SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

B. Tech. Year II: Semester – 3

Subject Name: Signals and Systems **Subject Code: BTIC13301**

Type of course: PCC

Prerequisite (if any): Basic knowledge of Mathematics, especially integration, differentiation and complex numbers.

List of Courses where this course will be prerequisite: Control Theory, Digital Signal Processing

Rationale:

This course will provide the students (i) abstraction of signals and systems, from the point of view of analysis and characterization (ii) to analyze Linear Time Invariant (LTI) systems in time and transform domains, and (iii) to build foundation for understanding of courses such as control system and signal processing. (iv) to develop mathematical skills to solve problems involving convolution, filtering

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

BSC: basic science course /ESC: Engineering Science Course /HSM: Humanities and management /PCC: Professional Core course /PEC: professional Elective course /OEC: Open Elective course/ MD: mandatory noncredit course

Content:

Sr. No.	Content	Total Hrs	Module Weightage
1	Introduction to Signal and System Introduction and Classification of Continuous Time Signals, Discrete Time Sequences and Systems, Unit impulse, step signal, Exponential and Sinusoidal signal. Elementary Operations on Signals and Sequences, Properties of Systems	**06**	**13%**
2	Linear Time Invariant System Discrete-Time (DT) LTI Systems: The Convolution Sum; Continuous-Time(CT) LTI Systems: The Convolution Integral; Properties of Linear Time-Invariant Systems; Causal LTI systems described by Differential and Difference Equations.	**05**	**11%**
3	Fourier Representation of Periodic Signals Fourier series representation of CT and DT as a linear combination of harmonically related complex exponentials properties (No derivation) and basic problems.	**06**	**13%**
4	Fourier Representation of aperiodic Signals FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance with derivation. Using Convolution property response of the systems Characterized by Linear Constant-Coefficient Differential Equations FT representation of aperiodic DT signals- DTFT, definition, DTFT of standard discrete signals, Properties and their significance	**08**	**17%**

5	Laplace Transform Introduction, Definition, Region of convergence (ROC), Inverse Laplace transform, Properties of the Laplace transform, Analysis and characterization of LTI systems using the Laplace transform: Causality, Stability	**09**	**20%**
6	Z transform Introduction, Definition, Region of convergence (ROC), Inverse z-tra Geometric evaluation of the Fourier transform from the pole-zero plot order and Second order systems, Prove the properties of the Z-tra Analysis and characterization of LTI systems using Z-transform, function algebra and block diagram representations.	**09**	**20%**
7	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.	**03**	**6%**

Suggested Specification table with Marks (Theory): (For B Tech only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20%	**25%**	**10%**	**20%**	**25%**	**0%**

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

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.

Reference Books:

Sr no	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Signals & Systems	Alan V. Oppenheim, Alan S. Willsky and S.Hamid Nawab,	PHI publications. ISBN 0-13–814757–4	1997	2nd Edition
2	Signal and Systems	Anand Kumar	PHI		3rd Edition
3	Signals and Systems	Simon Hay-kin and Barry Van Veen	John Wiley and Sons	2004	2nd Edition

Course Outcomes: After successfully completing this course, the student will be able to,

Sr. No.	CO statement	Marks % weightage
CO-1	classify various signals and systems and perform various operations on signals.	20%
CO-2	perform the process of convolution between signals and understand its implication for analysis of linear time-invariant systems. Understand the notion of an impulse response.	10%
CO-3	analyze the spectral characteristics of continuous-time periodic and aperiodic signals using Fourier analysis.	25%
CO-4	demonstrate the use of various transforms and their properties in analysis of signals and LTI systems in CT and DT domain.	45%

Mapping of CO-POs

	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			2							1	3	3	
CO2	3	3			2							1	3	3	
CO3	3	3			2							1	3	3	
CO4	3	3			2							1	3	3	

List of Open learning website:

https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/

NPTEL lectures on signals and systems

https://onlinecourses.nptel.ac.in/noc21_ee28/preview

List of Open Source Software:

Scilab simulation software

FOR LAB SESSIONS:

List of Experiments:

1. Aquire various continuous time signals from sensors and visualize on CRO.
2. Aquire various discrete time signals and plot them.
3. Using Matlab/Scilab simulation tool, Generate an impulse, step, exponential signal with different parameter values and sinusoidal waveform of different frequencies in continuous and discrete domain.
4. Perform mathematical operations on signals of equal and different lengths.
5. Find the discrete convolution between two sequences/signals. Verify the commutative, distributive and associative properties of convolution.
6. Find the Fourier Series Coefficients for a given signal. Draw the magnitude and phase spectrum.(Analysis and Synthesis)
7. Given an LTI system with transfer function, plot its (i) pole-zero plot in the z-plane and (ii) frequency response

8. Obtaining impulse response of the systems.
9. To Study the First order RC filter(low pass and High pass) and draw their frequency response.
10. Perform CTFT and DTFT operation on signals.
11. Locate the poles and zeros of continuous time system whose transform is taken using Laplace. Relate the stability of the system with its poles location.

Major Equipment Needed:

Computer Lab
MATLAB/Scilab software, CRO, DSO