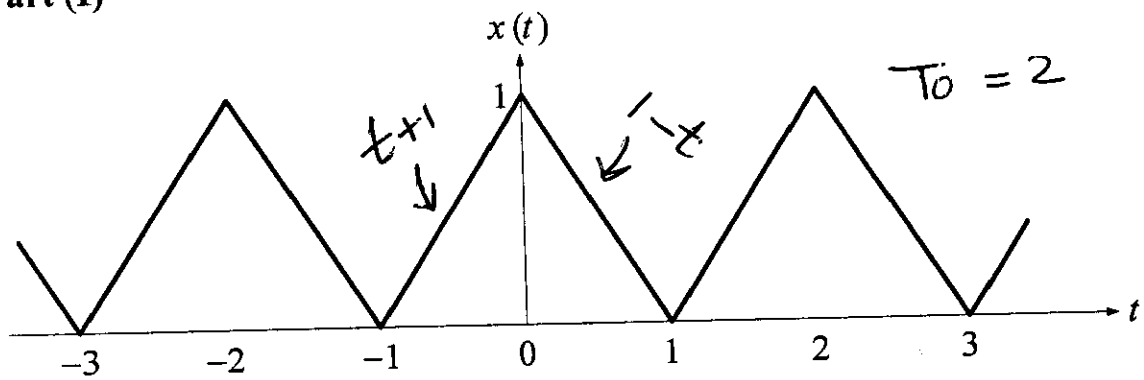
EE 207-03 – Winter 2012(112)
Quiz 3

SER	ID	NAME

Part (I)



For the periodical signal shown above , find the complex Fourier coefficients . DO NOT EVALUATE the integral

Part (II)

For the periodical signal $f(t)$ given below

$$f(t)=10+14\cos(10\pi t)+20\sin(20\pi t)$$

Find Complex Fourier coefficients ?

Part (I)

$$C_0 = \frac{1}{T_0}\int_{T_0} x(t)dt = \frac{1}{2}\,(\text{Area of Triangle})$$

$$= \frac{1}{2}\,\frac{(2)(1)}{2} = \frac{1}{2}$$

$$C_n = \frac{1}{T_0}\int_{T_0} x(t)\,e^{-jn\omega_0 t}dt = \frac{1}{2}\left[\int_{-1}^{0}(t+1)\,e^{-jn\frac{2\pi}{2}t}dt + \int_{0}^{1}(1-t)\,e^{-jn\frac{2\pi}{2}t}dt\right]$$

$$= \frac{1}{2}\left[\int_{-1}^{0} t\,e^{-jn\pi t}dt + \int_{-1}^{0} e^{-jn\pi t}dt + \int_{0}^{1} e^{-jn\pi t}dt - \int_{0}^{1} t\,e^{-jn\pi t}dt\right]$$

$$C_n = \frac{1}{2}\left[\int_{-1}^{0} t\, e^{-jn\pi t}\, dt + \int_{-1}^{1} e^{-jn\pi t}\, dt - \int_{0}^{1} t\, e^{-jn\pi t}\, dt\right]$$

Part (II) Since $\cos\alpha = \frac{e^{j\alpha} + e^{-j\alpha}}{2}$

$$\sin\alpha = \frac{e^{j\alpha} - e^{-j\alpha}}{j2}$$

$$\Rightarrow f(t) = 10 + 7\left[e^{j10\pi t} + e^{-j10\pi t}\right] + \frac{10}{j}\left[e^{j20\pi t} - e^{-j20\pi t}\right]$$

$$= \underbrace{10j}_{C_{-2}}\, e^{-j20\pi t} + \underbrace{7}_{C_{-1}}\, e^{-j10\pi t} + \underbrace{10}_{C_0} + \underbrace{7}_{C_1} e^{j10\pi t} + \underbrace{-10j}_{C_2} e^{j20\pi t}$$

$\Rightarrow$ The Complex Fourier coefficients for f(t) are

$$C_0 = 10$$
$$C_1 = 7$$
$$C_{-1} = 7$$
$$C_2 = -j10$$
$$C_{-2} = j10$$
$$C_n = 0 \quad \forall\ n > 2 \qquad n < -2$$