ECE 3710: Introduction to Telecommunications
Homework 1
Spring 2026

Instructor: JC Williams

Due: February 26, 2026 at 11:59 PM

Student Name: _____

Instructions: Please complete this homework assignment by hand (or by using a tablet) and submit your solutions as a .PDF file to the dropbox on ILearn by the due date. Late submissions will receive a grade of zero, unless the student provides an excuse from health services.

1. (20 points) Determine if each of the following signals is periodic. If a signal is periodic, determine its period.

   (a) $\sin^2(4t)$

   (b) $e^{(j2\pi t - \frac{\pi}{4})}$

2. (20 points) If $f(t) \leftrightarrow F(\omega)$ and $\omega = 2\pi f$, determine the Fourier Transform of the following functions in terms of $F(\omega)$:

   (a) $f(4t - 8)$

   (b) $f(t)cos(\pi(t - 1))$

3. (20 points) Find the Inverse Fourier Transform of $F(\omega) = 20\frac{\sin(5\omega)}{5\omega}e^{(-j3\omega)}$ and sketch the Inverse Fourier Transform.

4. (20 points) Are the following **Energy Signals**, **Power Signals**, or **Neither**? If **Energy Signals**, calculate their energy. If **Power Signals**, calculate their power.

   (a) $20\sin(16t)\cos(10t)$

   (b) $[8 + 4\cos(6t)]\cos(10t)$

5. (20 points) A certain signal $f(t)$ has the following Power Spectral Density (PSD):

$$S_f(\omega) = \frac{1}{1+\omega^2} + \delta(\omega - 2) + \delta(\omega + 2)$$

Hint: The Power of a signal with spectral density function $S_f(\omega)$ from the frequency a to the frequency b is given as:

$$P = \frac{1}{2\pi}\left\{\int_{-b}^{-a} S_f(\omega)\, d\omega \; + \; \int_{a}^{b} S_f(\omega)\, d\omega\right\}$$

(a) What is the Power of $f(t)$ from the frequency 0.9 to the frequency 1.1 ($\frac{rad}{sec}$)?

(b) What is the Power of $f(t)$ from the frequency 1.9 to the frequency 2.1 ($\frac{rad}{sec}$)?