Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Diploma Engineering College
Semester-4

Subject: Signal and System - DETEC14209

Type of course: Professional Elective Courses

Prerequisite: Electrical circuits and networks, Mathematics.

Rationale:

This course lays a solid ground work in signals and systems, crucial for communication and signal processing. Students will explore continuous-time and discrete-time signals and systems, along with different transforms for their analysis. Additionally, they will study the effects of sampling on a signal's spectrum.

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-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No.	Course content	Hrs	% Weight age
1.	**Introduction to Signals** Definition and meaning of signal, Classification of signals: Continuous-time and discrete-time ,Analog and digital ,Periodic and aperiodic ,Even and odd, Energy and power signals, Standard signals: Unit step, ramp, impulse, exponential, sinusoidal, pulse, Basic signal operations: Shifting (time shift), Scaling (amplitude/time scaling), Addition and multiplication of signal	12	25%

2.	**Classification and Properties of Systems** Definition of System, Continuous-time and Discrete-time systems. System properties: Linearity, Time-invariance, Causality, Stability.	8	20%
3.	**Time Domain Analysis of LTI Systems** Definition of Linear Time-Invariant (LTI) systems, Impulse response of a system, Convolution and its physical meaning: Graphical representation of convolution, Discrete-time convolution (basic concept only), Step and impulse response of RC and RL circuits, Relationship between input, output, and system.	8	20%
4.	**Laplace Transform** Introduction, Complex Frequency and s-Plane, Laplace Transform and Inverse Laplace Transform, Region of Convergence (ROC), Properties of Laplace Transform, Poles and Zeros of System Functions and Signals, ROC Properties for Laplace Transform, Inverse Laplace Transform.	12	25%
5	**Digital Signal Sampling** Unit Specifics, Rationale, Prerequisites, Unit Outcomes, Introduction to Sampling, Sampling Theorem, Reconstruction of Signals Using Interpolation, Aliasing and Its Effects.	5	10 %

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Signal Identification and Classification** Students will analyze different types of signals (continuous/discrete, periodic/aperiodic, even/odd) from real-world examples like ECG signals, audio waves, and sensor data, then classify them based on their properties. Upload report on GMIU web portal.	10
2	**Response of RC/RL Circuit** Students are required to apply a step or impulse input to a simple RC or RL circuit observe the output waveform .(Using Software). Analyze the transient and steady-state response of the circuit. Upload the report on GMIU web portal.	10
3	**Sound Sampling Demo** Students are required to prepare a voice recording at different sampling rates using software,8 kHz, 22 kHz, and 44 kHz. Analyze the effect of sampling rate on the recorded signal. Upload report on GMIU web portal. (No. of students per group - 02)	10
Total		30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	30%	15%	15 %	20%	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 Outcome:

After learning the course, the students should be able to:	
CO1	Identify and describe different types of signals and systems.
CO2	Perform time-domain analysis using impulse response and convolution.
CO3	Apply Fourier and Laplace transforms for signal analysis.
CO4	Determine system stability using poles and zeros.
CO5	Understand sampling process used in digital communication.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs
1.	Write a MATLAB program to plot the following continuous time and discrete time signals. i. Step Function ii. Impulse Function iii. Exponential Function iv. Ramp Function v. Sine Function	1	2
2.	Write a MATLAB program to perform amplitude-scaling, time-scaling and time shifting on a given signal.	1	2
3.	Write a MATLAB program to compute autocorrelation of a sequence x(n) and verify the property.	1	2
4.	Write a MATLAB program to compute cross-correlation of sequences x(n) and y(n) and verify the property.	2	2
5.	Write a MATLAB program to find the impulse response and step response of a system from its difference equation.	2	4
6.	Compute and plot the response of a given system to a given input.	2	2
7.	Write a MATLAB program to obtain linear convolution of the given sequences.	2	2
8.	Write a program to find Fourier transforms of a given signal. Plot its amplitude and phase spectrum	3	2

9.	Fourier Series and Gibbs Phenomenon a. To calculate Fourier series coefficients associated with Square Wave. b. To Sum the first 10 terms and plot the Fourier series as a function of time. c. To Sum the first 50 terms and plot the Fourier series as a function of time	3	4
10.	Determination of frequency response from poles and zeroes	4	2
11.	To plot pole-zero diagram in S-plane/Z-plane of given signal/sequence and verify its stability.	5	2
12.	To find the impulse response of a system described by Z transform	5	2
13.	Implementation of interpolation and decimation concept	6	2
	Total		**30**

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

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] A. Kumar, Signal and Systems, 3rd ed., PHI.
[2] A. V. Oppenheim, A. S. Wilsky, and I. T. Nawab, Signals and Systems, Prentice Hall.
[3] K. Gopalan, Signals and Systems, Cengage Learning (India Edition).
[4] M. J. Roberts and G. Sharma, Signals and Systems, Tata McGraw Hill Publications.
[5] S. Haykin and B. Van Veen, Signals and Systems, Wiley India Publications.
[6] C. L. Philips, J. M. Parr, and E. A. Riskin, Signal, Systems and Transforms, Pearson Education.