BRAINWARE UNIVERSITY

Term End Examination 2023-2024
Programme – Dip.RA-2022
Course Name – Signal and System
Course Code - ECPE401A
(Semester IV)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Identify mathematical representation of the unit impulse function.

a) δ(t) b) u(t)
c) sgn(t) d) r(t)

(ii) Given two discrete-time signals x[n] and h[n], if x[n] has a length of 4 and h[n] has a length of 3, compute the length of the resulting convolution y[n].

a) 1 b) 2
c) 3 d) 6

(iii) Can the output of a causal system ever depend on future inputs in a convolution operation?

a) Yes, always. b) No, never
c) Only if the system is linear. d) It depends on the specific causal system

(iv) Choose a characteristic property of a Linear Time-Invariant (LTI) system -

a) It can exhibit exponential growth or decay. b) It can change its characteristics over time.
c) It satisfies the superposition principle. d) It can only process sinusoidal input signals.

(v) Choose a key property of time-invariance in an LTI system-

a) The system's output only depends on its initial conditions. b) The system's output is not affected by the input signal.
c) The system's behavior does not change over time. d) The system's output is a linear combination of its inputs.

(vi) Choose from the following statements that is true regarding energy signals and power signals-

a) Energy signals have finite power, while power signals have finite energy. b) Energy signals have finite energy, while power signals have finite power.
c) Both energy signals and power signals have finite energy and power. d) Energy signals have infinite energy, while power signals have finite power.

(vii) In the context of discrete-time signals, the term "sampling" relates to -

a) The process of converting a continuous signal to a discrete signal
b) The process of quantizing signal values
c) The process of filtering out high-frequency components
d) The process of modulating the signal for transmission

(viii) Choose from the following systems that can have a non-causal impulse response-

a) Linear time-invariant system
b) Causal system
c) Memoryless system
d) None of the above

(ix) Select the non-causal system from the following -

a) An electronic filter that processes an audio signal.
b) A predictive text algorithm that suggests the next word in a sentence.
c) A thermostat that turns on the heating system when the temperature drops below a certain level.
d) A video player that displays video frames in the order they were encoded.

(x) Identify a mathematical concept that does the Laplace transformation primarily aim to simplify and solve in engineering and mathematics -

a) Derivatives
b) Integrals
c) Differential Equations
d) Trigonometric Identities

(xi) For a causal and stable system, describe the region of convergence (ROC) for the Laplace transform.

a) The entire complex plane.
b) The right-half of the complex plane
c) The left-half of the complex plane
d) A circular region centered at the origin

(xii) Solve the z-transform of a unit impulse signal.

a) 1
b) z
c) $\delta[n]$
d) 0

(xiii) The z-transform is used to describe -

a) Continuous-time signals
b) Continuous-time systems
c) Discrete-time signals
d) Discrete-time systems

(xiv) The ROC for the z-transform of a finite-length sequence defines -

a) Entire z-plane
b) Outside the unit circle
c) Inside the unit circle
d) A single point

(xv) The z-transform of a sinusoidal signal is defined as -

a) Rational function
b) Complex exponential
c) Unit step function
d) Dirac delta function

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Define continuous-time and discrete-time signals, and provide an example of each. (3)

3. Define Z-transform and ROC. (3)

4. Examine Laplace Transform of $x(t) = u(t)$ (3)

5. State sampling theorem. (3)

6. Differentiate between linear convolution and circular convolution. (3)

OR

Find the Nyquist rate and Nyquist interval of sinc[200t]. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Write properties of ROC of Z-Transforms. (5)

8. Determine the Z transform of x(n)={3, 2, 5, 7} (5)

9. (5)

Determine the response of an LTI system whose input x(n) and impulse response h(n) are given by

$$x(n)=\left\{\underset{\uparrow}{1},2,0.5,1\right\}, h(n)=\left\{1,\underset{\uparrow}{2},1,-1\right\}$$

10. Analyze continuous and discrete time systems. (5)

11. Analyse the concept of Laplace Transform. (5)

12. Estimate the Z transform of (5)

$(7/8)^n$ u(n).

OR

Compare Laplace Transform and Z-Transform. (5)

****