JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (Autonomous) PULIVENDULA

II B.Tech I Sem (E.C.E) **L – T – P – C 3 - 0 – 0 - 3**

SIGNALS AND SYSTEMS

COURSE OBJECTIVES:

1. To understand the basic properties ofsignal&systems and LTI systems.
2. Tolearn Fourierseriesrepresentationof periodic signals.
3. To study representation of signals in continuous and discretetimeFouriertransform
4. To analyze thesampling theorem and characterizesignals & systems in time & frequency domain.
5. To apply Laplacetransform andZtransform to study about thestabilityofsystems.

UNIT I

Signals and Systems: Continuous and Discrete Time Signals, Transformations of the Independent Variable, Elementary Signals-Unit Impulse, Unit Step Functions, Ramp Signal, Rectangular function, Signum Function, Sinc& Sa Function, Exponential and Sinusoidal Signals, Classification of Signals & Systems, Continuous and Discrete Time Systems, Basic System Properties, Linear Time Invariant (LTI) Systems, Discrete-Time LTI Systems, Convolution Sum, Continuous Time LTI Systems, Convolution Integral, Properties of LTI Systems, Causal LTI Systems described by Differential and Difference Equations, Singularity Functions.

Learning Outcomes:

At the end of the unit, the student will be able to

- Understand different types of signals and systems.
- State the properties of LTI systems.

UNIT II

Fourier series representation of periodic signals: Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous Time Periodic Signals, Trigonometric, Polar, Exponential fourier Series & related problems, Convergence of the Fourier Series, Properties of Continuous Time Fourier Series, Fourier Series Representation of Discrete Time Periodic Signals, Properties of Discrete Time Fourier Series, Fourier Series and LTI Systems,

Learning Outcomes:

At the end of the unit, the student will be able to

- Describe continuous time signals and discrete time signal.
- Analyze the periodic signals by applying Fourier series.

UNIT III

The Continuous-Time Fourier Transform: Representation of aperiodic Signals, Continuous Time Fourier Transform, Fourier Transform for Periodic Signals, Properties of

the Continuous Time Fourier Transform, Systems characterized by Linear constant coefficient differential equations, Discrete Time Fourier Transform - Representation of Aperiodic Signals, Discrete Time Fourier Transform, Frequency Response, Systems Characterized by Linear Constant-Coefficient Difference Equations.

Learning Outcomes:

At the end of the unit, the student will be able to

- Analyze the differences between Fourier series and Fourier transforms.
- Represent the signals in continuous and discretetimeFouriertransform.

UNIT IV

Time & Frequency Characterization of Signals and Systems: The Magnitude Phase Representation of the Fourier Transform, Magnitude Phase Representation of the Frequency Response of LTI Systems, Time-Domain Properties of Ideal Frequency Selective Filters, Time Domain and Frequency Domain Aspects of Non-ideal Filters, Examples of Continuous time filters and Discrete time filters described by differential equations, First-Order and Second-Order Continuous and Discrete-Time Systems, Examples of Time and Frequency Domain Analysis of Systems,

Sampling: Representation of a Continuous Time Signal by Its Samples, Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation, Effect of under sampling: Aliasing, Discrete Time Processing of Continuous-Time Signals.

Learning Outcomes:

At the end of the unit, the student will be able to

- Understand the impulse response, transfer characteristics of LTI system and various filters.
- Analyse filter characteristics and physical realisation of LTI system.

UNIT V

Laplace and z-Transforms: The Laplace Transform, Region of Convergence for Laplace Transforms, Inverse Laplace Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the Laplace Transform, Some Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform, System Function Algebra and Block Diagram Representations, Unilateral Laplace Transform, Z-Transform - Region of Convergence for the z-Transform, Inverse z-Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the z-Transform, Some Common z-Transform Pairs, Analysis and Characterization of LTI Systems Using z-Transforms, System Function Algebra and Block Diagram Representations, Unilateral z-Transforms.

Learning Outcomes:

At the end of the unit, the student will be able to

- Analyze the continuous time signals, discrete time signals and systems using Laplace and Z transforms.
- Apply transform techniques to analyse discrete-time signals and systems.

TEXT BOOKS:

1. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky, & S. Hamid, 2nd Edition, Pearson Higher Education, 1997.
2. Principles of Linear Systems and Signals, B.P. Lathi, 2nd Edition, Oxford University Press, 2011.

REFERENCE BOOKS:

1. Signals & Systems, Simon Haykin and B. Van Veen, 2nd Edition, John Wiley, 2003.
2. Signals and systems, NarayanaIyer and K Satya Prasad, 1st Edition, CENGAGE Learning, 2011.
3. Signals, Systems and Transforms, C. L. Philips, J. M. Parr and Eve A. Riskin, 4th Edition, Pearson education, 2008.

COUSE OUTCOMES:

After the completion of the course, students will be able to

1. Explain the basic properties ofsignal& systems and LTI systems.
2. Apply Fourierseries to represent periodic signals.
3. Represent signals in continuous and discretetimeFouriertransform
4. Analyze thesamplingtheoremand characterizesignals & systems in time & frequency domain.
5. Study thestabilityofsystems by applying Laplace transform andZtransform.