

Olin College of Engineering
ENGR2410 – Signals and Systems

Quiz 5

Instructions

- A. Collaboration is not allowed on quizzes.
- B. Students may only use a page of notes and the tables from the website during the quizzes.
- C. Time is limited to one continuous hour.
- D. Quizzes are due at the beginning of lecture on Thursday.
- E. Late or missed quizzes will be given a score of zero. Any excuses must come directly from the Office of Student Life.
- F. The two lowest quiz scores will be eliminated to allow for unforeseeable circumstances.
- G. In case of doubt, students are expected to base their behavior on the values expressed in the Honor Code.

Name:

Start time:

Problem 1 (*10 points*)

- A. Show the time shift property of the Fourier transform, $\mathcal{F}\{x(t+T)\} = X(j\omega)e^{j\omega T}$ where $\mathcal{F}\{x(t)\} = X(j\omega)$ denotes that $X(j\omega)$ is the Fourier transform of $x(t)$. *Hint: Use the substitution $t' = t + T$.*

- B. A periodic function $x(t)$ has the property $x(t) = x(t + T)$. Show that the Fourier transform of this equation implies that the Fourier transform of $x(t)$ can only have non-zero frequency components at $\omega = \frac{2\pi k}{T}$, where k is any integer. *This closes the loop back to the Fourier series by showing that the frequency content of a period T function only exists in the harmonics of $2\pi/T$.*

C. Show that

$$\cos(\omega_0 t) \quad \xLeftrightarrow{\mathcal{F}} \quad 2\pi \left[\frac{1}{2} \delta(\omega - \omega_0) + \frac{1}{2} \delta(\omega + \omega_0) \right]$$

Hint: Recall that $\cos(\omega t) = \frac{e^{j\omega t} + e^{-j\omega t}}{2}$ and the “picking” property of the impulse, $\int_{-\infty}^{\infty} \delta(x - x_0) f(x) dx = f(x_0)$.

Course feedback

Feel free to send any additional feedback directly to us.

Name (optional):

- A. End time: How long did the quiz take you?
- B. Was the quiz a fair measure of your understanding?
- C. Was the assignment effective preparation for the quiz?
- D. Is the Monday session effective?
- E. Are the connections between lecture, assignment and quiz clear?
- F. Are the objectives of the course clear? Do you feel you are making progress towards those objectives?
- G. Anything else?

Assignment grades

Date:

Assignment number:

Group member 1:

Grade:

Group member 2:

Grade:

Group member 3:

Grade: