

November 12, 2008
Midterm Exam II
EE 3302: Signals and Systems

NOTE: Please, complete the following table and keep record of your assignment number.

First Name	
Last Name	
Student ID	
Assignment #	0

Exercise 1. Consider the periodic signal $x(t) = 2 \cos(\pi t) - j \sin(2\pi t) + 2$.

- A) Determine the fundamental period of $x(t)$ and the value of the coefficients of the Fourier series of $x(t)$ [pt. 15].
- B) Indicate how much power is carried by the first harmonic component, i.e., P_1 , and how much power is carried by the second harmonic component, i.e., P_2 of signal $x(t)$ [pt. 10].

Exercise 2. Consider the continuous-time signal $x(t) = \frac{\sin(20t) - \sin(40t)}{t}$.

- A) Derive, sketch and label carefully the Fourier transform of $x(t)$, i.e., $X(j\omega)$ [pt. 15].
- B) Compute the energy of $x(t)$ [pt. 5].

Exercise 3. A continuous-time signal $x(t)$ has the following spectrum

$$X(j\omega) = \frac{d}{d\omega} \frac{\sin(\omega A)}{\omega}$$

where A is a constant positive real value.

- A) Evaluate $x(t)$ [pt. 15].

Exercise 4. Consider the continuous-time signal $x(t) = \frac{\sin(Bt)}{t}$, which is sent to the input of the ideal pass band filter with frequency response

$$H(j\omega) = \begin{cases} 1 & A < |\omega| < C \\ 0 & \text{otherwise} \end{cases}$$

where $A < B < C$ are constant positive real values. Let $y(t)$ be the signal at the output of the pass band filter.

- A) Calculate the energy of $x(t)$ [pt. 10].
- B) Calculate the energy of $y(t)$ [pt. 15].

Exercise 5. Consider the continuous-time signal $x(t) = e^{j\omega_0 t}$. Signal $x(t)$ is sent to the input of a first LTI system (System 1) with frequency response $H_1(j\omega) = e^{-j\omega A}$. Let A and ω_0 be constant positive real values. Let $y(t)$ be the output signal of System 1. Signal $y(t)$ is then sent to the input of a second LTI system (System 2) with frequency response $H_2(j\omega) = \omega$. Let $z(t)$ be the output signal of System 2.

- A) Derive, sketch and label carefully both $y(t)$ and $z(t)$ [pt. 15].