Marwadi University

Syllabus for Bachelor of Technology

Information and Communication Technology

Subject Code: 01CT0302

Subject Name: Signals and Systems

B. Tech. Year – II (Semester III)

Objectives:

1. To understand classification of signals and systems
2. To learn applications of mathematical tools like Laplace Transform, Fourier Transform and Z-Transform in analysis of signals and systems
3. To understand the importance of different domain representation of signals and systems

Credits Earned: 04 Credits

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

1. Understand about various types of signals, classify them, analyze them, and perform various operations on them.
2. Understand about various types of systems, classify them, analyze them and understand their response behaviour.
3. Appreciate use of transforms in analysis of signals and system.
4. Carry simulation on signals and systems for observing effects of applying various properties and operations.
5. Create strong foundation of signal processing to be studied in the subsequent semester

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 Marks		Total Marks
				E	I		V	T	
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term Work	
3	0	2	4	50	30	20	25	25	150

Contents:

Unit	Topics	Contact Hours
1	**Module 1: Continuous time and discrete time signals and systems** **Signal**: Definition and Examples, Classification of Signals, Signal Operations, Elementary 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 **System**: Definition, Classification, Examples, Signal processing concept.	09
2	**Module 2: Analysis of Continuous Time Signals and Systems** Time domain representation and convolution integral of continuous time LTI systems, Unit impulse response, Properties of continuous time LTI systems, Stability and causality, Linear constant co-efficient of differential equation, Review of Laplace Transform.	08
3	**Module 3: Analysis of discrete time signals and systems** Time domain representation and convolution sum of discrete time LTI systems, Unit impulse (sample) response, Computation of convolution sum and unit impulse response, Interconnections and Properties of discrete time LTI systems, Linear constant co-efficient difference equation representation, Homogeneous and particular solution, Z-transform, region of convergence (ROC), properties of ROC, Properties of z-transform, Poles and Zeros, Inverse z-transform -Power Series expansion and Partial fraction expansion, Solution of difference equation using Z-transform, Convolution and LTI system analysis using Z-transform.	14
4	**Module 4: Frequency domain analysis** Determination of Fourier series representation of continuous time periodic signals – Trigonometric and Complex Exponential Fourier series representation. Important properties of Fourier series. Continuous time Fourier transform with examples, Properties of the continuous time Fourier transform, Parseval's relation, Convolution in time and frequency domains. Application to analysis of continuous time LTI systems, Relationship between Laplace and continuous time Fourier transform, Fourier series representation of discrete time periodic signals and important properties, Discrete Time Fourier Transform, Properties of Discrete Time Fourier Transform, Discrete time system analysis using Discrete Time Fourier Transform, Frequency response of discrete time systems, Effect of periodicity and discretization on spectra.	11
	Total Hours	42

Suggested Text books / Reference books:

1. AlanV.Oppenheim, Alan S.Willsky with S.HamidNawab, Signals & Systems, Pearson Education.
2. John G.Proakis and DimitrisG.Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, PHI.
3. Signal and Systems By Anand Kumar, 3rd Edition, PHI
4. M.J.Roberts, Signals and Systems Analysis using Transform method and MATLAB, TMH.
5. B. P. Lathi, "Signal Processing and Linear System", Berkeley Cambridge Press.
6. Matthew N. O. Sadiku, Warsame Hassan Ali, "Signals and Systems: A Primer with MATLAB", CRC Press.

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
20%	20%	35%	15%	5%	5%

Suggested List of Experiments:

1. Introduction to MATLAB and Generation of Elementary signals using MATLAB.
2. Generation of discrete time signals and plot them in MATLAB.
3. Observing the effects of sampling rate conversion (lower sampling rate and higher sampling rate) on signal Using MATLAB.
4. Discretization using different sampling rate and observing aliasing effect.
5. Performing various operations on the signal using computational software.
6. Write a program to analyze discrete time LTI System.
7. Find Poles, Zeros and gain from a given transfer function and plot it in Z-domain using software tool.
8. Find the Fourier series representation of a periodic signal and observe Gibbs phenomenon using MATLAB.
9. Observe frequency domain analysis of discrete time signal using software tool.
10. Check linearity of continuous time LTI system.
11. Check Time variance/Time invariance property of LTI system.
12. Obtain impulse response of system by Simulink.

Open Ended Projects:

1. Design of sample and hold circuits.
2. Design of anti-aliasing filter.
3. Write a MATLAB code to compress/expand image.
4. Design of FIR filter

Supplementary Resources:

1. NPTEL Videos
2. MIT open course ware website