



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

DISCRETE TIME SIGNAL PROCESSING								
III Semester: ES								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BESE27	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisite: Signals and Systems.								

I. COURSE OVERVIEW:

Discrete-Time Signal Processing (DTSP) is a field of study that deals with the analysis, processing, and manipulation of signals that are defined in discrete time. This field is crucial in various applications such as digital signal processing, telecommunications, audio processing, image processing, and more. A course on Discrete-Time Signal Processing typically covers fundamental concepts, theories, and techniques related to discrete-time signals and systems.

II. COURSES OBJECTIVES:

The students will try to learn

- I. Understand the fundamental properties of discrete-time signals.
- II. Analyze discrete-time systems, considering properties like linearity and stability.
- III. Apply discrete-time signal processing to practical domains such as audio, image, and communication systems.
- IV. Use the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) for frequency analysis.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

- CO 1 Understand the illustration of discrete-time signals and systems
- CO 2 Apply the Discrete/Fast Fourier Transform for discrete time signal processing.
- CO 3 Analyze the design of Infinite Impulse Response (IIR) filters.
- CO 4 Analyze the design of Finite Impulse Response (FIR) filters.
- CO 5 Understand the concepts of programmable DSPs.
- CO 6 Design the IIR filters by Impulse invariant and bilinear transformation methods.

IV. COURSE CONTENT:

MODULE - I: INTRODUCTION TO DISCRETE TIME SIGNAL PROCESSING (9)

Introduction to discrete time signals, review of signals and systems: discrete time complex exponentials and other basic signals, analysis of discrete time linear time invariant systems. Introduction to discrete convolution, impulse response and convolution sum, convolution of infinite sequences, circular shift

and circular symmetry, periodic and circular convolution.

MODULE - II: TRANSFORM ANALYSIS OF SYSTEMS (9)

Introduction to Discrete Fourier Transform (DFT), Inverse DFT (IDFT), Properties of DFT, Relation between Z-Transform and DFT, Linear Convolution using DFT. Introduction to Fast Fourier Transform, Decimation in time radix-2FFT, Decimation in frequency radix-2 FFT.

MODULE - III: DESIGN OF INFINITE IMPULSE RESPONSE (IIR) FILTERS (9)

Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by impulseinvariant and bilinear transformation methods.

Frequency transformations and basic structures of IIR filters.

MODULE -IV: DESIGN OF FINITE IMPULSE RESPONSE (FIR) FILTERS (9)

Characteristics of FIR filters with linear phase, frequency response of linear phase FIR filters, Design of FIR filters using windows (Rectangular, Triangular and Hanning), Basic structures of FIR filters and Comparison of IIR & FIR filters.

MODULE -V: IIR DIGITAL FILTERS (9)

IIR Digital Filters: Analog Filter Approximations - Butterworth and Chebyshev, Design of IIR Digital filters from Analog Filters, Bilinear Transformation Method.

Analog Filter Approximations - Butterworth and Chebyshev, Design of IIR Digital filters from Analog Filters, Bilinear Transformation Method.

V. TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", 4th Edition, Pearson Education / PHI, 2007.
2. A. Anand Kumar, "Digital Signal Processing", 2nd Edition, PHI, Eastern Economy edition, 2015.

VI. REFERENCE BOOKS:

1. A.V. Oppenheim and R.W. Schafer, "Discrete-Time Signal Processing", 3rd Edition, PHI, 2010.
2. S.K. Mitra, "Digital Signal Processing – A practical approach", 4th Edition (Indian Edition), McGraw HillEducation, 2013.
3. M.H. Hayes, "Digital Signal Processing: Schaum's Outlines", 4th edition, Tata Mc-Graw Hill, 2011.
4. Robert. J. Schilling, Sandra. L. Harris, "Fundamentals of Digital Signal Processing using MATLAB",3rd Edition, Cengage Learning, 2016.

VII. WEB RESOURCES:

1. <https://nptel.ac.in/courses/108/105/108105055/>
2. <https://nptel.ac.in/courses/117/102/117102060/>

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Assignments
4. Model question paper - I
5. Model question paper - II
6. Lecture notes
7. Power point presentations
8. Early Lecture Readiness Videos