GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering (Part Time)
Subject Code: 2921102

SUBJECT: SIGNALS AND SYSTEMS
SEMESTER – II

Type of course: Foundation of signals and systems for electrical, electronics and electronics and communication engineering

Prerequisite: Differential equations and difference equations, Laplace Transform, Electrical circuits and networks,.

Rationale: The course will provide strong foundation on signals and systems which will be useful for creating foundation of communication and signal processing. The students will learn basic continuous time and discrete time signals and systems. Student will understand application of various transforms for analysis of signals and systems both continuous time and discrete time. Students will also explore effect of sampling on spectrum of signal.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE(E)	PA	ESE (V)	PA(I)	
3	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction to Signals & Systems:** Basic definitions of signals and systems, Basic elementary signals, Classification of signals and systems. Signal operations and properties. Basic continuous time signals, Basic system properties, Case study of different signals	4	10
2	**Behaviour of Continuous time (CT)& Discrete Time(DT) Linear Time Invariant (LTI) System:** Impulse response characterization and convolution for CT- LTI and DT-LTI systems, Properties of LTI systems,LTI systems characterized by Differential and difference equations	12	25
3	**Introduction to Fourier Series, Fourier Transform:** Fourier Series Representation of periodic Signals, Fourier series, Waveform Symmetries, Calculation of Fourier Coefficients, Frequency spectrum of aperiodic signals, Fourier Transform, Relation between Laplace Transform and Fourier Transform. Properties of Continuous Time Fourier transform. System Analysis using Fourier Transform. Introduction to DTFT and DFT.	12	25
4	**Z Transform:** The z-Transform, Convergence of z-Transform, , Properties of z-Transform, Inverse z-Transform , LTI System analysis from Linear Constant Coefficient Difference Equations using z-Transform	12	25
5	**Sampling & Reconstruction:** Representation of digital signals, The Sampling Theorem, Sampling with a zero order hold, Reconstruction of a signal from its samples using interpolation, Aliasing and its effects.	5	15
Total		**45**	**100**

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Suggested Specification table* with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**10**	**20**	**20**	**5**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

**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 from above table.*

Books:

1. Signal and Systems By Anand Kumar, 3rd Edition, PHI
2. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall
3. Signals and Systems by K. Gopalan, Cengage Learning (India Edition)
4. Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications
5. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley-India Publications
6. Linear Systems and Signals by B.P.Lathi, Oxford University Press
7. Signal, Systems and Transforms by Charles L. Philips, J. M. Parr and E. A. Riskin, Pearson Education
8. Digital Signal Processing Fundamentals and Applications by Li Tan, Elsevier, Academic Press

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand about various types of signals, classify them, analyze them, and perform various operations on them.	
CO-2	Understand about various types of systems, classify them, analyze them and understand their response behavior.	
CO-3	Appreciate use of transforms in analysis of signals and system.	
CO-4	Carry simulation on signals and systems for observing effects of applying various properties and operations.	
CO-5	Create strong foundation of communication and signal processing to be studied in the subsequent semester	

List of Experiments:

1. Generations and capturing various continuous time signals from sensors.
2. Generation and capturing of discrete time signals and plot them.
3. Discretization using different sampling rate and observing aliasing effect.
4. Observing the effects of lower sampling rate and higher sampling rate on CT signal.
5. Performing various operations on the signal using circuits and computational software.
6. Using digital circuit building block to perform operations on signals.
7. Simulation of continuous time LTI system.
8. Simulation of discrete time LTI systems.

9. Obtaining impulse response of the systems.
10. Computing FT and DTFT of the CT signals and DT sequences.

Open Ended Problems

1. Design of active noise removal / cancellation circuit.
2. Design of digital building blocks to perform various operations on discrete time sequences and signals.
3. Design of efficient and accurate signal converter.
4. Design of sample and hold circuits
5. Design of anti aliasing filter.

Major Equipments:

Computers, analog circuit blocks, digital circuit blocks, signal generators, digital storage oscilloscope and spectrum analyser

List of Open Source Software/learning website:

1 SEQUEL
2 SCILAB
3 NPTEL Videos
4 MIT open course ware website
5 MATLAB