CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Electrical Engineering)**

Semester: **IV**

Course Code: **202050404**

Course Title: **Signals and Systems**

Course Group: **Professional Core Course V**

Course Objectives: In today's era of automation, the interfacing of various parts of the systems specifically need to calculate and estimate about signals and systems. Every domain expects engineers to be fundamentally clear about the signals and systems. This course introduces the characteristics and properties of signals and systems and provides fundamental tools for their analysis and representation. This course aims to provide detailed description Signals and System Analysis. Fourier series and Fourier transform, Laplace and Z Transform along with respect to SISO systems and State variable analysis for MIMO systems.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25/9	25 / 9	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Fundamentals of Signals and Systems:** Representations of Signals, Classifications of Signals – Continuous time, Discrete time, comparison among Analog, Digital and Discrete Signals, Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, and the complex exponential. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Related examples.	10

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2	**Behavior of continuous and discrete-time LTI systems:** Impulse response and step response, convolution, input-output behavior with periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.	**10**
3	**Fourier Series & Fourier Transform:** Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.	**12**
4	**Laplace and z- Transforms:** Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.	**10**

List of Practicals / Tutorials:

1	Introduction to MATLAB and its functions for Signals and Systems.
2	Write programs to generate the discrete sequences (i) unit step (ii) unit impulse (iii) ramp (iv) periodic sinusoidal sequences. Plot all the sequences.
3	Various Matrix Operations & Plotting using MATLAB.
4	Perform operations on signals using digital circuit building blocks.
5	To perform Fourier transform of continuous time signals.
6	To perform Fourier series representation of continuous time signals.
7	MATLAB programs related to Convolution on Continuous Time Signals.
8	MATLAB programs related to Convolution on Discrete Time Signals.
9	MATLAB programs related for Computation of DFT.
10	Perform Z transform of discrete time signals.
11	To perform DFT & FFT algorithms using Matlab.
12	To perform Laplace Transforms using Matlab.
13	Simulation of continuous and discrete time LTI systems.

Reference Books:

1	Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall
2	Signals and Systems by K. Gopalan, Cengage Learning (India Edition)
3	Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications
4	Signals and Systems by Simon Haykin and Bary Van Veen, Wiley- India Publications
5	Signal, Systems and Transforms by Charles L. Philips, J. M. Parr and E. A. Riskin, Pearson Education

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6	Signal and Systems by Anand Kumar, 3rd Edition, PHI
7	B.P.Lathi, "Linear Systems and Signals", Oxford University Press
8	Erwin Krezyg, "Advanced Engineering Mathematics", John Wiley & Sons.
9	Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall

Supplementary learning Material:	
1	www.nptel.com
2	https://electrical-engineering-portal.com/
3	https://www.electrical4u.com/
4	www.allaboutcircuits.com

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation: The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
30%	20%	20%	20%	10%	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 (CO):

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Sr.	Course Outcome Statements	%weightage
CO-1	Apply knowledge of mathematics and Engineering fundamentals to Identify and characterize different classes of signals and systems	**20**
CO-2	Identify, formulate the methodology to compute the response and analyze the properties of an LTI system	**20**
CO-3	Identify Fourier Representations and analyze the signals in time and frequency domain.	**15**
CO-4	Apply Fourier representations to analyze sampling process and mixed signals	**15**
CO-5	Apply ZT for broader characterization of discrete time signals and LTI systems.	**15**
CO-6	Demonstrate, Analyze, Compute the basic characteristics of Signals and Systems using software tools	**15**

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2025

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