## SIGNALS AND SYSTEMS

Course Code		Category	Hours / Week			Credits	Maximum Marks		
AECB14 Contact Classes: 45		CORE Tutorial Classes: Nil	L	Т	Р	С	CIA	SEE	Total
			3	1	-	4	30	70	100
			Practical Cla			sses: Nil	Total Classes: 45		
OBJECT The stud	TIVES: ents will try to	learn:	lysis of	fcontin		and discret	a tima si	male in ti	ime and
I	frequency don The Fourier tra	nains. nsform, Laplace and Z- tra	nsform	s and the	heir pr	operties to	analyze	the signa	ls and
III	systems The temporal a	and spectral characteristics	of Ran	ndom p	rocess	and the ex	traction	of Signal	from
IV	The sampling, applications	ung. quantization and reconstru	iction r	requirer	nents	for digital	signal pr	ocessing	
COURSE	COUTCOMES	totion of the course Sta	•	•11.1					
Atter su	ccessiui comp	neuon of the course, Su	udents	s will b	e abl	e to			
CO 1	Summarize th mathematical	e basic signalsexponential, operations on signals.	sinuso	<b>will b</b> idal, in	npulse	e to , unit step	and sigm	umfor per	forming
CO 1 CO 2	Summarize th mathematical Demonstrateth functions.	e basic signalsexponential, operations on signals. ne concepts of vector algeb	sinuso sinuso ra for a	<b>will b</b> idal, in approxi	npulse mating	e to , unit step g a signal y	and signu with the c	umfor per orthogona	forming 1
CO 1 CO 2 CO 3	Summarize th mathematical Demonstrateth functions. Explainthespe	e basic signalsexponential, operations on signals. ne concepts of vector algeb	sinuso ra for a nals usin	s <b>will b</b> vidal, in approxi ng Fou	npulse mating rier se	e to , unit step g a signal v ries and Fo	and signu with the courier tra	umfor per orthogona nsforms.	forming 1
CO 1 CO 2 CO 3 CO 4	Summarize th mathematical Demonstrateth functions. Explainthespe Make use of F systems.	e basic signalsexponential, operations on signals. ne concepts of vector algeb ectral characteristics of sign Fourier transform and its pr	sinuso ora for a nals usin opertie	s <b>will b</b> idal, in approxi ng Fou sfor de	npulse mating rier se termin	e to , unit step g a signal v ries and Fo he the frequ	and signu with the courier transition transition to the second se	umfor per orthogona nsforms. ponse of	forming l
CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	Summarize th mathematical Demonstrated functions. Explainthespe Make use of F systems. Identify the I time invarian	e basic signalsexponential, operations on signals. ne concepts of vector algeb ectral characteristics of sign Fourier transform and its pr inearity and time invariant system.	sinuso ra for a nals usin opertie nce pro	s will b idal, in approxi ng Fou sfor de opertie	npulse mating rier se termin s for o	e to , unit step g a signal v ries and Fo he the frequ obtaining	and signu with the o purier tra- nency res the beha	umfor per orthogona nsforms. ponse of <b>viour of</b> b	forming l the <b>linear</b>
CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7	Summarize th mathematical Demonstrated functions. Explainthespe Make use of F systems. Identify the I time invarian Classifythe id signal and syst Illustratethe	e basic signalsexponential, operations on signals. ne concepts of vector algeb ectral characteristics of sign Fourier transform and its pr <b>inearity and time invariant system.</b> leal low pass, high pass, h stem bandwidth. Laplace and Z-transform	sinuso ra for a nals usin opertie nce pro pand pa	s will b idal, in approxi ng Fou sfor de opertie ass and nalysin	mating mating rier se termin s for ( band g the (	e to , unit step g a signal v ries and Fo he the frequ obtaining stop filter continuou	and signa with the o purier tra- nency res the beha rsfor det s and dis	umfor per orthogona nsforms. ponse of viour of ermining crete tim	forming l the <b>linear</b> g the ne
CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7 CO 8	Summarize th mathematical Demonstrated functions. Explainthespee Make use of F systems. Identify the It time invarian Classifythe ic signal and syst Illustratethe signals and syst Apply theReg causal and nor	e basic signalsexponential, operations on signals. ne concepts of vector algeb ectral characteristics of sign Fourier transform and its pr <b>inearity and time invariant t system.</b> leal low pass, high pass, h stem bandwidth. Laplace and Z-transform ystems. gion of Convergence Prop neausal Signals.	sinuso ra for a nals usin opertie nce pro pand pa for an perties	s will b idal, in approxi ng Fou sfor de opertie ass and aalysing of Lap	mating mating rier se termin s for o band g the o lace a	e to , unit step g a signal v ries and Fo the the freque obtaining stop filter continuous nd z trans	and signa with the o purier tra- nency res the beha rsfor det s and dis formto r	amfor per orthogona nsforms. ponse of viour of l ermining crete time epresent	forming l the <b>linear</b> g the ne the
CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7 CO 8 CO 9	Summarize th mathematical Demonstrated functions. Explainthespee Make use of F systems. Identify the It time invarian Classifythe id signal and sys Illustratethe signals and sy Apply theReg causal and non Identifythe si	e basic signalsexponential, operations on signals. ne concepts of vector algeb ectral characteristics of sign Fourier transform and its pr inearity and time invariant t system. leal low pass, high pass, h stem bandwidth. Laplace and Z-transform systems. gion of Convergence Prop incausal Signals. milarities between two signals.	sinuso ra for a nals usin opertie nce pro pand pa ofor an perties gnalsus	s will b idal, in approxi ng Fou sfor de opertie ass and aalysing of Lap sing co	mating mating rier se termin s for o l band g the o lace a nvolu	e to , unit step g a signal v ries and Fo the the frequ obtaining toontinuous nd z trans tion and c	and signa with the o purier tra- nency res the beha rsfor det s and dis formto r	amfor per orthogona nsforms. ponse of f viour of f cermining crete time represent f on.	forming l the <b>linear</b> g the ne the
CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7 CO 8 CO 9 CO 10	Summarize th mathematical Demonstrated functions. Explainthespee Make use of F systems. Identify the It time invarian Classifythe id signal and sys Illustratethe signals and sy Apply theReg causal and non Identifythe si Make useofcr aperiodic sign	e basic signalsexponential, operations on signals. ne concepts of vector algeb ectral characteristics of sign Fourier transform and its pr inearity and time invariant t system. leal low pass, high pass, h stem bandwidth. Laplace and Z-transform systems. gion of Convergence Prop incausal Signals. milarities between two sign cosscorrelation functionfor nal.	sinuso ra for a nals usin opertie nce pro pand pa ofor an perties gnalsus or meas	s will b idal, in approxi ng Fou sfor de opertie ass and aalysing of Lap sing co suring	e abl npulse mating rier se termin s for o l band g the o lace a nvolu energ	e to , unit step g a signal y ries and Fo the the freque obtaining a stop filter continuous and z trans tion and c y spectral	and signa with the o purier tra- nency res the beha rsfor det s and dis formto r correlation density	amfor per orthogona nsforms. ponse of viour of l cermining crete tim represent on. of a given	forming l the <b>linear</b> g the ne the
CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7 CO 8 CO 9 CO 10 CO 11	Summarize th mathematical Demonstrated functions. Explainthespe Make use of F systems. Identify the I time invarian Classifythe id signal and sys Illustratethe signals and sy Apply theReg causal and non Identifythe si Make useofer aperiodic sign Utilizethe poy	e basic signalsexponential, operations on signals. ne concepts of vector algeb ectral characteristics of sign Fourier transform and its pr inearity and time invariant at system. leal low pass, high pass, histem bandwidth. Laplace and Z-transform systems. gion of Convergence Proponcausal Signals. milarities between two sign cosscorrelation function for nal.	sinuso ra for a nals usin opertie nce pro pand pa for an perties gnalsus or meas easure o	s will b idal, in approxi ng Fou sfor de opertie ass and aalysin of Lap sing co suring of powe	e abl npulse mating rier se termin s for ( l band g the ( lace a nvolu energ er in e	e to , unit step g a signal y ries and Fo the the freque obtaining stop filtes continuous nd z trans tion and c y spectral ach freque	and signu with the c ourier tra hency res the beha rsfor det s and dis formto r correlation density ncy comp	amfor per orthogona nsforms. ponse of viour of l ermining crete tim epresent on. of a given	forming l the <b>linear</b> g the ne the

**MODULE -I** SIGNAL ANALYSIS Classes: 09 Signal Analysis: Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonally in Complex functions, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function. **MODULE -II FOURIER SERIES** Classes: 09 Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum. Fourier Transforms: Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforminvolving Impulse function and Signum function, Introduction to Hilbert Transforms **MODULE -III** SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS Classes: 09 Linear System, Impulse response, Response of a Linear System, Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and **BPF** characteristics. Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution. MODULE -IV LAPLACE TRANSFORM AND Z-TRANSFORM Classes: 09 Laplace Transforms: Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T., Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis. Z-Transforms: Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms MODULE -V SAMPLING THEOREM Classes: 10 Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling. Correlation: Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parseval's Theorem, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Relation between Convolution and Correlation, Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of Signal from Noise by filtering **Text Books:** 1. Signals, Systems & Communications, B.P. Lathi, BS Publications, 2009. 2. Signals and Systems, A.V. Oppenheim, A.S. Willsky and S.H. Nawab ,PHI, 2<sup>nd</sup> Edition 2009. 3. Digital Signal Processing, Principles, Algorithms, and Applications, John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI. 2007. **Reference Books:** 1. Signals & Systems, Simon Haykin and Van Veen, Wiley, 2nd Edition, 2009. 2. Signals and Signals, Iyer and K. Satya Prasad, Cengage Learning, 2 nd Edition, 2009. 3. Discrete Time Signal Processing, A. V. Oppenheim and R.W. Schaffer, PHI, 2009. 4. Fundamentals of Digital Signal Processing, LoneyLudeman. John Wiley, PHI, 2009.