Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SET A

SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2024

Semester : Semester III - 2022
Course Code : ECE2003
Course Name : Signals and Systems
Program : B.Tech.

Date : 05-JAN-2024
Time : 9:30AM - 12:30 PM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS **5 X 2M = 10M**

1. A system that satisfies the superposition principle is said to be linear system. Check whether the given system, $y(n) = Ax(n) + B$ is linear or not.

(CO1) [Knowledge]

2. The Fourier series of a signal has an unlimited numbers of harmonics. Find the Fourier coefficients of the signal, $x(t) = |e^{j\omega_0 t}| + sin(\omega_0 t + \pi/4)$.

(CO2) [Knowledge]

3. Fourier transform is an integral transform that converts a function into a form that describes the frequencies present in the original function. Find the Fourier transform of continuous time unit impulse , $\delta(t)$.

(CO2) [Knowledge]

4. The Laplace transform has a number of properties that make it useful for analysing linear dynamical systems. Explain time shifting property of Laplace transform.

(CO3) [Knowledge]

5. The values of z for which the sum in $X(z) = \sum_{-\infty}^{\infty} x(n)z^{-n}$ converges is called Region of Convergence (ROC). Write any five properties of ROC.

(CO3) [Knowledge]

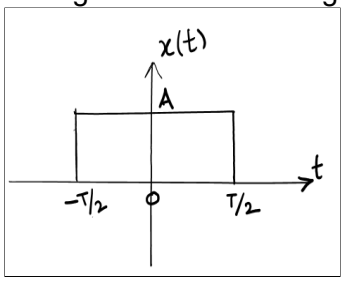
PART B

ANSWER ALL THE QUESTIONS **5 X 10M = 50M**

6. A signal whose amplitude is constant over infinite duration is a power signal. Find the energy and power of the given signal, $x(t) = cos(t)$ and justify whether the given signal is energy or power signal or neither energy nor power signal.

(CO1) [Comprehension]

7. The Fourier transform is a generalization of the complex Fourier series in the limit $T \to \infty$. Find the Fourier transform of the signal $x(t)$ shown in figure.



(CO1) [Comprehension]

8. Fourier transform exists, when signal $x(t)$ has finite number of discontinuities and finite number of maxima and minima in every finite time interval. Find the Fourier transform of Signum function, $sgn(t)$ and from the result of Signum function, find the Fourier transform of $e^{-at}u(t)$ and $e^{at}u(-t)$.

(CO2) [Comprehension]

9. 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 $x(t) = e^{at}sin(\omega_0 t)u(t)$.

(CO3) [Comprehension]

10. In image processing, convolution is a highly effective way to extract features and filter noises. Using z-transform, find the convolution of two sequences given, $x_1(n) = \{1, 2, -1, 0, 3\}$ and $x_2(n) = \{1, 2, -1\}$. Verify the convolution with the tabular method.

(CO3) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS **2 X 20M = 40M**

11. Laplace transform provides a unified approach in solving initial and boundary value problems. Find the inverse Laplace transform of the following. $X(S) = \frac{8S}{S^2 + 3S + 2}$; with ROC $-2 < Re\{S\} < -1$.

(CO3) [Application]

12. Z-transform is used to design and analyse digital filters for applications such as noise reduction, equalization and signal seperation. Find inverse z-transform $x(n)$, for the following $X(z) = \frac{5z^{-1}}{(1 - 2z^{-1})(1 - 3z^{-1})}$; $ROC, |z| > 3.$

(CO3) [Application]