BRAINWARE UNIVERSITY

Term End Examination 2023-2024
Programme – B.Tech.(EE)]-2021
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) In practical terms, indicate an example of a system that generates discrete time signals.

a) Analog clock
b) Digital audio recorder
c) Incandescent light bulb
d) FM radio transmitter

(ii) Examine the characteristics of a discrete-time sequence with a periodic behavior.

a) Identify the sampling rate
b) Determine the periodicity
c) Calculate the Fourier transform
d) Assess the amplitude variations

(iii) Explain the role of difference equations in describing the behavior of discrete systems.

a) By converting continuous signals into discrete signals
b) By providing a mathematical framework for discrete-time systems
c) By analyzing analog circuit behavior
d) By predicting random process outcomes

(iv) Explain the primary purpose of sampling in the context of signal processing

a) To generate signals
b) To compress signals
c) To filter signals
d) To transport signals over long distances

(v) Indicate the following methods is commonly used for designing FIR (Finite Impulse Response) filters

a) Butterworth filter design
b) Chebyshev filter design
c) Parks-McClellan algorithm
d) Elliptic filter design

(vi) Explain for an energy signal

a) E=0
b) P=0
c) Both
d) Neither 1 not 2

(vii) Identify the Z-transform of a unit impulse function

a) 1
b) z
c) e^s
d) e^(-s)

(viii) Choose the mathematical operation in the Z-domain is equivalent to convolution in the time domain

a) Multiplication
b) Addition

c) Differentiation
d) Integration

(ix) Simulate a digital low-pass filter with a cutoff frequency of 1000 Hz using the Butterworth approximation and a sampling frequency of 8000 Hz.

a) Determine the filter order required.
b) Design the filter coefficients.
c) Implement the filter in code.
d) Evaluate the filter's frequency response.

(x) The system represented by h(n)=0.99>n< u(n 2).Identify its stability condition

a) unstable because it is an FIR system
b) stable because it is an IIR system
c) unstable because it does not obey BIBO stability criterion
d) stable because it is obey BIBO stability criterion

(xi) Write from the following is NOT a property of the Discrete Fourier Transform (DFT)

a) Linearity
b) Time-domain aliasing
c) Circular convolution property
d) Time-shift property

(xii) In DFT, state the Nyquist frequency represent

a) The frequency at which the magnitude response drops to zero.
b) Half the sampling frequency.
c) The highest frequency component that can be represented without aliasing.
d) The frequency at which the phase response becomes nonlinear.

(xiii) Identify parameter is NOT typically used to characterize a digital filter.

a) Passband frequency
b) Stopband frequency
c) Phase distortion
d) Gain

(xiv) Identify the example of deterministic signal from the following

a) Step
b) Ramp
c) Exponential
d) All of these

(xv) The system y(n)= x(n) + x(n-1) is expressed as

a) time invariant
b) time variant
c) none of the these
d) cannot be defined

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Compute the relationship between S-plane and Z-plane. (3)
3. Predict the advantages of using DFT over Fourier Transform (FT). (3)
4. Compare the Sampling Theorem and the Nyquist Rate, highlighting their key differences. (3)
5. Explain the order of a digital filter that affect its performance? (3)
6. Compare the Chebyshev filter to the Butterworth filter. (3)

OR

Estimate the trade-offs between FIR and IIR filters in terms of implementation complexity. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Explain the difference between the Z-transform and the discrete-time Fourier transform (DTFT). (5)
8. Describe the process of calculating power spectra in Fourier transform analysis and discuss its applications. (5)
9. Predict the represent a discrete-time signal using an orthogonal basis. Provide an example to illustrate the process. (5)
10. When a discrete time system is excited by an input x(n), the response is y(n)= {2,5,11,17,13,12}. If the impulse response of the system is h(n)= {2,1,3}. Calculate input sequence. (5)

11. Evaluate IDFT of the DFT sequence X(k)={1,0,1,0} (5)

12. Estimate Butterworth and Chebyshev filters advantages and disadvantages, (5)

OR

Explain the significance of the design parameters in digital filter design. Discuss how variations in these parameters affect the characteristics of the resulting filter (5)

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