Kadi Sarva Vishwavidyalaya's

Gandhinagar-382 015

B.E Semester: 7
Electronics & Communication Engineering
Subject Name: Digital Signal Processing
Subject Code: EC-701

A. Course Objective:

The educational objectives of this course are

- To present a problem oriented introductory knowledge of digital Signal processing.
- To address the underlying concepts and methods of extracting information from the signal which in turn depend on the type of the signal and the nature of information it carried.
- Thus signal processing concerned with representing signals in mathematical terms and extracting the information by carrying out algorithmic operations on the signal.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
EC- 701	Digital Signal processing	3	0	2	5	4	3	70	30	20	30	150

C. Syllabus

1 **Introduction:** Basic elements of DSP , Concepts of frequency in Analog and Digital Signals, Sampling theorem , Discrete time signals and systems , Analysis of discrete time LTI systems, Properties of LTI Systems, Linear convolution and its properties, Fourier transform theorem.

2 **Z-transform**: Introduction to Z transform, Properties of Region of Convergence for the Z transform, The Inverse Z transform, Z transform properties, Convolution (linear and circular).

3 **The Discrete Fourier Transform: its properties and applications:** Representation of sequences by discrete time Fourier Transform, (DTFT), Properties of discrete time Fourier Transform, and correlation of signals, Introduction to DFT, Relation between DTFT and DFT, Properties of DFT.

4 **Efficient Computation of the DFT : Fast Fourier Transform Algorithms FFT:**

Algorithms Decimation in time Algorithms, Decimation in frequency Algorithms, Use of FFT in Linear Filtering approach to computation of the DFT.

5 **Implementation of discrete time system:** Structures for the realization of Discrete time system, Structures for FIR systems, Structures for IIR Systems, Quantization of Coefficients In FIR filters.

6 **Design of Digital filter:** General considerations, Design of FIR filters, Symmetric and Asymmetric FIR filter, Design of Liner phase FIR filters Using Windows, design of IIR filters from Analog filters, IIR filter design by Approximation of Derivatives, IIR filter design by Impulse Invariance, IIR filter design by the Bilinear transformation.

7 **DSP Processors:** Overview of DSP Processors, Harvard modified Harvard Architecture Multiplier accumulator (MAC) hardware, Floating point Vs Fix point dsp processor. Case Study.

D. **Lesson Planning**

Sr. No.	No. of Hrs.	% Weight-age in Exam	Topic
1	07	**16**	**Introduction :** Basic elements of DSP , Concepts of frequency in Analog and Digital Signals, Sampling theorem , Discrete time signals and systems , Analysis of discrete time LTI systems, Properties of LTI Systems, Linear convolution and its properties, Fourier transform theorem.
2	06	**14**	**Z-transform :** Introduction to Z transform, Properties of Region of Convergence for the Z transform, The Inverse Z transform, Z transform properties, Convolution (linear and circular).
3	07	**16**	**The Discrete Fourier Transform: its properties and applications:** Representation of sequences by discrete time Fourier Transform, (DTFT), Properties of discrete time Fourier Transform, and correlation of signals, Introduction to DFT, Relation between DTFT and DFT, Properties of DFT.
4	07	**14**	**Efficient Computation of the DFT : Fast Fourier Transform Algorithms FFT:** Algorithms Decimation in time Algorithms, Decimation in frequency Algorithms, Use of FFT in Linear Filtering approach to computation of the DFT.
5	07	**12**	**Implementation of discrete time system :** Structures for the realization of Discrete time system, Structures for FIR systems, Structures for IIR Systems, Quantization of Coefficients In FIR filters.
6	07	**16**	**Design of Digital filter:** General considerations, Design of FIR filters, Symmetric and Asymmetric FIR filter, Design of Liner phase FIR filters Using Windows, design of IIR filters from Analog filters, IIR filter design by Approximation of Derivatives, IIR filter design by Impulse Invariance, IIR filter design by the Bilinear transformation.

7	04	**12**	**DSP Processors :** Overview of DSP Processors, Harvard modified Harvard Architecture Multiplier-accumulator (MAC) hardware, Floating point Vs Fix point dsp processor. Case Study.
TOTAL	45	**100**	

E. **Instructional Method & Pedagogy**

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weight age should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- Experiments shall be performed in the laboratory related to course contents.
- Experiments shall be performed in the laboratory using MATLAB, Scilab, or lab view.

Suggested list of Experiments

Sr. No	Name Of Experiment
1	Generation of Unit Sample Sequence.
2	Generation of a complex exponential sequence and Generation of a real exponential sequence

3	Write a program to generate sinusoidal sequence
4	plot given function 1-Sampling 2-Stem 3-Ramp
5	Find the correlation of the two Sequences (A)Using correlation function. (B)Without using correlation function.
6	Write a program to plot Sequence of given function. X(n)= (0.9).^n.*cos((2*pi*n)+(pi/3)) Y(n)=cos((2*pi*n)/128)+cos((2*pi*n)*(5/128))
7	Signal Smoothing by Averaging.
8	Generation of the ensemble average
9	Generation of real and complex exponential sequence.
10	Signal Smoothing by a Moving-Average Filter
11	Illustration of Median Filtering.
12	Find the correlation of the two Sequences (A)Using correlation function. (B)Without using correlation function. .
13	Determine the DFT of sequence x(n)=[1 2 3 4 5 6 6 5 4 3 2 1] and plot Magnitude and Phase
14	Design of L^{th} Band FIR Filter Using the Windowed Fourier Series Approach

F. **Students Learning Outcomes**

On successful completion of the course

- The student can identify different areas of signal processing. One can find the applications of all the areas in day to day life.
- Digital processing of a signal facilitates the sharing of single processor among a number of signals by time sharing. This reduces the processing cost per signal.

G. **Recommended Study Materials**

Text/ Reference Books:

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall
2. John G.Proakis and D.G. Manolakis, Digital Signal Processing: Principle, Algorithms and Applications, Prentice Hall
3. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall
4. D.J. DeFatta, J.G.Lucas and W.S. Hodgkiss, Digital Signal Processing, J Wiley and Sons, Singapore.
5. Digital Signal Processing, S.Salivahanan, A.Vallavaraj, C.Gnapriya TMH