17328

BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – B.Tech.(RA)-2022/B.Tech.(RA)-2023
Course Name – Signal Processing and Implementation to Automation
Course Code - PEC-ECR501A
(Semester V)

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 the average power for an energy signal

a) infinite b) finite
c) zero d) cannot be defined

(ii) Identify the example of deterministic signal from the

a) step b) ramp
c) exponential d) all of the these

(iii) A real valued signal x(n) is represented as anti-symmetric if

a) x(n)=x(-n) b) x(n)=-x(-n)
c) x(n)=-x(n) d) none of these

(iv) The system y(n)= sin[x(n)] is indicated as

a) stable b) BIBO stable
c) unstable d) none of the above

(v) The system y(n) = nx(n) is described as

a) causal b) non causal
c) anti-causal d) none of these

(vi) The system y2(n) = cos[x(n)] is expressed as

a) stable b) unstable
c) BIBO Stable d) cannot be defined

(vii) Define region of convergence (ROC) in the context of Z-transform

a) The set of values for which the Z-transform converges b) The region where the signal is nonzero.
c) The region of complex frequencies d) The region where the Z-transform diverges.

(viii) Identify Z-transform of the convolution of two signals, x[n] and h[n]

a) X(Z)H(Z) b) X(Z) * H(Z).
c) X(Z)H(Z) + 1 d) X(Z)H(Z) - 1

(ix) With respect to time, the unit step function is expressed as the integral of

a) ramp function
b) impulse function
c) sinusoidal function
d) exponential function

(x) If all the poles of H(z) are outside the unit circle, then the system is indicated as

a) causal
b) Only BIBO stable
c) BIBO stable and causal
d) None of these

(xi) A linear time invariant system is represented as BIBO stable if and only if the ROC of the system function

a) Includes unit circle
b) Excludes unit circle
c) Is an unit circle
d) None of these

(xii) Choose a type of filter that is known for its equi ripple behavior in the frequency domain

a) Butterworth
b) Chebyshev Type I
c) Chebyshev Type II
d) Elliptic

(xiii) Choose the main purpose of frequency transformations in filter design

a) To change the filter order
b) To change the filter type
c) To adjust the filter's frequency response
d) To increase the filter's delay

(xiv) Choose the purpose of windowing in signal processing

a) To reduce the amplitude of a signal
b) To remove high-frequency components
c) To smooth the signal and reduce spectral leakage
d) To increase the sampling rate

(xv) Differentiate a following statement that is true regarding the relationship between the Z-Transform and the Fourier Transform

a) The Z-Transform is a special case of the Fourier Transform.
b) The Fourier Transform is a special case of the Z-Transform
c) The Z-Transform and Fourier Transform are unrelated
d) The Z-Transform is the continuous-time version of the Fourier Transform

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Describe time-invariant and time variant systems. (3)

3. Describe deterministic and non-deterministic signals with example. (3)

4. Describe continuous time, discrete time and digital signal. (3)

5. Explain rectangular window. (3)

6. Evaluate z-transform and ROC of the sequence. (3)

$$x(n)=\{\underset{\uparrow}{1},0,3,-1,2\}$$

OR

Calculate the difference equation of the following transfer function: (3)

$$T(z)=\frac{3+2z^{-1}+z^{-2}}{1-4z^{-1}+5z^{-2}}$$

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Calculate the z transform and ROC of the given signal: (5)

$$x(n) = a^n u(n) + b^n u(-n-1)$$

8. Determine the relation between Fourier Transform and Z-Transform. (5)

9. Calculate the DFT of a sequence (5)

$x(n) = 1 \quad \text{for } 0 \le n \le 2$

$\quad = 0 \quad \text{otherwise}$

for $N = 4$.

10. Determine whether the following system is time-invariant or time variant: (5)
y(n) = x(n) + x(n - 1)

11. The impulse response of linear time invariant system is $h(n) = \{1, \underset{\uparrow}{2}, 1, -1\}$. Evaluate the response of the system to the input signal $x(n) = \{\underset{\uparrow}{1}, 2, 3, 1\}$. (5)

12. Write the procedure for design of low pass digital butterworth filter. (5)

OR

Write the bilinear transformation method to design IIR filter. (5)

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