ECE326: Digital Signal Processing

Programme: B. Tech. (ECE and CCE) Year: 3rd Semester: I
Course: Core Credits: 3 Hours: 40

Course Context and Overview (100 words):
The objective of the course is to make senior students learn the advanced theoretical concepts in digital signal processing. After attending this course they are expected to carry out research in the broad area of digital signal processing with ease. They will be exposed to the concepts of representation theory, transform domain analysis, system theory, fast algorithm, adaptive signal processing and few important applications.

Prerequisites Courses: Signal, Systems and Control

Course Outcomes (COs):

On completion of this course, the students will have the ability to:	
CO1:	Represent real world signals in digital format and understand transform-domain (Fourier and z-transforms) representation of the signals.
CO2:	Understand the meaning and implications of the properties of systems and signals.
CO3:	Introduce applications of linear filters and their real-time implementation challenges.
CO4:	Understand the meaning and applications of multi-rate signal processing.
CO5:	Become aware of some applications of digital signal processing.

Course Topics:

Topics	Lecture Hours	
UNIT - I **1. Topic**	10	
1.1 Motivation and introduction to the course, basic concepts of signals and systems, interconnection of the systems and filtering. Z-transform and the region of convergence of the system, complex convolution theorem.	4	4
1.2 System described by difference equations, frequency response of LTI systems and system functions, relation between magnitude and phase, all pass systems, minimum phase systems, linear systems with generalized linear phase.	6	6
UNIT - II **2. Topic**		7
2.1 Representation of system described by linear constant coefficient difference equations, lattice structures.	7	

UNIT - III **3. Topic**		6
3.1 Design of FIR filters by windowing, FIR filter by the Kaiser window, optimum approximation of FIR filters.	6	
UNIT - IV **4. Topic**		7
4.1 Orthogonal transform, discrete Fourier transform (DFT), relation between Fourier transform and DFT, circular convolution, DFT properties, computation of DFT, linear convolution using the DFT.	5	
4.2 Fast computation of DFT.	2	
UNIT-V **5. Topic**		10
5.1 Rate convertor and their characterization, multistage design of decimator and interpolator, polyphase decomposition, applications of multi-rate systems.	7	
5.2 Stochastic signals, Wiener filtering, LMS and RMS algorithms and spectral estimation.	3	

Text Books:

1. Proakis et al., *"Digital Signal Processing: Principles Algorithms and Applications"*, Prentice Hall, 4th Ed. 2007.
2. S. K. Mitra, *"Digital Signal Processing*", Tata McGraw Hill, 3rd Ed.
3. Papoulis et al., *"Probability, Random Variables and Stochastic Processes"*, McGraw Hill, 3rd Ed.

Evaluation Methods:

Item	Weightage
Quiz 1	25%
Quiz 2	
Quiz 3	
Quiz 4	
Mid-term Examination	30%
End-term Examination	45%