EC-310 **DIGITAL SIGNAL PROCESSING** **L T P C**
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COURSE OBJECTIVES:

1. To provide fundamental knowledge of digital signal processing techniques and applications.
2. To learn Z transforms.
3. To learn Discrete Fourier transforms and Fast Fourier transform techniques.
4. To understand various design techniques and realization methods of IIR filters.
5. To understand various design techniques and realization methods of FIR filters.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. use concepts of complex quantities, discrete Fourier transforms, Z-transforms to analyze the operations on discrete signals and acquire comprehensive knowledge of discrete-time signal and frequency transform methods, i.e. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT).
2. apply the Z-transform to analyze the digital filters to compute magnitude and phase response, and analyze the stability of the system.
3. perform Discrete Fourier transform using standard transforms and properties and also acquire knowledge of computing DFT efficiently by using decimation in time and decimation in frequency algorithms.
4. design, implementation, analysis of IIR & FIR digital filters for processing of discrete time signals.
5. asses the techniques, skills and modern engineering tools for analysis of discrete signals and perform the digital filtering in engineering practice.

UNIT I **(13)**

DISCRETE - TIME SIGNALS AND SYSTEMS : Discrete - Time Signals - Sequences, Linear Shift - Invariant Systems, Stability and Casuality, Linearity, Linear constant - Coefficient Difference Equations, Frequency Domain Representation of Discrete - Time Signals and Systems.

UNIT II **(13)**

Z-TRANSFORMS : Z-transforms, Region of convergence, Z-transform theorems and properties, Parseval's relation, Relation between Z-transform and Fourier transform of a sequence, Inverse Z transform using Cauchy's integration theorem, Partial fraction method, Long division method, Solution of differential equations using one sided Z-transform, Frequency response of a stable system.

UNIT III **(13)**

DFT AND FFT : Discrete Fourier Series, Properties of DFS, Discrete Fourier Transform, Properties of DFT, Linear convolution using DFT.

Efficient Computation of the DFT : Computations for evaluating DFT, Decimation in time FFT algorithms, Decimation in frequency FFT algorithm, Computation of inverse DFT.

UNIT IV **(13)**

IIR FILTER DESIGN TECHNIQUES : Introduction, Properties of IIR filters, Design of Digital Butterworth and Chebyshev filters using bilinear transformation, Impulse invariance transformation methods. Design of digital filters using frequency transformation method.

UNIT V **(13)**

FIR FILTER DESIGN TECHNIQUES : Introduction to characteristics of linear phase FIR filters, Frequency response, Designing FIR filters using windowing methods: Rectangular window, Hanning

window, Hamming window, Generalized Hamming window, Bartlett triangular window, Comparison of IIR and FIR filters.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Alan V Oppenheim and Ronald W Schafer - Digital Signal Processing, PearsonEducation/PHI, 2004.
2. John G.Proakisand Dimitris G.Manolakis - Digital Signal Processing Principles, Algorithms and Applications, 2007.
3. P Ramesh Babu - Digital Signal Processing, 5th edition, scitech, 2014.

REFERENCE BOOK(s):

1. Tarun Kumar Rawat - Digital Signal Processing, Oxford University Press,2015.
2. Johnny R. Johnson - Introduction to Digital Signal Processing, PHI, 2001.
3. Andreas Antoniou - Digital Signal Processing,TMH, 2006.
4. Lonnie C Ludeman - Fundamentals of Digital Signal Processing, John Wiley & Sons, 2003.
5. S K Mitra - Digital Signal Processing: A Computer Based Approach, 4th Edition, TMH, 2011.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/117102060/
2. http://www.ece.cmu.edu/~ee791/
3. http://www.ee.umanitoba.ca/~moussavi/dsp815/LectureNotes/index.html
4. http://cobweb.ecn.purdue.edu/~ipollak/ee438/FALL04/notes/notes.html