Course Code	18ECC104T	Course Name	SIGNALS AND SYSTEMS	Course Category	C	Professional Core	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	18MAB201T	Progressive Courses	18ECC204J, 18ECS201T, 18ECE240T, 18ECE241J
Course Offering Department	Electronics and Communication Engineering	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Know about requirements of signal and system analysis in communication.
CLR-2 :	Understand the analysis of Periodic and Aperiodic Continuous time Signals using Fourier series and transforms
CLR-3 :	Educate about Continuous time system through Laplace transform and Convolution integral
CLR-4 :	Understand the characterization of the Discrete time signals and system through DTFT, Convolution sum
CLR-5 :	Understand the concept of Z-Transform for the analysis of DT system
CLR-6 :	Develop expertise in time-domain and frequency domain approaches to the analysis of continuous and discrete systems and also the ability to apply modern computation software tool for the analysis of electrical engineering problems

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)															
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO–1: Professional Achievement	PSO – 2: Project Management Techniques	PSO – 3: Analyze & Research
CLO-1 :	Acquire knowledge of various classifications of Signals and Systems	1	85	70	H	-	-	-		-	-	-	-	-	-	-	-	-	-
CLO-2 :	Analyze Periodic and Aperiodic Continuous time Signals using Fourier series and Fourier Transform	2	85	70	H	M	-	-	M	-	-	-	-	-	-	-	-	-	-
CLO-3 :	Analyze and characterize the Continuous time system through Laplace transform and Convolution integral.	2	85	70	H	M	-	-	M	-	-	-	-	-	-	-	-	-	-
CLO-4 :	Analyze and characterize the Discrete time signals and system through DTFT, Convolution sum	2	85	70	H	M	-	-	M	-	-	-	-	-	-	-	-	-	-
CLO-5 :	Analyze and characterize the Discrete time system using Z transform	2	85	70	H	M	-	-	M	-	-	-	-	-	-	-	-	-	-
CLO-6 :	Present the mathematical techniques used for continuous-time signal and discrete-time signal and system analysis	3	85	70	H	M	-	-	-	-	-	-	-	-	-	L	L	-	-

Duration (hour)		Classification of Signals and Systems	Analysis of Continuous Time Signals	Analysis of LTI CT System	Analysis of DT Signals and Systems	Analysis of LTI DT System using Z-Transform
		12	12	12	12	12
S-1	SLO-1	Introduction to signals and systems	Introduction to Fourier series	System modeling	Representation of sequences	Z transform – introduction
	SLO-2	Requirements of signal and system analysis in communication	Representation of Continuous time Periodic signals	Description of differential equations	Discrete frequency spectrum and range	Region of convergence of finite duration sequences
S-2	SLO-1	Continuous time signals (CT signals)	Fourier series: Trigonometric representation	Solution of Differential equation	Discrete Time Fourier Transform (DTFT) – Existence	Properties of ROC
	SLO-2	Discrete time signals (DT signals)	Fourier series: Trigonometric representation	Differential equation: Zero initial conditions	DTFT of standard signals	Properties of ROC
S-3	SLO-1	Representation of signals: Step, Ramp, Pulse, Impulse	Fourier series: Cosine representation	Differential equation: Zero state response	Properties of DTFT	Properties of Z transform
	SLO-2	Representation of signals: Sinusoidal, Exponential	Fourier series: Cosine representation	Differential equation: Zero Input response	Properties of DTFT	Properties of Z transform
S-4	SLO-1	Basic operation on the signals	Symmetry conditions	Total Response	Inverse DTFT	Unilateral z transforms
	SLO-2	Problems on signal operations	Properties of Continuous time Fourier series	Step response	Practice on IDTFT	Properties of z transform
S-5	SLO-1	Classification of CT and DT signals: Periodic & Aperiodic signals.	Practice problems on Fourier series	Impulse response	Impulse response of a system with DTFT	Bilateral Z transforms
	SLO-2	Classification of CT and DT signals: Deterministic & Random signals.	Practice problems on Fourier series	Frequency response	Frequency response of a system with DTFT	Properties of z transform

S-6	SLO-1	*Energy signal*	*Gibb's Phenomenon*	*Convolution integral*	*Practice problems*	*Relation between DTFT and Z transform*
	SLO-2	*Power signal*	*Parseval's relation for power signals*	*Properties of convolution*	*Practice problems*	*Practice problems*
S-7	SLO-1	*Even & Odd signals*	*Power density spectrum,*	*Practice Problems*	*Solution of linear constant coefficient difference equations*	*condition for causality in Z domain*
	SLO-2	*Even & Odd signals*	*Frequency spectrum.*	*Practice Problems*	*Initial conditions*	*condition for stability in Z domain*
S-8	SLO-1	*CT systems and DT systems*	*Fourier transform: Introduction*	*Signal and system analysis with Laplace transform*	*Solution of difference equations*	*Inverse Z transform*
	SLO-2	*Classification of systems: Static & Dynamic*	*Representation of Continuous time signals*	*Convergence of Laplace Transform*	*Zero input response*	*Power series expansion*
S-9	SLO-1	*Superposition theorem*	*Properties of Continuous time Fourier transform*	*Properties of Laplace transform*	*Solution of difference equations with Zero state response*	*Inverse Z transform with Partial fraction*
	SLO-2	*Linear & Nonlinear system*	*Properties of Continuous time Fourier transform*	*Properties of Laplace transform*	*Total response*	*Inverse Z transform with Partial fraction*
S-10	SLO-1	*Time-variant & Time-invariant system*	*Parseval's relation for energy signals*	*Inverse Laplace transform*	*Evaluation of Impulse response*	*Residue method*
	SLO-2	*Time-invariant system*	*Energy density spectrum*	*Problems*	*Evaluation of Step response*	*Convolution method*
S-11	SLO-1	*Causal system*	*Analysis of LTI system using Fourier Transform*	*Analysis and characterization of LTI system using Laplace transform*	*Convolution Properties*	*Analysis and characterization of DT system using Z-transform*
	SLO-2	*Noncausal system*	*Analysis of LTI system using Fourier Transform*	*Analysis and characterization of LTI system using Laplace transform*	*Convolution Sum*	*Analysis and characterization of DT system using Z-transform*
S-12	SLO-1	*Stable & Unstable,LTI System*	*Practice problems on Fourier Transform*	*Practice problems on Laplace transform*	*Circular convolution*	*Practice problems on LTI-DT systems in Z transform*
	SLO-2	*Unstable, LTI System*	*Practice problems on Fourier Transform*	*Practice problems on Laplace transform*	*Frequency response*	*Practice problems on LTI-DT systems in Z transform*

Learning Resources	1. *Alan V Oppenheim, Ronald W. Schafer Signals & Systems, 2nd ed., Pearson Education, 2015* 2. *P.Ramakrishna Rao, Shankar Prakriya, Signals & Systems, 2nd ed., McGraw Hill Education, 2015* 3. *Simon Haykin, Barry Van Veen, Signals and Systems, 2nd ed., John Wiley & Sons Inc., 2007* 4. *Lathi B.P, Linear Systems & Signals, 2nd ed., Oxford Press, 2009*	5. *John G. Proakis, Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, 4th ed., Pearson Education, 2007.* 6. *Software: Matlab Student Version Release 2011a, Mathworks, Inc. The Matlab Student Version and toolboxes may be purchased through the Mathworks website at http://www.mathworks.com/*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

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