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BRAINWARE UNIVERSITY

Term End Examination 2025-2026

Programme – B.Tech.(EE)-2021/B.Tech.(EE)-2023

Course Name – Digital Signal Processing

Course Code - OE-EE601A

(Semester VI)

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) $\delta(t)$ | b) $u(t)$ |
| c) $\text{sgn}(t)$ | d) $r(t)$ |

(ii) Define the unit step function $u(t)$.

- | | |
|---|---|
| a) $u(t) = 0$ for $t < 0$, $u(t) = 1$ for $t \geq 0$ | b) $u(t) = 1$ for $t < 0$, $u(t) = 0$ for $t \geq 0$ |
| c) $u(t) = 0$ for $t \leq 0$, $u(t) = 1$ for $t > 0$ | d) $u(t) = 1$ for $t \leq 0$, $u(t) = 0$ for $t > 0$ |

(iii) Choose from the following that defines a causal system.

- | | |
|--|--|
| a) The output depends only on past and present inputs. | b) The output depends only on future inputs. |
| c) The output depends on both past and future inputs. | d) The output is constant for all inputs. |

(iv) 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 |

(v) Identify the term "sampling" in the context of discrete-time signals.

- | | |
|---|--|
| 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 |

(vi) Choose the impulse response of a system that is both causal and time-invariant.

- | | |
|----------------------|------------------------|
| a) Unit impulse | b) Unit step |
| c) Exponential decay | d) Sinusoidal function |

(vii) Select the true statements about even signals.

- | | |
|---|--------------------------------------|
| a) Even signals have zero energy. | b) Even signals have zero power. |
| c) Even signals are symmetric about the y-axis. | d) Even signals are always positive. |

(viii) Name the domain used for z-transform analysis

- a) s-domain
- c) z-domain

- b) ω -domain
- d) n-domain

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(ix) Indicate the primary use of z-transform

- a) Signal reconstruction
- c) Sampling

- b) Stability analysis
- d) Modulation

(x) Choose the correct relation for Parseval's identity

- a) Energy preserved
- c) Phase preserved

- b) Amplitude preserved
- d) Frequency preserved

(xi) Identify the method commonly used for FIR filter design using truncation

- a) Window method
- c) Impulse invariance

- b) Bilinear method
- d) Frequency sampling

(xii) Identify the IIR filter approximation with ripple in passband only

- a) Butterworth
- c) Elliptic

- b) Chebyshev Type-I
- d) Bessel

(xiii) Indicate the filter that passes low frequencies and attenuates high frequencies

- a) Band-pass
- c) Low-pass

- b) High-pass
- d) Band-stop

(xiv) Identify the noise introduced due to coefficient quantization

- a) Thermal noise
- c) Shot noise

- b) Quantization noise
- d) Flicker noise

(xv) Choose the filter approximation requiring minimum order

- a) Butterworth
- c) Elliptic

- b) Chebyshev
- d) FIR

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Apply DTFT on the sequence $x(n) = u(n)$.

(3)

3. Examine DTFT of the given sequence:

(3)

$$x(n) = \{1, 3, -2, 5\}$$

4. State the main characteristic of a Butterworth IIR filter.

(3)

5. List any three properties of the DFT.

(3)

6. Deduce the linearity property of Z transform.

(3)

OR

Estimate the Z transform of

(3)

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

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Explain aliasing in sampling.

(5)

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

9. Calculate Fourier Transform on

$$x(t) = \begin{cases} e^{-at}; t > 0 \\ 0; t < 0 \end{cases}$$

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(5)

10. Illustrate the properties of Fourier Transform. (5)

11. Define DFT and explain its mathematical formulation. (5)

12. Analyze the impact of finite word length effects in FIR filter implementation. (5)

OR

Analyze the differences between parametric and non-parametric spectral estimation methods. (5)
