Philadelphia University

Faculty of Engineering

Student Name:
Student Number:
Serial Number:

First Exam, First Semester: 2019/2020
Dept. of Communication & Electronics Engineering

Course Title:	Signals and Systems	**Date:**	17/11/2019
Course No:	650320+640543	**Time Allowed:**	50 minutes
Lecturer:	Dr. Qadri Hamarsheh	**No. Of Pages:**	4

Instructions:
- **ALLOWED**: pens, calculators and drawing tools (**no red color**).
- **NOT ALLOWED**: Papers, literatures. Otherwise, it will lead to the non-approval of your examination.
- **Shut down** Telephones, and other communication devices.

Please note:
- *This exam paper contains 5 questions totaling 20 marks*
- *All solutions together with solution methods must be inserted in the labelled position on the solution sheets.*

Basic Notions: *The aim of the questions in this part is to evaluate the required minimal student knowledge and skills. Answers in the pass category represent the minimum understanding of basic concepts: continuous and discrete signal, LTI systems, their classifications, properties and manipulation with signals using matlab.*

Question1 **Multiple choices (circle the most appropriate one):** ***(5 marks)***

1) The **unit step** function is related to the **unit impulse** function via which of the following relationships

a) $u(t) = \int_{-\infty}^{t} \delta(\tau)d\tau$

b) $u(t) = \int_{0}^{t} \delta(\tau)d\tau$

c) $u(t) = \int_{t}^{\infty} \delta(\tau)d\tau$

d) $u(t) = \sum_{0}^{\infty} \delta(t-n)$

2) If you evaluate $\int_{-\infty}^{\infty} (t-1)\delta(t-5)dt$ you get

a) 0
b) 5
c) 4
d) $t-5$

3) The system is **linear**, if it is both

a) **Additive and commutative**
b) **Additive and associative**
c) **Additive and distributive**
d) **Additive and homogeneous**

4) The system $y(t) = x(t)\cosh(t)$ is

a) **BIBO stable**
b) **Only memoryless**
c) **Memoryless and causal**
d) **Causal and BIBO stable**

5) Which of the following systems is **time invariant**?

a) $y(t) = x(t) + x(t-1)$
b) $y(t) = x(t) + x(1-t)$
c) $y(t) = -x(t) + x(1-t)$
d) $y(t) = x(2t) + x(t)$

***Familiar and unfamiliar Problems Solving**: The aim of the questions in this part is to evaluate that the student has some basic knowledge of the key aspects of the lecture material and can attempt to solve familiar and unfamiliar problems of continuous and discrete signal, LTI systems, their classifications, properties.*

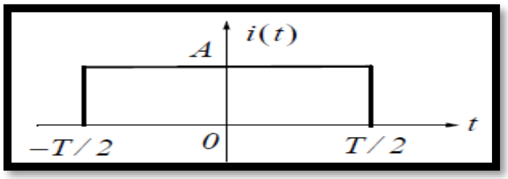
Question 2 **(4 marks)**

What are the operations performed on a signal?

Solution

<u>Question 3</u> ***(5 marks))***

a) Express the **symmetric rectangular pulse** of the following figure as a sum of **unit step** functions. (*1 mark)*



Solution

b) Write the equations of $N-$point non-causal Moving Average **(MA)** and Exponentially Weighted Moving Average **(EWMA)** filters ***(2 marks)***

Solution

c) For the following signal $\boldsymbol{x}[\boldsymbol{n}]$, **Plot** $\boldsymbol{x}[\boldsymbol{n}]$ and $\boldsymbol{x}[-\boldsymbol{n}+\mathbf{2}]$. ***(2 marks)***

$$\boldsymbol{x}[\boldsymbol{n}] = -\boldsymbol{\delta}[\boldsymbol{n}+\mathbf{2}] - \mathbf{2}\boldsymbol{\delta}[\boldsymbol{n}+\mathbf{1}] - \mathbf{3}\boldsymbol{\delta}[\boldsymbol{n}] - \mathbf{1.5}\boldsymbol{\delta}[\boldsymbol{n}-\mathbf{1}] + \boldsymbol{\delta}[\boldsymbol{n}-\mathbf{2}] + \mathbf{2}\boldsymbol{\delta}[\boldsymbol{n}-\mathbf{3}] + \mathbf{0.5}\boldsymbol{\delta}[\boldsymbol{n}-\mathbf{4}]$$

Solution

Question 4 ***(2 marks)***

The system that follows have input $x[n]$ and output $y[n]$. Determine whether it is memoryless, stable, causal and linear

$$y[n] = \sum_{k=-\infty}^{n} x[k+2]$$

Solution

Question 5 ***(4 marks)***

Generate and sketch in the same figure each of the following signals using MATLAB. Do not use the "for" loops in your code. In each case, the horizontal axis used to sketch the signals should extend only for the range over which the two signals are defined.

a) $x_1(t) = 5\sin(2\pi t)\cos(\pi t - 8) \qquad for\ -5 \le t \le 5$

b) $x_2[n] = 2.0\,(1.1)^{1.8n} - 2.1\,(0.9)^{0.7n} \qquad for\ -5 \le n \le 25$

Solution

GOOD LUCK