SIGNALS AND SYSTEMS

Course Code: 13EC1104

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Course Educational Objectives:

- To study and analyze characteristics of continuous and discrete time signals and systems.
- To familiarize with various signals & their transforms.

Course Outcomes:

- After completion of the course, students are able to
- Classify various signals and analyze their properties.
- Analyze various signals in time domain and frequency domain by using different transform techniques.

UNIT-I (12 lectures)

SIGNALS-SYSTEMS ANALYSIS:

Elementary signals, Classification of signals, Basic operations on signals, System definition, Systems Classification and Testing.

Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Orthogonality in complex functions.

UNIT-II (14 lectures)

FOURIER SERIES & FOURIER TRANSFORMS:

Review of Fourier series, Representation of Continuous time periodic signals using Fourier series, Dirichlet's conditions, Properties of Fourier series, Trigonometric Fourier series and Exponential Fourier series.

Fourier transform from Fourier series, Dirichlet's conditions, Fourier transform of standard and arbitrary signals, Fourier transform of periodic signals, Properties of Fourier transforms. Inverse Fourier Transforms.

UNIT-III (10 Lectures)

SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS:

System impulse response, Response of a linear system, Linear time variant and invariant system, Transfer function of a LTI system, Properties of LTI system, Causality, Filter characteristics of linear systems - Ideal LPF, HPF and BPF characteristics. Distortionless transmission through a system, Signal bandwidth, System bandwidth, relationship between bandwidth and rise time.

UNIT-IV (10 lectures)

CONVOLUTION AND CORRELATION OF SIGNALS:

Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution properties, Cross correlation and Auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Parseval's theorem, Relation between auto correlation function and energy/power spectral density function, comparison between ESD and PSD.

UNIT-V (14 lectures)

LAPLACE AND Z–TRANSFORM :

Review of Laplace transforms, Concept of region of convergence (ROC), constraints on ROC for various classes of signals, Properties of Laplace transforms, Inverse Laplace transform.

Concept of Z- Transform, Distinction between Laplace, Fourier and Z transforms, Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Properties of Z-transforms, Inverse Z-transform.

TEXT BOOKS:

1. B.P. Lathi, *"Signals, Systems & Communications"* BSPublications, 5th Reprint, 2008.
2. A.V. Oppenheim, A.S. Willsky and S.H.Nawab, *"Signals and Systems"*, PHI, 2nd Edition, 1997.
3. K.Raja Rajeswari, B.Visvesvara Rao, *"Signals & Systems"* –1st Edition, PHI, 2009.

REFERENCES:

1. Simon Haykin and Van Veen, *"Signals & Systems"*, Wiley, 2nd Edition, 2002.
2. Anand Kumar, *"Signals & Systems"* –2nd Edition, PHI, 2012.
3. D. Ganesh Rao, *"Signals & Systems"*, Pearson Publications, 2011
4. Charles L.Phillips, John M. Parr, Eve A. Riskin, *"Signals, Systems, and Transforms"*, Pearson Publications, 4th Edition.