Electrical Engineering and Computer Science
Syracuse University

Homework #1, Solutions

1. L&D Exercise 2.1-1

(1) $\phi(t)$ is a periodical signal with period π. The average power can be computed only over one period as follows.

$$P_g = \frac{1}{\pi}\int_0^{\pi}\left(e^{-t/2}\right)^2 dt = \frac{1}{\pi}\int_0^{\pi} e^{-t}dt = \frac{1-e^{-\pi}}{\pi}.$$

(2) $W_0(t)$ is also a periodic signal with period T_0.

$$P_g = \frac{1}{T_0}\int_0^{T_0} w_0(t)^2 dt = \frac{1}{T_0}\int_0^{T_0} 1dt = 1$$

2. L&D Exercise 2.4-3

(a)

$$\int_{-\infty}^{\infty} g(\tau+a)\delta(t-\tau)d\tau = g(t+a)\int_{-\infty}^{\infty}\delta(t-\tau)d\tau = g(t+a)$$

(b)

$$\int_{-\infty}^{\infty}\delta(\tau)g(t-\tau)d\tau = g(t)\int_{-\infty}^{\infty}\delta(\tau)d\tau = g(t)$$

(c)

$$\int_{-\infty}^{\infty}\delta(t)e^{-jwt}dt = 1$$

(d)

$$\int_{-\infty}^{1}\delta(t-2)sin\pi t dt = 0$$

(e)

$$\int_{-2}^{\infty}\delta(t+3)e^{-t}dt = 0$$

(f)

$$\int_{-2}^{2}(t^3+4)\delta(1-t)dt = 5$$

(g)

$$\int_{-\infty}^{\infty} g(2-t)\delta(3-t)dt = g(-1)$$

(h)

$$\int_{-\infty}^{\infty} cos\frac{\pi}{2}(x-5)\delta(2x-3)dx \overset{t=2x}{=} \int_{-\infty}^{\infty} cos\frac{\pi}{4}(t-10)\delta(t-3)\frac{dt}{2} = \frac{1}{2}\cos\frac{7\pi}{4} = \frac{1}{2}\cos(\frac{\pi}{4})$$