



BRAINWARE UNIVERSITY

Term End Examination 2023-2024
Programme – B.Tech.(ECE)-2019/B.Tech.(ECE)-2020

Course Name – Wavelet Analysis

Course Code - PEC-ECEL701B

(Semester VII)

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Brainware University
Barasat, Kolkata - 700125

Time : 2:30 Hours

Full Marks : 60

[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 which time-frequency analysis method is particularly well-suited for transient signals?
- a) Short-Time Fourier Transform (STFT)
 - b) Continuous Wavelet Transform (CWT)
 - c) Discrete Fourier Transform (DFT)
 - d) Fast Fourier Transform (FFT)
- (ii) Choose the primary purpose of the scaling function in wavelet analysis
- a) To detect high-frequency details in a signal
 - b) To analyze the overall trend or low-frequency components of a signal
 - c) To identify the phase of a wavelet transform
 - d) To perform time-frequency analysis of a signal
- (iii) Select from the following is a disadvantage of the Short-Time Fourier Transform (STFT) compared to the Continuous Wavelet Transform (CWT)
- a) STFT provides better time localization
 - b) STFT is more computationally efficient
 - c) STFT works well for non-stationary signals
 - d) STFT has fixed window sizes
- (iv) Recognize the primary purpose of wavelet theory from following
- a) Image compression
 - b) Signal processing
 - c) Quantum physics
 - d) Social networking
- (v) Indicate the mathematical concept that is the core of wavelet analysis
- a) Differentiation
 - b) Integration
 - c) Convolution
 - d) Discretization
- (vi) In time-frequency analysis, the Heisenberg Uncertainty principle states that
- a) You can simultaneously obtain precise information about time and frequency
 - b) The more precise you are about time, the less precise you are about frequency (and vice versa)

- c) Time and frequency are independent of each other
- d) The analysis is limited to stationary signals
- (vii) In wavelet analysis, what does the term scaling function infer to
- a) A function that scales data
- b) A function that dilates or compresses wavelets
- c) A function used for signal generation
- d) A function for noise reduction
- (viii) Predict the primary goal of time-frequency analysis
- a) To analyze signals in the time domain
- b) To analyze signals in the frequency domain
- c) To analyze signals in both time and frequency domains
- d) To analyze signals in the spatial domain
- (ix) Time-frequency analysis is particularly useful for applying on signals that are
- a) Stationary
- b) Non-stationary
- c) Periodic
- d) Discrete
- (x) Diagonally opposed filters is inferred as
- a) modulation
- b) multiplier
- c) cross modulation
- d) subband coding
- (xi) Identify the primary advantage of using the Discrete Wavelet Transform (DWT) over the Continuous Wavelet Transform (CWT)?
- a) DWT provides better frequency localization
- b) DWT is faster and computationally more efficient
- c) DWT can analyze non-stationary signals
- d) DWT is less affected by the Heisenberg Uncertainty Principle
- (xii) Choose the a drawback of using a larger overlap in the STFT analysis
- a) Reduced spectral accuracy.
- b) Improved time localization.
- c) Increased computational complexity.
- d) Reduced sensitivity to signal variations.
- (xiii) Name from the following is NOT a common application of time-frequency analysis?
- a) Speech recognition
- b) Seismic signal processing
- c) Image compression
- d) Radar signal processing
- (xiv) Time-frequency analysis is essential for understanding and characterizing signals with
- a) Constant amplitude and frequency
- b) Variable amplitude and constant frequency
- c) Variable amplitude and variable frequency
- d) High spatial resolution
- (xv) Select that which time-frequency representation provides a high-resolution representation of signal components at the expense of increased computational complexity
- a) Short-Time Fourier Transform (STFT)
- b) Continuous Wavelet Transform (CWT)
- c) Discrete Wavelet Transform (DWT)
- d) Fast Fourier Transform (FFT)

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Illustrate Wave-Packet Concept (3)
3. Differentiate wavelet analysis from Fourier analysis. (3)
4. Discuss the advantages of using wavelet analysis over Fourier analysis. (3)
5. Explain the concept of wavelet families and their importance in wavelet analysis. (3)

6. Explain Denoising

(3)

OR

Explain Multi-tone digital communication

(3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Explain how the STFT works

(5)

8. Explain characteristics of the Wigner-Ville Transform

(5)

9. Explain benefits of Biorthogonal Wavelets.

(5)

10. Explain Stationary Wavelet Transformation.

(5)

11. Explain Haar Wavelet.

(5)

12. Explain properties of the Continuous Wavelet Transform.

(5)

OR

Explain how Discrete Wavelet Transform (DWT) works.

(5)

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