

Spring 2019 - Exam 2  
ECE 301: Signals and Systems

Prof. Aly El Gamal

Last Name :

First Name :

PUID :

**Instructions.**

- Write your full name, PUID on this page
- This is a 50 minutes exam containing 6 questions, 25 points each. Maximum score is 125.
- Please write clearly and legibly
- Your solutions must include detailed steps and/or explanations. Do not simply state the answer
- Two A-4 sized crib sheets front and back are allowed.
- There should be 7 pages including the cover page.

Question	Points
1	
2	
3	
4	
5	
6	
Total	

## Problem 1

For the following impulse response signals, comment if the corresponding LTI systems are: (1) Invertible (2) Stable (3) Causal. Justify your answers.

a  $h[n] = \delta[n - 1]$

b  $h(t) = u(t)u(t + 1)$

## Problem 2

- a What is Euler's observation on the movement of strings? What was the criticism of his observation?
- b Describe Fourier's discovery on the application of trigonometric signals.

### Problem 3

For parts (a) - (d) below, find the Fourier Series coefficients of the given signals.

a  $x(t) = e^{j2\omega_0 t}$

b  $x(t) = e^{j\omega_0 t}$

c  $x(t) = e^{j2\omega_0 t} + e^{j\omega_0 t}$

d  $x(t) = 1$

## Problem 4

Let  $x[n]$  be a discrete periodic signal with fundamental period  $N$  equal to 20. The discrete Fourier Series coefficients of  $x[n]$  are  $a_k$  as given below.

$$a_k = \begin{cases} 1, & k = 0 \\ 2, & 1 \leq k \leq 9 \\ 0, & 10 \leq k \leq 14 \\ -1, & 15 \leq k \leq 19 \end{cases}$$

Find the following:

a  $\sum_{n=60}^{99} x[n]$

b Average power of the signal.

c  $x[100]$

d  $x[101]$

## Problem 5

Find the Fourier Transform of the following signals.

- a Even $\{\cos(t)\}$
- b Odd $\{\cos(t)\}$
- c Even $\{\sin(t)\}$
- d Odd $\{\sin(t)\}$
- e  $x(t)$  in Figure 1.

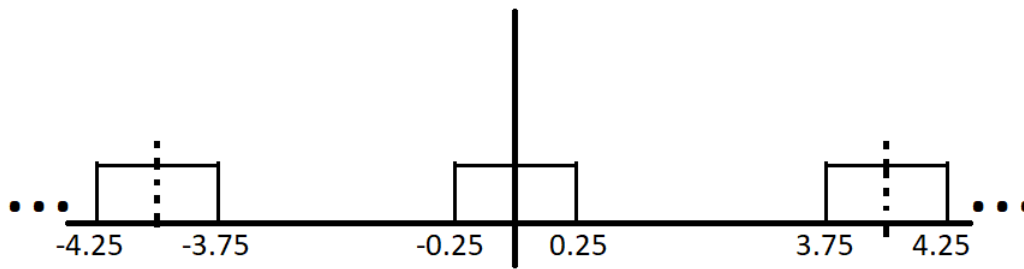


Figure 1:  $x(t)$

## Problem 6

Find the Fourier Transform of the following signals.

a  $e^{-2t}u(t)$

b  $e^{-2|t|}$

c  $e^{-3|t|} + e^{-4t}u(t)$

d  $x(t)$  in Figure 2.

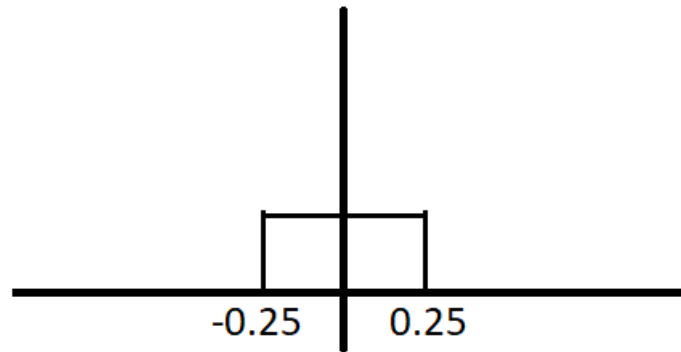


Figure 2:  $x(t)$