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**Presidency University**

**Bengaluru**

 **SCHOOL OF ENGINEERING**

**Make Up Examinations, July 2024**

**Date**: 04 July 2024

**Time**: 09:30am – 12:00pm

**Max Marks**: 100

**Weightage**: 50%

**Semester**: II

**Course Code**: ECE2008

**Course Name**: Signals and Systems

**Department:** ECE

 **Instructions:**

1. *Read the all questions carefully and answer accordingly.*
2. *Do not write any matter on the question paper other than roll number.*

**PART A**

**Answer any 5 Questions. Each question carries 6 marks. (5Qx 6M= 30M)**

1. Signals can also be classified into deterministic and random signal. Define deterministic and random signals with examples. [C.O.No.1] [Knowledge]
2. The basic signal operations in digital signal processing (in time) are time shifting, time scaling and time reversal. Perform the time operations for the signal $x(2t-1)$.

[C.O.No.1] [Comprehension]

1. Even and odd decomposition is useful to analyze differential equations. It is also used in information theory for example, discrete time channel equalization and maximum likelihood PAM detection. Find the even and odd components of the following signal.

$x\left(t\right)=\cos(\left(t\right))+\sin(\left(t\right))+\cos(\left(t\right))sin⁡(t)$ . [C.O.No.2] [Comprehension]

1. The signal which is symmetric around vertical axis is even signal and symmetric about origin is odd signal. Find even and odd parts of the given signal$ x\left(t\right)=2+t$. [C.O.No.1] [Comprehension]
2. The Laplace transform has a number of properties that make it useful for analysing linear dynamical systems. Explain time shifting property of Laplace transform.

[C.O.No.3] [Knowledge]

1. In practice, unit step signal is used as a test signal because the response of a system for the unit step signal gives the information about how quickly the system responds to a sudden change in the input signal. Draw the unit step signal and write its equation.

 [C.O.No.2] [Comprehension]

1. The properties of z-transform can be used to find closed form of expression for the z-transform of a given sequence. State and prove the conjugation property of z-transform [C.O.No.4] [Knowledge]

**PART B**

**Answer any Four Questions. Each question carries 10 marks. (4Qx 10M= 40M)**

1. The Fourier transform is a generalization of the complex Fourier series in the limit . Find the Fourier transform of the signal $x(t)$ shown in figure.



[C.O.No.2] [Application]

1. A very simple application of Laplace transform in the area of Physics is to find out the harmonic vibration of a beam, which is supported at two ends. Find the Laplace transform of given x(t).



 [C.O.No.3] [Application]

1. A system that satisfies the superposition principle is said to be linear system. Check whether the given system, $y\left(n\right)=Ax\left(n\right)+B$ is linear or not. Also explain linearity property in detail. [C.O.No.1] [Application]
2. Both energy and power are mutually exclusive. No signal can be both power and energy signal. Find the power and energy for the signal,$ x\left(t\right)=Asin\left(ωt+ϴ\right).$

 [C.O.No.1] [Application]

1. The z-transform is a mathematical tool, which is used to convert the difference equations in time-domain into the algebraic equations in z-domain. Find the z-transform for the following signals.
(i) 
(ii). Justify the answers.

 [C.O.No.4] [Application]

**PART C**

**Answer any two Questions. Each question carries 15 marks. (2Qx 15M= 30M)**

1. Convolution is a mathematical way of combining two signals to form a third signal. Perform discrete convolution for the input sequence,$x\left(n\right)=\left\{4,3,2,1\right\}$  and impulse response, $h\left(n\right)=\{1,1,1\}$ using graphical method. Verify the answers with tabular method.

[C.O.No.3] [Application]

1. Convolution is used in various fields like image processing, signal filtering, signal denoising, audio processing and synthesized seismology. Perform discrete convolution for the input sequence,$x\left(n\right)=\{1,2,3,4\}$  and impulse response, h(n)={1,2,3} using graphical method. Verify the answers with tabular method. [C.O.No.3] [Application]
2. Convolution is used in the design and implementation of finite impulse response filters in Signal Processing. State and prove the convolution property using z-transform. Also, convolve the sequence given below using z-transform and verify with tabular method.
$x1\left(n\right)=\left\{1,2,3,4\right\} $and $x2\left(n\right)=\left\{4,3,1\right\}.$ [C.O.No.4] [Application]