QP Code: R261B016 | Reg. No | | | | | | | | | | | AY 25

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

M.Tech. (Second Semester - Regular) Examinations, May – 2026

24MECPC12001– Advanced Digital Signal Processing

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	R261B001is the LMS (Least Mean Squares) algorithm, and how is it applied in adaptive filtering?	CO1	K1
b.	Explain the difference between nonparametric and parametric methods for power spectrum estimation.	CO2	K2
c.	Explain the concept of a stationary random process briefly.	CO3	K2
d.	Describe the concept of eigenanalysis in the context of spectrum estimation.	CO4	K3
e.	What is minimum-variance spectral estimation, and how does it contribute to spectrum estimation?	CO5	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	Describe the role and implementation challenges of sub-band coding in speech and image compression applications.	5	CO1	K3
b.	Explain the design and application of FIR filters using windowing techniques with examples.	5	CO1	K2
	(OR)			
c.	Discuss Wiener filters and their mathematical formulation, applications, and limitations with relevant examples.	5	CO1	K3
d.	Explain the characteristics and implications of a stationary random process in signal processing.	5	CO1	K2
3.a.	Explain the concept of optimum linear filters and the MMSE criterion for filter optimization.	5	CO2	K2
b.	Provide a comparative analysis of parametric vs. non-parametric spectral estimation techniques with examples	5	CO2	K4
	(OR)			
c.	Explain the fundamentals of Digital Signal Processing (DSP) and its significance in modern signal processing applications.	5	CO2	K2
d.	Explain techniques such as periodogram, Welch's method, AR modeling, and MV spectral estimation in spectrum analysis.	5	CO2	K3
4.a.	Describe the structure and convergence analysis of the RLS (Recursive Least Squares) algorithm.	5	CO3	K3
b.	Discuss filter structure selection impact on performance in real-time DSP hardware implementations.	5	CO3	K2
	(OR)			

c.	Explain the concept of filter banks in multirate DSP and describe their importance in signal decomposition and reconstruction.	5	CO3	K2
d.	Provide an overview of Quadrature Mirror Filters (QMF) and their role in multi-rate signal processing.	5	CO3	K3
5.a.	Discuss the challenges and techniques involved in estimating spectra from finite-duration observations of signals.	5	CO4	K3
b.	Explain the role of window selection in nonparametric spectrum estimation and compare rectangular, Hamming, and Hanning windows.	5	CO4	K3
	(OR)			
c.	Discuss the principles and operation of the Gradient Adaptive Lattice algorithm in adaptive filtering.	5	CO4	K2
d.	Discuss how the criterion is used to derive adaptive filter algorithms such as LMS and RLS.	5	CO4	K3
6.a.	Explain the Kalman filtering approach for signal estimation and discuss its advantages over conventional linear filters..	5	CO5	K2
b.	Explore the concept of eigenanalysis and its role in spectrum estimation.	5	CO5	K2
	(OR)			
c.	Describe the MUSIC algorithm for high-resolution spectrum estimation and explain its use in frequency or direction-of-arrival estimation.	5	CO5	K2
d.	Describe the architecture and use cases of Wiener filters in practical signal enhancement applications.	5	CO5	K3

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