Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Diploma Engineering College
Semester–5

Subject: Digital Signal Processing - DETEC15214

Type of course: Minor Stream

Prerequisite: Signals and Systems, Digital Electronics, Communication Engineering Fundamentals

Rationale:

Digital signal processing plays a vital role in modern communication and electronic systems. This course introduces fundamental concepts of discrete-time signals, systems, and signal processing techniques. It enables students to understand and analyze digital signals and apply basic DSP operations used in real-world applications such as audio processing, communication, and control systems

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
3	0	2	4	60	30	10	20	30	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical;C – Credit;ESE - End SemesterExamination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment;

Course Content:

Unit No	Course content	Hrs	% Weightage
1	**Introduction to Signals and Systems** Classification of signals, continuous-time and discrete-time signals, basic signal operations (shifting, scaling, folding), elementary signals, introduction to systems, properties of systems (linearity, time invariance, causality, stability), representation of discrete-time signals.	9	20%

2	**Discrete-Time Signal Processing** Discrete-time signal representation and sequences, linear convolution, graphical and analytical methods of convolution, correlation of discrete-time signals and its applications	9	20%
3	**Z-Transform and System Analysis** Introduction to Z-transform, properties of Z-transform, inverse Z-transform using standard methods, region of convergence (ROC) and its significance, application of Z-transform in system analysis and stability	9	20%
4	**Frequency Domain Analysis** Need for frequency domain representation, discrete-time Fourier transform (DTFT), discrete Fourier transform (DFT), properties of DFT, relationship between DTFT and DFT, introduction to fast Fourier transform (FFT), advantages of FFT over DFT, applications of frequency domain analysis.	9	20%
5	**Digital Filters and Applications** Introduction to digital filters, classification of digital filters, FIR and IIR filters, basic difference equations, realization of simple digital filters, comparison of FIR and IIR filters, concept of frequency response, applications of digital filters in audio processing, communication systems, and noise reduction.	9	20%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Signal Visualization and Analysis** Students will generate and analyze different types of discrete-time signals (unit step, ramp, sinusoidal, exponential) using software tools (e.g., MATLAB/Python) or graph plotting methods. They will perform basic operations such as shifting, scaling, and folding, and interpret the results. Upload Document on GMIU Web Portal. (No. of Students per group - 03)	10
2	**Convolution and System Response Study** Students will perform convolution of two discrete-time signals using graphical/manual method or simulation tools and verify the output. They will analyze how input signals affect system response.Upload Document on GMIU Web Portal. (No. of Students per group - 03)	10
3	**Frequency Analysis using DFT/FFT** Students will analyze a given signal in time and frequency domain using DFT/FFT (via MATLAB/Python or any DSP tool). They will compare results, observe spectral components, and explain practical significance in applications like audio signals. Upload Document on GMIU Web Portal. (No. of Students per group - 03)	10
Total		**30**

List of Practical:

Sr. No	Title	Unit No	Hrs
1	Study of discrete-time signals and generation of basic signals such as unit step, impulse, ramp, and sinusoidal sequences	1	2
2	Perform basic operations on discrete-time signals such as shifting, scaling, and folding	1	2
3	Representation and plotting of discrete-time signals using MATLAB/Python	1	2
4	Verification of linearity and time invariance properties of discrete-time systems	1	2
5	Linear convolution of two discrete-time sequences using graphical method	2	2
6	Linear convolution of two discrete-time sequences using MATLAB/Python	2	2
7	Determination of correlation between discrete-time signals	2	2
8	Computation of auto-correlation and cross-correlation of sequences	2	2
9	Study and implementation of Z-transform of discrete-time sequences	2	2
10	Determination of inverse Z-transform using standard methods	2	2
11	Analysis of stability of discrete-time systems using Z-transform	2	2
12	Computation of Discrete Fourier Transform (DFT) of a sequence	3	2
13	Frequency spectrum analysis using Fast Fourier Transform (FFT)	3	2
14	Design and implementation of FIR digital filter	4	2
15	Design and implementation of IIR digital filter and comparison with FIR filter	4	2
	TOTAL		**30**

Suggested Specification table with Marks (Theory): NA

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	30%	30%	25%	10%	5%	0%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes:

After learning the course the students should be able to:	
CO1	Classify and represent continuous-time and discrete-time signals, perform basic signal operations, and analyze the properties of systems
CO2	Apply discrete-time signal processing techniques to perform convolution and correlation of discrete-time signals
CO3	Analyze discrete-time systems using Z-transform, determine the region of convergence, and evaluate system stability.
CO4	Analyze signals in the frequency domain using DTFT, DFT, and FFT, and interpret their significance in signal processing applications.
CO5	Compare FIR and IIR digital filters, realize simple digital filters, and apply digital filtering techniques to communication, audio processing, and noise reduction systems.

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment. Viva examination will be conducted at the end of semester for evaluation of performance of students in the viva session.

Reference Books:

[1] S.K. Mitra, Digital Signal Processing: A Computer-Based Approach, McGraw Hill.

[2] John G. Proakis and Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Pearson.

[3] Alan V. Oppenheim and Ronald W. Schafer, Discrete-Time Signal Processing, Pearson.

[4] Tarun Kumar Rawat, Digital Signal Processing, Oxford University Press.

[5] Richard G. Lyons, Understanding Digital Signal Processing, Pearson Education.