SIGNALS AND SYSTEMS

IV Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB14	CORE	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The students will try to learn:

I	Therepresentation, classification and analysis of continuous and discrete time signals in time and frequency domains.
II	The Fourier transform, Laplace and Z- transforms and their properties to analyze the signals and systems
III	The temporal and spectral characteristics of Random process and the extraction of Signal from Noise by filtering.
IV	The sampling, quantization and reconstruction requirements for digital signal processing applications

COURSE OUTCOMES:

After successful completion of the course, Students will be able to

CO 1	Summarize the basic signalsexponential, sinusoidal, impulse, unit step and signumfor performing mathematical operations on signals.
CO 2	Demonstratethe concepts of vector algebra for approximating a signal with the orthogonal functions.
CO 3	Explainthespectral characteristics of signals using Fourier series and Fourier transforms.
CO 4	Make use of Fourier transform and its propertiesfor determine the frequency response of the systems.
CO 5	**Identify the linearity and time invariance properties for obtaining the behaviour of linear time invariant system.**
CO 6	**Classifythe ideal low pass, high pass, band pass and band stop filtersfor determining the signal and system bandwidth.**
CO 7	**Illustratethe Laplace and Z-transform for analysing the continuous and discrete time signals and systems.**
CO 8	**Apply theRegion of Convergence Properties of Laplace and z transform**to represent the causal and noncausal Signals.
CO 9	**Identifythe similarities between two signalsusing convolution and correlation.**
CO 10	**Make useofcrosscorrelation functionfor measuring energy spectral density of a given aperiodic signal.**
CO 11	**Utilizethe power spectral density to** measure of power in each frequency component.
CO12	**Understand the procedure consists of processing the impulse train of samples** by an ideal bandpass filter

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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, 2nd 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.		