GUJARAT TECHNOLOGICAL UNIVERSITY
Master of Engineering
Subject Code: 3730715
Semester – III
Subject Name: Advanced DSP

Type of course: Engineering

Prerequisite: Understanding of Signals and Systems at UG level

Rationale: It is very important to understand the signal characteristics and system behaviour when the signals are digitized. Noises from the signals can be removed by designing filters using software. So, it is very important to understand the fundamentals of processing of complex signals. This subject will provide better understanding of discrete-time and digital signal in time and frequency domain. Students will also be able to design and implement FIR and IIR filters with different structures. Students will also be introduced to digital signal processor.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	• Discrete time signals • Linear shift invariant systems- Stability and causality • Sampling of continuous time signals and its effects • Discrete time Fourier transform- Discrete Fourier series- Discrete Fourier transform • Z transform-Properties of different transforms	8	20
2	• Linear convolution using DFT • Computation of DFT Design of IIR digital filters from analog filters • Impulse invariance method • Bilinear transformation method	8	20
3	• FIR filter design using window functions • Comparison of IIR and FIR digital filters • Basic IIR and FIR filter realization structures • Signal flow graph representations Quantization process and errors • Coefficient quantisation effects in IIR and FIR filters	8	20
4	• A/D conversion noise- Arithmetic round-off errors • Dynamic range scaling • Overflow oscillations and zero input limit cycles in IIR filters • Linear Signal Models	8	20
5	• All pole, All zero and Pole-zero models	6	10

	• Power spectrum estimation- Spectral analysis of deterministic signals. • Estimation of power spectrum of stationary random signals		
6	• Optimum linear filters • Optimum signal estimation • Mean square error estimation • Optimum FIR and IIR Filters	**6**	10

Reference Books:

1. Sanjit K Mitra, "Digital Signal Processing: A computer-based approach ",TataMc Grow-Hill Edition 1998
2. Dimitris G. Manolakis, Vinay K. Ingle and Stephen M. Kogon, "Statistical and Adaptive Signal Processing", Mc Grow Hill international editions .-2000
3. Steve White, "Digital Signal Processing", Thomson Delmar

Course Outcome:

After learning the course, the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand relation between continuous time and discrete time signals	20
CO-2	Acquire knowledge about the time domain and frequency domain representations as well analysis of discrete time signals and systems	25
CO-3	Understand the design techniques for IIR and FIR filters and their realization structures.	25
CO-4	Understand the effect of finite word length in implementation of digital filters.	15
CO-5	Design of optimum FIR and IIR filters	15

List of Open Source Software/learning website:

1. https://www.nptel.ac.in
2. https://www.mathworks.com/
3. https://powersimtech.com
4. https://www.scilab.org/