

EECS 361
Homework #9

1. Section 4.8 Participation Activities

- 4.8.1: Time scaling property of the Fourier transform.
- 4.8.2: Fourier transform time scaling.
- 4.8.3: Fourier transforms of shifted impulse functions.
- 4.8.4: Time shift property of the Fourier transform, and phase.
- 4.8.6: Fourier transform pairs.
- 4.8.7: Fourier transforms of step functions and exponentials.
- 4.8.8: Deriving the Fourier transform modulation property, using the frequency-shift property.
- 4.8.9: Fourier transform properties: derivative, modulation, and convolution.
- 4.8.10: Reviewing Fourier transform properties.

2. Find the Fourier transform of:

- a. $\frac{5}{\pi} \cos(2\pi 5000t)$
- b. $\frac{5}{\pi} \cos(2\pi 5000t + \frac{\pi}{4})$
- c. $e^{-0.25t} \cos(2.5t) u(t)$
- d. $\frac{5}{\pi} \cos(2\pi 50000t) + \frac{2.5}{\pi} \cos(2\pi 5000t) \cos(2\pi 50000t)$

3. Find the Fourier Transform of $x(t)g(t)$ where $x(t) = \frac{30}{\pi} \text{sinc}(30t)$ and $g(t) = \frac{40}{\pi} \text{sinc}(40t)$.

4. Section 4.9 Participation Activities

- 4.9.1: Time-domain energy computations for non-periodic signals.
- 4.9.2: Parseval's theorem and energy spectral density.

5. Find the energy in $y(t)$ where $y(t) = x(t)*h(t)$ and $x(t) = u(t)e^{-0.5t}$ and $h(t) = \frac{2}{\pi} \text{sinc}(2t)$

6. Section 4.12 Participation Activities

- 4.12.1: Fourier circuit analysis.
- 4.12.2: RC circuit analysis via Fourier transform, with exponential input.
- 4.12.3: RC circuit analysis via Fourier transform, for cosine input

7. Find the continuous time Fourier Transform (CTFT) and plot the magnitude of the continuous time Fourier Transform (CTFT) of the following signals:

- a. $10^3 \text{rect}(\frac{t}{\tau})$ for $\tau = 1\text{ms}$ and 10ms
- b. $10^3 \text{tri}(\frac{t}{\tau})$ for $\tau = 1\text{ms}$ and 10ms
- c. $e^{-\frac{\pi t^2}{\tau^2}}$ for $\tau = .2$ and 2
- d. $2000 \text{rect}(t/\tau) \cos(\omega_c t)$ for $\tau = 1\text{ms}$ and $\omega_c = 60\,000$

8. Find the inverse continuous time Fourier Transform of the following signals:

- a. $0.001 \text{sinc}(\frac{0.001\omega}{2})$
- b. $\frac{0.001}{2} (\text{sinc}(\frac{0.001(\omega-\omega_c)}{2}) + \text{sinc}(\frac{0.001(\omega+\omega_c)}{2}))$
- c. $\frac{6}{9+\omega^2}$

9. Find the Fourier transform of $x(t)$ for $\tau = 1.0\text{ms}$ and $T_0 = 4.0\text{ms}$

$$x(t) = \sum_{k=-\infty}^{\infty} \text{rect}\left(\frac{t - kT_0}{\tau}\right)$$

10. If $x(t)$ is real then, the Fourier transform of $x(t)$ is a odd and odd function. True or False.