

# GUJARAT TECHNOLOGICAL UNIVERSITY

## ELECTRICAL & ELECTRONICS ENGINEERING

### B. E. SEMESTER: VII

Subject Name: **Discrete Time Signal Processing**

Subject Code: **170804**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
3	0	2	5	70	30	30	20

Sr. No	Course Content	Total Hrs.
1.	<b>Introduction:</b> Classification of signal, basic operation on signals, elementary signal, properties of system, properties of the impulse response representation for LTI system, differential and difference equation representation for LTI system, block diagram representations, state variable descriptions for LTI systems.	6
2.	<b>The Z- transform:</b> Introduction, the Z-transforms, properties of the ROC, properties the Z transforms. Inversion Z-transform, transform analysis of LTI system, computational structures for implementing discrete time system.	6
3.	<b>Fourier representations for signals:</b> Introduction, discrete time periodic signals, discrete time non periodic signals, properties of Fourier representations.	4
4.	<b>DFT and FFT:</b> Its properties and applications , frequency domain sampling, linear filtering methods, frequency analysis of signals, FFT algorithms , application of FFT algorithms , linear filtering approaches to computation of DFT.	8
5.	<b>IIR digital filter:</b> Introduction, impulse transformation, bilinear transformation, frequency transformation, designs digital Butterworth and chebyshev filter, design inverse chebyshev and elliptic filter, phase modification.	5

6.	<b>FIR digital filter:</b> Introduction, windowing techniques (ALL), frequency sampling technique.	5
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### Laboratory & Assignments:

- Write a program to generate following wave-form:  
a) Sinusoidal; b) Cosine; c) Sawtooth; d) Triangle.
- Write a program to generate the following sequence & plot:  
a) unit impulse (b) unit step (c) unit ramp d) exponential
- Write a program for arithmetic operation in MATLAB.
- Write a program for linear convolution of the sequence  $x=[1,2]$  and  $h=[1,2,4]$
- Write a program for computing circular convolution for sequence  $x=[1,2]$  and  $h=[1,2,4]$
- Write a program to correlation of given sequence by: 1) Auto correlation; 2) Cross correlation.
- Write a program to compute DFT of a sequence without using FFT function.
- Write a program to generate pole zero plot of given transfer function using MATLAB.
- Write a program for computing inverse Z-transform of a rational transfer function.
- Write a program for the design of FIR low pass, High pass, Band pass and band stop filters using all windowing techniques.
- Write a program for the design of IIR low pass, High pass, Band pass and band stop filters using Butterworth analog filter.
- Write a program for transforming an analog filter into digital filter using: a) impulse invariant technique; b) Bilinear transformation

### Text Books:

1. Sanjit Mitra, "Digital Signal Processing", Tata Mcgraw Hill, New Delhi, 2010.
2. Alan V. Oppenheim, Ronald W. Schaffer, "Digital Signal Processing", Prentice Hall.

### Reference Books:

1. John G. Proakis, "Digital Signal Processing", PHI.
2. Johnny R. Johnson, "Introduction to Digital Signal Processing, PHI.
3. Ashfaq A. Khan, "Digital Signal Processing Fundamentals", DA VINCI Engineering Press, 2005.
4. Rabiner, L.R. & Gold, B., "Theory and Application of Digital Signal Processing", Prentice Hall, 1989.