

April 9, 2003  
 Midterm Exam II  
 EE 3302: Signals and Systems

NOTE: Please, complete the following table and keep record of your assignment number.

First Name	
Last Name	
Student ID	
Assignment #	0

**Exercise 1.** Consider the periodic signal  $x(t) = \sin(\omega_0 t)\cos(\omega_0 t)$ , where  $\omega_0$  is a positive constant.

A) Determine the fundamental period of  $x(t)$  and the coefficients of the Fourier series of  $x(t)$  [pt. 15].

**Exercise 2.** Consider the periodic signal shown in Fig. 1.

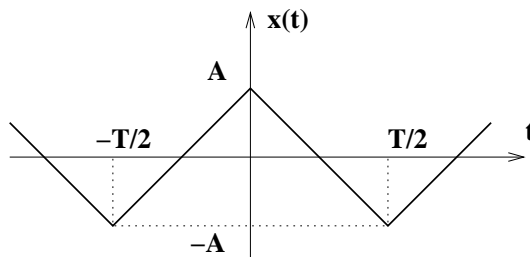


Figure 1: Periodic signal  $x(t)$ .

A) Determine the fundamental period of  $x(t)$  and the coefficients of the Fourier series of  $x(t)$  [pt. 15].

**Exercise 3.** Consider the continuous-time signal

$$x(t) = u(t - t_0) \cdot e^{j\omega_0 t}$$

where  $u(t)$  is the unit step function,  $\omega_0$  and  $t_0$  are real constants, and their product  $\omega_0 t_0 = \pi$ .

A) Evaluate the Fourier Transform of  $x(t)$  [pt. 15].

**Exercise 4.** Consider signal  $x(t)$  shown in Fig. 2.

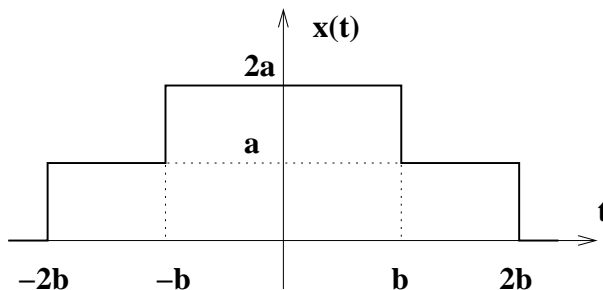


Figure 2: Signal  $x(t)$ .

A) Evaluate the Fourier Transform of  $x(t)$  [pt. 15].

**Exercise 5.** A continuous-time signal  $x(t)$  has the following spectrum

$$X(j\omega) = j\delta(\omega - 1) + j\delta(\omega - 3) + j\delta(\omega) - j\delta(\omega + 1) - j\delta(\omega + 3).$$

A) Evaluate  $x(t)$  [pt. 10].

**Exercise 6.** Let  $X(j\omega)$  be the Fourier Transform of

$$x(t) = \frac{b}{t^2 + b}$$

where  $b$  is a positive real value.

A) Calculate

$$\int_{-\infty}^{+\infty} \omega X(j\omega) d\omega$$

[pt. 15].

**Exercise 7.** An impulse signal  $\delta(t)$  is sent to the input of a system whose frequency response is

$$H(j\omega) = \begin{cases} |\omega| & |\omega| < 1 \\ 0 & \text{otherwise} \end{cases}$$

A) Calculate the energy of the output signal [pt. 15].