AMITY UNIVERSITY
UTTAR PRADESH

Course Title: DIGITAL SIGNAL PROCESSING

L	T	P/ S	SW/F W	TOTAL CREDIT UNITS
3	0	2	0	4

Course Code: ECE311
Credit Units: 4
Level: UG

Course Objectives:
The objective of the course in Digital signal processing is to provide the student with significant skills in general as well as advanced theories and methods for analysis, and classification of digital signals. Furthermore the objective is to give the student a broad knowledge of central issues regarding design, realization of digital signal processing systems consisting of hardware and/or software components. The specialization in signal processing makes it possible to study practical or theoretic fields, ranging from mathematics/signal theory over algorithmic design to development of instruments based on hardware and/or software for real time signals.

Prerequisites: Signals & Systems

Course Contents / Syllabus:

Module I: Introduction to Discrete Time Signals & Systems	**20% Weightage**
Sampling and Reconstruction of continuous time signals: Periodic sampling, Reconstruction of a band limited signal from its samples, Sampling Theorem, Changing the sampling rate using discrete time processing. Introduction to Multirate signal processing, Decimation and Interpolation Characterization and properties of discrete time signals and systems: Discrete time signals and systems, Linear convolution, Eigen functions for linear time-invariant systems, Linear constant-coefficient difference equations.	

Module II: DFT and its Implementation	**25% Weightage**
Review of Z Transform and DTFT, The Discrete Fourier Transform (DFT) and its properties, Circular and linear convolution using the Discrete Fourier Transform Efficient computation of the Discrete Fourier Transform, Decimation -in-Time FFT algorithm, Decimation-in-Frequency FFT algorithm,	
Module III: Frequency Response & Filter Structures	**20% Weightage**
The frequency response of LTI systems, All pass and minimum-phase systems. Digital Filter Structure: filter structures for IIR and FIR filters, direct form I and II, parallel and cascade forms, frequency sampling structure for FIR filters.	
Module IV: FIR Digital Filter Design	**20% Weightage**
Linear Phase FIR filter. Design of FIR Digital filters by Windowing. Rectangular, Hamming and Hanning windows.	
Module V: IIR Digital Filter Design	**15% Weightage**
Design of IIR Digital Filters from Continuous-time Filters (Butterworth and Chebyshev), Impulse invariant, and bilinear transformation Techniques	

List of Laboratory Experiment

1. Study of sampling theorem, effect of undersampling
2. Study of Quantization of continuous-amplitude, discrete-time analog signals.
3. Time domain analysis of discrete time signals and systems
4. Study of convolution: Linear and Circular
5. Study of Z-transform and Its Application
6. Study of Discrete Fourier Transform (DFT) and its inverse.
7. Study of FIR filter design using window method: Lowpass and highpass filter.

8. Study of FIR filter design using window method: Bandpass and Bandstop filter.
9. Study of Infinite Impulse Response (IIR) filter.
10. Design of a speech scrambler/de-scrambler.
11. Analyse the effects of Down-sampler and Up-sampler in Multi-rate Systems.

Pedagogy for Course Delivery:
The course would be covered under theory and laboratory It incorporates designing of problems, analysis of solutions submitted by the students groups and how learning objectives will be achieved. Continuous evaluation of the students would be covered under quiz, assignments etc.

Student Learning Outcomes:
- Identify and describe discrete and digital signals & systems.
- Analyze how digital signals are different from analog counterparts.
- Evaluate the effectiveness of FFT algorithms in DFT implementation.
- Analysis of digital filter design of FIR and IIR filters

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical (%)**	**Total**
75%	25%	100%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					**End Term Examination**
Components (Drop down)	Mid-Term Exam(CT)	**S/V/Q**	**HA**	Attendance(A)	
Weightage (%)	10%	8%	7%	5%	70%

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Lab Assessment (P):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	A	**PR**	**LR**	V	
Weightage (%)	5%	10%	10%	5%	70%

A: Attendance, PR- Performance, LR – Lab Record, V – Viva. EE- External Exam,

Text Book

- Digital Signal Processing: Principles, Algorithms and Applications (3rd Edition), John G.Proakis, Dimitris G. Manolakis, and D Sharma, Pearson Education India.

Supplementary Text book:

- Discrete-Time Signal Processing (Second Edition), Alan V. Oppenheim, Ronald W. Schafer,and John R. Buck, Pearson Education India.

Reference Book:

- S.K.Mitra: Digital Signal Processing

Reference book for Assignments and Lab:

- Digital Signal Processing using MATLAB, Vinay K. Ingle, John G. Proakis, Brooks/Cole -Thomson Learning

Additional Material:

DSP Video Lectures –

http://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/

http://utubersity.com/lectures/business-2-2-5/business-2-6/business-2-5-4-2/