Fall 2024 EE 313 Linear Systems and Signals Prof. Evans

Homework #9

# Fourier Transforms

Assigned on November 30, 2024, at 1:00 pm

Due on Friday, December 6, 2024, by 11:59 pm via Canvas submission

*Late homework is subject to a penalty of two points per minute late*.

***Reading***: McClellan, Schafer & Yoder, *Signal Processing First*, 2003, Ch. 11

Companion Web site with demos and other supplemental information: <http://dspfirst.gatech.edu/>

Web site contains solutions to selected homework problems from *DSP First*.

Office hours for Prof. Evans follow.

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| ***Time Slot*** | ***Monday*** | ***Tuesday*** | ***Wednesday*** | ***Thursday*** | ***Friday*** |
| 11:00am – 12:30pm |  | Evans (ECJ 1.204) |  | Evans (ECJ 1.204) |  |
| 12:30pm – 2:00pm |  |  |  |  |  |
| 2:00pm – 3:30pm | Evans (EER 6.882; [Zoom](https://utexas.zoom.us/j/96309736592)) |  | Evans (EER 6.882; [Zoom](https://utexas.zoom.us/j/91284174942)) |  |  |
| 3:30pm – 5:00pm |  |  | Evans (EER 6.882; [Zoom](https://utexas.zoom.us/j/91284174942)) |  |  |
| 5:00pm-6:30pm |  |  |  |  |  |
|  |  |  |  |  |  |
| 7:00pm-8:30pm | [Tutoring](http://www.ece.utexas.edu/academics/tutoring) in EER 0.814 |  |  | [Tutoring](http://www.ece.utexas.edu/academics/tutoring) in EER 0.814 |  |
| 8:30pm-10:00pm | [Tutoring](http://www.ece.utexas.edu/academics/tutoring) in EER 0.814 |  |  | [Tutoring](http://www.ece.utexas.edu/academics/tutoring) in EER 0.814 |  |

\*\* Prof. Evans holds coffee/advising hours on Fridays 12:00-2:00pm in the EER café.

1. **Continuous-Time Frequency Response. *31 points*.**

*Signal Processing First*, problem P-10.9, page 305. In addition, for each of the seven filters given, describe the frequency selectivity in the magnitude response as lowpass, highpass, bandpass, bandstop, allpass, or notch.

*Same as Homework Problem 8.3 in Fall 2023.*

1. **Forward Continuous-Time Fourier Transform. *45 points.***

Compute the continuous-time Fourier transform for continuous-time signal using the definition in *Signal Processing First* in equation (11.1)

for the following time-domain signals : *6 points for each.*

1. Rectangular pulse of unit amplitude that lasts from to seconds.
2. for positive and real-valued
3. for positive and real-valued
4. for for positive and real-valued .  
   *Hint: You can reuse results from parts (c) and (d).*

*Signal Processing First* Section 11.4 covers examples (a)-(d). You can check your answers using continuous-time Fourier transform pairs in Table 11-2 of on page 338 in *Signal Processing First.*

In addition, for each part, describe the frequency selectivity of the magnitude response as lowpass, highpass, bandpass, bandstop, allpass, or notch. *3 points for each.*

*Same as Homework Problem 9.1 in Fall 2023.*

1. **Continuous-Time Fourier Transforms Using Transform Properties and Pairs. *24 points.***

*Signal Processing First*, problem P-11.8, page 343. *6 points for each part*.

*Same as Homework Problem 9.2 from Fall 2023.*

As stated on the course descriptor, “Discussion of homework questions is encouraged. Please be sure to submit your own independent homework solution.”