3rd Year: FIFTH SEMESTER (ODD)

Department Core Course-10 (DCC)

EC301: Digital Signal Processing

Details of course:-

Course Title	Course Structure			Pre-Requisite
	L	T	P	
Digital Signal Processing	3	0	2	NIL

Course Objective: This course aims to provide in-depth knowledge to the student about various digital signal processing techniques, the design of digital filters and learn the concept of DFT, FFT algorithms, and design of digital filters using different approximations.

Course Outcomes:
1. Analyze DFT, FFT algorithms, and circular convolution for efficient digital signal processing.
2. Design and realize digital filters using FIR and IIR structures for various filter applications.
3. Implement linear-phase FIR filter design using windowing and frequency sampling techniques.
4. Apply analog filter design methods to create IIR filters using impulse invariance and bilinear methods.
5. Evaluate finite word length effects and their impact on the performance of IIR and FIR filters.

S. No.	Content	Contact Hours
Unit 1	Review of DTFT and z-transform, Introduction to Discrete Fourier Transform (DFT), Properties of DFT, Circular Convolution, Linear Convolution Using Circular Convolution, Filtering methods based on DFT, FFT Algorithms, Decimation-in-time Algorithms, Decimation-in-frequency Algorithms, Linear Filtering Approach for Computing DFT, Discrete Cosine Transform (DCT), Use and Application of DCT.	10
Unit 2	Realization of Digital Filters: Non-recursive and recursive structure, FIR filter structure (Direct form, Cascade form, Linear	8

	phase structure, polyphase structure), IIR filter structure, Direct form-I, Direct form-II, Cascade form, parallel form, polyphase structure), Lattice structure, Lattice structure for all-zero system, Lattice structure for all-pole system, Lattice ladder structure.	
Unit 3	FIR Filter Design: Linear Phase FIR filter, Frequency Response of Linear-phase FIR filters, Design Techniques for Linear-Phase FIR Filters, Fourier Series Method, Filter Design using Windowing Techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency Sampling Techniques.	10
Unit 4	IIR Filter design:Analog Filter Design, Design of IIR filter from Analog Filter, IIR Filter design Using Impulse Invariance Method and Bilinear transformation Method, Design of Butterworth and Chebyshev IIR Filters; Frequency Transformation in Digital Domain	10
Unit 5	Finite word length effect in digital filters, fixed- and floating-point numbers, representation of negative number, effect of truncation, finite word length effect in realization of IIR and FIR system, Recent trends in DSP processor.	4
	Total	42

Books:-

S. No	Name of Books/Authors/Publisher
1	S. K. Mitra, ``Digital Signal Processing- A Computer-based approach, '', Tata McGraw-Hill, 2007
2	John G. Proakis, Dimitris G. Manolakis, `` Digital Signal Processing: Principles, Algorithms, And Applications, '' Pearson Education, 2007.
3	Tarun Kumar Rawat, "Digital Signal Processing", Oxford University Press, 2016.
4	Alan V. Oppenheim and Ronald W.Schafer, ``Digital signal processing,'' Prentice Hall of India, 2004.
5	Emmanuel C.Ifeachor, and Barrie.W.Jervis, "Digital Signal Processing", Second Edition, Pearson Education, Prentice Hall, 2002