform, we are assured that there is no other waveform with that Fourier series, except for waveforms differing from the waveform under consideration only over an inconsequential set of values of the independent variable (this is referred to in mathematics as a set of measure zero). With this assistance, find the following trigonometric Fourier series of the signals without doing any integration:

(a) $x_1(t) = \cos^2(100\pi t)$;
(b) $x_2(t) = \exp(j200\pi t)$;
(c) $x_3(t) = \sin(2\pi t)\cos^2(10\pi t)$;
(d) $x_4(t) = \cos^3(20\pi t)\,[1 - \sin^2(10\pi t)]$

Problem 2.
Problem 3-4.
in your book
Signal & Systems - Ziemer

3-4. Obtain the trigonometric Fourier series of the square wave

$$x(t) = \begin{cases} A, & \dfrac{-T_0}{4} < t \le \dfrac{T_0}{4} \\ -A, & \dfrac{-T_0}{2} < t \le \dfrac{-T_0}{4} \quad \text{and} \quad \dfrac{T_0}{4} < t \le \dfrac{T_0}{2} \end{cases}$$

with $x(t) = x(t + T_0)$, all t. Why is it composed of only cosine terms?

Problem 3.
Find the sin-cos form
of the Fourier series of the
waveform in Figure P3-17 (d)
on page 146 of Ziemer.
Use an amplitude of A.

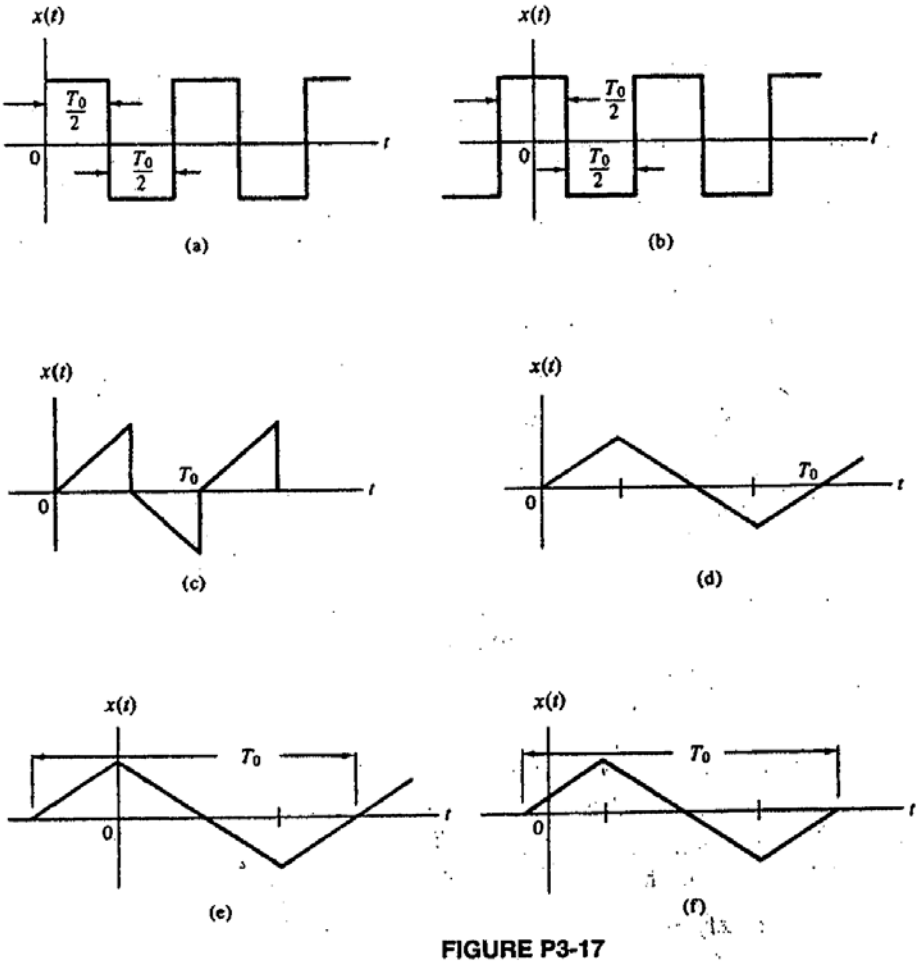

FIGURE P3-17

Problem 4. Find the sin-cos form of the Fourier series of the waveform in Figure P3-18 on page 147 of Ziemer.

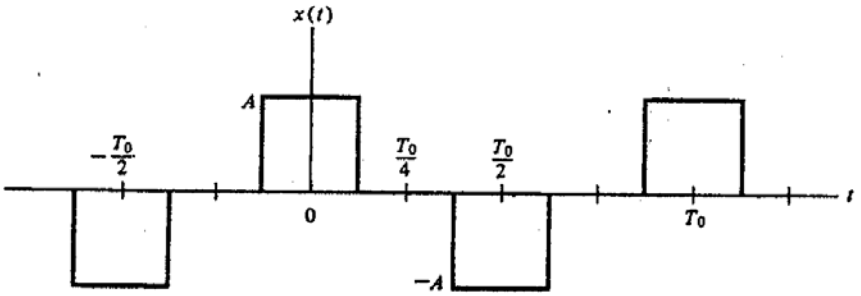

FIGURE P3-18

Problem 5.
Plot five different $f(t)$'s over the region $-4 < t < +4$ if it is known that $f(t)$ is periodic with period T=8 and the additional information is provided in 5 different cases (a)-(e) below.

(a) $T = 2$, *for* $0 \le t \le 1$, $f(t) = 1 - t$, and $f(t)$ has even symmetry.

(b) $T = 2$, *for* $0 \le t \le 1$, $f(t) = 1 - t$, and $f(t)$ has odd symmetry.

(c) $T = 2$, *for* $0 \le t \le 1$, $f(t) = 1 - t$, and $f(t)$ has half-wave symmetry (neither even nor odd).

(d) $T = 4$, *for* $0 \le t \le 1$, $f(t) = 1 - t$, and $f(t)$ has quarter-wave even symmetry.

(e) $T = 4$, *for* $0 \le t \le 1$, $f(t) = 1 - t$, and $f(t)$ has quarter-wave odd symmetry.

Problem 6.
Plot $f(t)$ for $-8 < t < +8$ for the periodic function listed below based upon the information provided.
$T = 8$, *for* $2 \le t \le 4$ $f(t) = 4(t-3)^2$, and $f(t)$ has quarter-wave even symmetry.