Subject Code: 01CT1302

Subject Name: Signals and Systems

B. Tech. Year – II (Semester III)

Objective: The objective of the course is to provide understanding of classification of signals and systems. Students learn applications of mathematical tools like Laplace Transform, Fourier Transform and Z-Transform in analysis of signals and systems. Students understand the importance of different domain representation of signals and systems.

Credits Earned: 03 Credits

Course Outcomes: After completion of this course, student will be able to:

1. Understand various types of signals and systems and classify them. (Understand)
2. Apply various operations and transforms on signals and systems. (Apply)
3. Analyze different signals and systems in the time domain. (Analyze)
4. Analyze different signals and systems in frequency domain. (Analyze)
5. Development of mathematical skills to solve problems involving filtering, modulation and sampling (Apply).

Pre-requisite of course: Basic knowledge of differentiation, integration, differential equations and difference equations

Teaching and Examination Scheme:

Teaching Scheme (Hours)			**Credits**	**Theory Marks**			**Tutorial / Practical**		**Total Marks**
				E	I		V	T	
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term Work	
3	0	0	3	50	30	20	00	00	100

Contents:

Unit	Topics	Contact Hours
1	**Continuous time and discrete time signals and systems:** Definition of signal, classification of signals, basic continuous and discrete time signals, sampling of continuous time signals, Sampling theorem, reconstruction of a signal from its samples, aliasing, concept of quantization and quantization error, concept of analog to digital conversion and digital to analog conversion, basic operations on signals, definition of system, classification of systems, properties of systems	10
2	**Analysis of continuous time signals and systems:** Representation of signals in terms of impulses, continuous time LTI systems: The convolution integral, Unit impulse response, properties of continuous-time LTI systems, linear constant coefficient differential equations, representation of LTI systems by differential equations, singularity functions, Laplace transform, one sided Laplace transform of commonly used signals	8
3	**Analysis of discrete time signals and system:** Discrete time LTI systems: The convolution sum, Unit impulse response, properties of discrete-time LTI systems, linear constant coefficient difference equations, representation of LTI systems by difference equations, recursive and non-recursive discrete time systems, solution of linear constant coefficient difference equations, Z- transform, Region of Convergence (ROC), properties of ROC, properties of Z-transform, Inverse Z-transform: power series expansion and partial fraction expansion, solution of difference equation using Z-transform, analysis of LTI systems in Z-domain	12
4	**Frequency domain analysis:** Representation and existence of Fourier series, trigonometric and complex exponential Fourier series representation, Fourier spectrum, Gibbs phenomenon, properties of continuous time Fourier series, Fourier transform representation of non-periodic functions, Fourier transform of standard signals, properties of continuous time Fourier transform, relationship between Laplace and continuous time Fourier transform, Fourier series representation of discrete time periodic signals, Discrete Time Fourier Transform, relation between Z-transforms and Fourier transform, properties of discrete time Fourier transform, transfer function, frequency response of discrete time systems	12
	Total Hours	**42**

Suggested Text books / Reference books:

1. Alan V. Oppenheim, Alan S. Willsky with S. Hamid Nawab, "Signals & Systems",2nd edition, Pearson Education, 1997.
2. A. Anand Kumar, "Signals and Systems", 3rd edition, PH, 2013
3. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", 4th edition, Pearson Education, 2007.
4. Simon Hykin, Barry Van Veen, "Signals and Systems", 2nd edition, John Wiley and Sons, 2007
5. B. P. Lathi, "Signal Processing and Linear System", 2nd edition, Oxford University Press, 2000.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
05%	15%	25%	15%	20%	20%

Instructional Method:

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Supplementary Resources:

1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011
2. https://nptel.ac.in/courses/108106163
3. https://nptel.ac.in/courses/108104100