ECE 45 – Circuits and Systems
Winter 2025

Homework #8
Due: February 27 at 11:59pm, submitted via GradeScope.

You can make multiple upload attempts to experiment with the system and the best way to upload. You must correctly mark the answers to the problems in GradeScope, e.g. problem 1, problem 2, problem 3, to get full credit. Note that you must tag your problems when uploading to GradeScope or they will not be graded and you will not receive credit. Any regrade requests must be placed through GradeScope within one week of the return of the homework.

Remember, discussion of homework questions is encouraged. Please be absolutely sure to submit your own independent homework solution.

1. (70 %) Compute the following Fourier transform or inverse Fourier transform as requested. You may compute these using the integral form or the common transform pairs and properties (but be sure to explain your work).
   (a) $x(t) = 1 - |t|$ for $t \in [0, 1]$ otherwise $x(t) = 0$
   (b) $x(t) = \frac{\sin(3\pi t)}{t}$
   (c) $x(t) = \sum_{n=-\infty}^{\infty} \text{rect}(2t - n)$
   (d) Fourier transform of $x(t)$, which is **periodic** with $T = 10$ signal and first period $t \in [-5, 5)$ given by
   $$x(t) = \text{rect}\,(t - 1) - \text{rect}\,(t + 1)\,. \tag{1}$$
   (e) Inverse Fourier transform of $Y(j\omega) = e^{j\omega^2}\delta(\omega + 1) + e^{-j\omega^2}\delta(\omega - 1) + e^{j\omega/2}\frac{1}{\frac{1}{2}+j\omega}$.
   (f) Inverse Fourier transform of $Q(j\omega) = 2e^{j2\omega}\text{rect}(2\omega)$.
2. (10 %) Find an example of a signal that does not satisfy the Dirichlet sufficient conditions for a Fourier transform to exist, and is not an example in our textbook. Describe the signal and give the details about how you found it (e.g., searched online, used chatGPT with the following prompts, etc but not asking your friend).
3. (20 %) Based on the solutions, correct your previous week's homework using a colored pen (or annotation) so it's obvious what you've corrected. If you got a problem exactly right, just use a red check mark to indicate as such.