C. Syllabus Detailing and Learning objectives

Module	Chapter	Detailed Content	Syllabus Detailing	Learning Objectives
Module 1	**CH 1** Overview of Computer Architecture & Organization (12-Hours)	**Discrete Time Signal** -Introduction to Digital Signal Processing, -Discrete Time Signals, -Sampling and Reconstruction, -Standard DT Signals, -Concept of Digital Frequency, -Representation of DT signal using Standard DT Signals, -Signal Manipulations (shifting, addition, subtraction, multiplication), -Classification of Signals, -Linear Convolution formulation(without mathematical proof), -Circular Convolution formulation(without mathematical proof), -Matrix Representation of Circular Convolution, -Linear by Circular Convolution, -Auto and Cross	**Purpose**: To make students understand the mathematical description and representation of signals. **Scope –** **1. Academic Aspects-** Analysis of signals in time and frequency domain and performing various operations on the same. **2. Technology Aspect-** Understand basics of Discrete Time Signal. **3. Application Aspect-** Applications of theory of DT Signals in three important areas: DSP, Digital Control, Digital Communication. **Students Evaluation** – 1. Theory Questions to be asked on Sampling and Reconstruction, Signal Manipulation Operations, Convolution and Correlation. 2. Implementation of Signal Sampling and reconstruction, Convolution, Correlation.	1. To describe the fundamentals of Discrete Time signals **(R)** 2. To Classify the DT signals **(AP)** 3.To explain the concept of Digital Frequency **(U)** 4. To sketch the DT signals **(AP)** 5. To apply signal manipulation operations on DT signals **(AP)** 5. To compute convolution and correlation of DT signals. **(AP)**

		Correlation formula		
	CH 2 Discrete Time System (8-Hours)	-Introduction to Discrete Time System, -Classification of DT Systems (Linear/Non Linear, Causal/Non Causal, Time Invariant/Time Variant Systems, Stable/ Unstable), BIBO Time Domain Stability Criteria. LTI system, Concept of Impulse Response and Step Response. -Concept of IIR System and FIR System, Output of IIR and FIR DT system using Time Domain Linear Convolution formula Method.	**Purpose** – To make students understand the classification of Discrete Time Systems **Scope –** **1. Academic Aspects-** Learn the concepts of Discrete time system and methods of classifying them. **2. Technology Aspect-** Understand the BIBO Time Domain Stability. **3. Application Aspect-** Classifying the systems into Linear/Non Linear, Causal/Non Causal, Time Invariant/Time Variant Systems, Stable/ Unstable **Students Evaluation** 1. Problems to be solved on DT system classification. 2. Problems to be solved on IIR system classification.	1.To classify the DT systems **[AP]** 2.To describe the BIBO Time Domain Stability Criteria.**[U]** 3. To summarize the working of IIR System and FIR System also conclude on the Output of IIR and FIR DT system. .**[U] [E]**
Module	**Chapter 3**	-Introduction to DTFT,	**Purpose-** This chapter is focuses on a powerful	1. Define the properties of DFT. **(R)**

3	**Discrete Fourier Transform** (Hours -8)	DFT, -Relation between DFT and DTFT, -Properties of DFT without mathematical proof (Scaling and Linearity, Periodicity, Time Shift and Frequency Shift, Time Reversal, Convolution Property and Parsevals' Energy Theorem). -DFT computation using DFT properties. -Transfer function of DT System in frequency domain using DFT. -Linear and Circular Convolution using DFT. -Response of FIR system calculation in frequency domain using DFT.	mathematical technique-the Fourier Transform which provides spectral content of a signal, thus providing frequency-domain description of the signal. **Scope –** **1. Academic Aspects-** Understanding the properties of DFT and applying these properties in problem solving. **2. Technology Aspect-** **3. Application Aspect-** Students should understand how to apply the properties of DFT in signal precessing **Students Evaluation –** 1. Theory Questions to be asked on properties of DFT 2. Lab experiments for performing DFT	2. Apply DFT properties in DFT computations. **(AP)** 3. Compute linear and circular convolution using DFT . **(AP)** 4. Analyze the response of FIR system in frequency domain using DFT .**(AN)**
	Chapter 4 Fast Fourier	-Radix-2 DIT-FFT algorithm,	**Purpose-** This chapter introduces an efficient algorithm(FFT) to compute the DFT with reduced computations.	1. Derive Radix-2 DIT-FFT algorithm . **(U)**

	Transform (Hours -6)	-DIT-FFT Flowgraph for N=4, 6 & 8, -Inverse FFT algorithm. -Spectral Analysis using FFT, -Comparison of complex and real, -multiplication and additions of DFT and FFT.	**Scope -** **1. Academic Aspects-** Understanding the method of fast DFT computation. **2. Technology Aspect-** Design of FFT and comparing the efficiency of FFT and DFT. **3. Application Aspect-** Students should understand how FFT can be used in multiplication and addition application . **Students Evaluation –** 1. Theory Questions to be asked on Radix-2 DIT-FFT for N=4,6,8 2. Lab experiments for implementation of FFT algorithm.	2. Sketch the DIT-FFT Flowgraph for N=4, 6 & 8. **(AP)** 3. Conclude on the efficiency of DFT and FFT computational speed. **(E)** 4. Apply FFT for performing multiplication and additions of DT signals using DFT . **(AP)**
		-Carls' Correlation Coefficient Algorithm,	**Purpose –** This chapter introduces the Correlation coefficient algorithms and the algorithms for long sequence data processing.	1. To describe the Carls' Correlation Coefficient Algorithm. **(R)**

Module 5	**Chapter 5 - DSP Algorithms** (Hours -6)	-Fast Circular Convolution Algorithm, -Fast Linear Convolution Algorithm, -Linear FIR Filtering using Fast Overlap Add Algorithm and Fast Overlap Save Algorithm,	**Scope –** **1. Academic Aspects-** Understanding the Correlation Coefficient algorithms and long sequence filtering algorithms. **2. Technology Aspect-** Understand basics of Correlation Coefficient algorithms and long sequence filtering algorithms. **3. Application Aspect-** Learn how to filter long sequence data signals **Student Evaluation -** 1. Theory Questions to be asked on Correlation coefficient algorithms and the algorithms for long sequence data processing. 2. Lab experiments for implementation of Real time signal processing.	2. To compute linear filtering of long data sequence using fast save and fast overlap algorithm.**(AP)**
	Chapter 6 - DSP Processors and	Need for Special architecture of DSP processor, Difference between DSP processor &	**Purpose –** To make students understand the need for Special architecture of DSP processor like TMS320C54XX series	1. Distinguish DSP and microprocesor . **(U)** 2. Sketch the TMS320C54XX DSP processor. **(AP)**

Module 6	**Application of DSP** (Hours -6)	microprocessor, A general DSP processor TMS320C54XX series, Case study of Real Time DSP applications to Speech Signal Processing and Biomedical Signal Processing.	**Scope –** **1. Academic Aspects-** Understanding the difference between DSP processor & microprocessor . **Student Evaluation -** 1. Theory Questions to be asked on DSP Processors. 2. Case study will be given to study applications of Speech Signal Processing and Biomedical Signal Processing.	