Digital Signal Processing

Course Code	23EC3603	**Year**	III	**Semester**	II
Course Category	PC	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Signals & Systems
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		BL
CO1	Interpret discrete-time signals using DTFT.	L3
CO2	Analyse discrete-time LTI systems using Z-transform.	L4
CO3	Interpret discrete-time signals using DFT & Apply FFT algorithms for various signal processing operations.	L3
CO4	Design IIR and FIR digital filters for the given specifications.	L5
CO5	Build Digital Systems in Direct, Cascade and Parallel form structures.	L3

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3								2		1		
CO2	3	3							2		1	1	
CO3	3								2		1	2	
CO4	3	3	3						2		1	2	1
CO5	3								2				
Average	3	3	3						2		1	2	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
1	**Transform Analysis of Discrete-time Signals & Systems**: Fourier Transform of Discrete-Time Signals, Properties of Discrete-time Fourier Transform (DTFT), Discrete-time LTI Systems, Convolution of discrete-time signals, Properties of LTI Systems, Analysis of Discrete-time LTI Systems using Z-transform: System functions of LTI systems characterized by Difference equations, Frequency Response of LTI Systems, Impulse response and Step response of LTI systems.	CO1, CO2
2	**The Discrete Fourier Transform (DFT)**: Introduction to Discrete Fourier Transform, Computation of DFT, Properties of DFT, Circular convolution, Linear convolution using DFT, Sectioned Convolution: Overlap-add method, Overlap-save method, Relationship between Z-transform and DFT	CO3
3	**Fast Fourier Transform (FFT)**: Introduction, Radix-2 Decimation-in-time FFT algorithm, Computational Complexity of Decimation-in-time FFT algorithm, Radix-2 Decimation-in-frequency FFT algorithm, Computational Complexity of Decimation-in-frequency FFT algorithm, Inverse DFT using FFT algorithms.	CO3
4	**Design of IIR Digital Filters**: Design of Analog Prototypes from Digital filter specifications using Butterworth and Chebyshev	CO4

	approximations, Design of IIR digital filters using Impulse Invariance method, Design of IIR digital filters using Bilinear Transformation Method.	
5	**Design of FIR Digital Filters**: Symmetric and Antisymmetric FIR filters, Linear discrete time systems with generalized linear phase, Design of linear phase FIR filters using Window functions, Design of Linear Phase FIR Filters using Frequency Sampling technique. **Realization of Discrete time systems:** Realization of IIR and FIR Systems - Direct, Cascade & Parallel form realizations.	CO4, CO5

Learning Resources
Text Books
1. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4th Ed., Pearson Education, 2007. 2. Lonnie C Ludeman, Fundamentals of Digital Signal Processing, John Wiley & Sons, 2003
Reference Books
1 A.V. Oppenheim, R. W. Schafer, Discrete-Time Signal Processing, 3rd Ed, Prentice Hall of India, 2009. 2. Sanjit K Mitra, Digital Signal Processing "A – Computer Based Approach", Tata Mc Graw Hill 2nd Ed., 2003.
e- Resources & other digital material
1. http://www.nptel.iitm.ac.in/ 2. http://www.ee.umanitoba.ca/~moussavi/dsp815/LectureNotes/index.html 3. http://www.ece.cmu.edu/~ee791 4. http://cobweb.ecn.purdue.edu/~ipollak/ee438/FALL04/notes/notes.html

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