AR 24 Reg. No | | | | | | | | | | |

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

Ph.D. (Second Semester-Summer) Examinations, May – 2025

23SPPEEC2011 – Advanced Digital Signal Processing

(ECE)

Time: 3 hrs Maximum: 70 Marks

The figures in the right hand margin indicate marks.

	Answer *ANY FIVE* Questions. **(14 x 5 = 70 Marks)**	**Marks**
1.a.	Explain the decimation-in-time (DIT) FFT algorithm with a signal flow graph for an 8-point FFT. Compare its computational complexity with the DFT.	8
b.	Design a linear phase FIR filter using the Hamming window for a given cutoff frequency. Discuss the trade-offs of using Hamming vs. Kaiser windows.	6
2.	Explain the polyphase decomposition of an FIR filter and derive its efficient structure for decimation. How does this reduce computational load? Discuss an application in software-defined radios (SDR).	14
3.a.	Derive the Wiener-Hopf equations for an optimum FIR Wiener filter. How does it minimize mean square error?	7
b.	Compare AR lattice and ARMA lattice-ladder filters in terms of structure and prediction error minimization.	7
4.	Explain the LMS algorithm with its stability conditions. Compare its convergence behavior with the RLS algorithm in the context of channel equalization.	14
5.a.	Describe the Bartlett and Welch methods for non-parametric spectrum estimation. How do they reduce variance compared to the periodogram?	7
b.	Explain the Yule-Walker method for AR model-based spectrum estimation. Derive the normal equations.	7
6.a.	Discuss the role of multirate DSP in radar systems (e.g., pulse compression). How does polyphase filtering improve efficiency?	7
b.	Explain the design of a Hilbert transformer using an FIR filter and its application in single-sideband (SSB) modulation.	7
7.	Describe the MUSIC algorithm for spectrum estimation. How does eigenanalysis help in resolving closely spaced frequencies? Provide a mathematical formulation.	14
8.a.	Explain how adaptive noise cancellation is achieved using LMS filters in speech processing.	7
b.	Discuss the application of wavelets in image compression (e.g., JPEG 2000). Why are wavelets superior to DCT?	7

---End of Paper---