Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code: OE- EI 603	**Category: Open Elective Courses-III**
Course Name: Digital Signal Processing	**Semester: Sixth**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 42	
Pre-Requisite: No-prerequisite	

Objectives:

1. To provide students a brief concept of signals and systems related to signal processing.
2. To acquire knowledge of different types of signal processing methods.
3. To familiar with the importance of Fourier Transformation in signal processing and its different methods.
4. To realize the importance of filter and their various designing techniques.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	**Discrete-time signals:** Concept of signals and systems, Advantages and application of digital signal processing, Analog signal to digital signal conversion, Sampling theorem, Reconstruction of signal, Concept of Discrete –time signal, Representation of discrete time sequences, Classifications of discrete time sequences with example, Mathematical operations on sequences. **Discrete-time System** Classifications of Discrete time systems, LTI systems, Representation of Discrete time signal using Impulse response, Concept and properties of linear convolution, Methods of convolution process between two signals by both graphical and tabular form procedure, De-convolution, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems .	3 5
2	**Z-Transform:** Defination, Relationship between Laplace Transform and Fourier Transform, Mapping between s-plane and z-plane, concept of unit circle (Fourier transformation from z transformation, stability of a system using z transformation, concept of ROC, Z-transformation of finite and infinite sequences and their ROC, z-transformation of standard sequences, properties of z-transform **Inverse Z-transform :** Direct evaluation of inverse Z-transform -Residue theorem, partial fraction method, Long division or power series expansion method, convolution process	3 3

3	**Discrete Time Fourier Transform (DTFT):** Concept of Fourier series of discrete time signals, difference between continuous time and discrete time Fourier series, frequency spectrum of periodic discrete time signals, properties of discrete time Fourier series and its example, definition of DTFT, frequency spectrum of discrete time signal, properties of DTFT, DTFT of periodic discrete time signals,analysis of discrete time system using DTFT and its frequency response. **Discrete Fourier Transform:** Concept of DFT/IDFT, relation between DFT and IDFT, Properties of DFT, Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as lineartransformations and computation of DFT in matrix form, multiplication of DFTs or concept of circular convolution,computation of circular convolution by graphical and matrix form, relationship between linear convolution and circular convolution, computation of linear convolution from circular convolution, , linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods .	4 5
4	**Fast Fourier Transform (FFT):** Complexity analysis of direct computation of DFT, Concept of FastFourier transformation, Radix-2 computation of FFT using decimation-in-time and decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations of FFT in one place using both algorithms, bitreversal process, examples for DIT & DIF FFT Butterfly computations .	5
5	**FIR Filter Design:** Basic concepts of IIR and FIR filters, Gibbs Phenomenon, design of linear phase FIR filters, no. of taps, concept of window technique to design FIR filter,Fourier series method of FIR filter designing, different types of window sequences and their spectrum-rectangular, Bartlett, Hamming, Hanning, Blackman and Kaiser windows, Design of FIR filter using window techniques.	6
6	**IIR Filter Design:** Concept of IIR digital filter, recursive and nonrecursive system, analog to digital domain transformation- impulse invariant method and bilinear transformation and their properties, limitations of bilinear transformation, warping and prewarping, methods to find out the order of IIR filter, mapping of poles and zeroes of filter in analog domain, computation of filter transfer function in analog domain, digital filter realization techniques, procedure to design Butterworth digital IIR filters.	8

Course Outcome:

1. Distinguishdifferent types of signals, can acquire a brief idea about analog and digital signals and their conversion techniques , criterion for stability of a system.
2. To evaluate different types of mathematical operation on signals.
3. Learn a good idea about Z-transform and importance of analog to digital domain transformation technique.
4. Appropriately distinguish between Fourier series and Fourier transformation, properly compute it,
5. Know different types of filters, distinguish between analog and digital filter, methods to transform from one type to another types of filter.
6. Acquire a clear idea of different filter designing techniques and their realization methods.

Learning Resources

Text books:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis&D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.

Reference books:

1. Digital Signal Processing, A. NagoorKani, TMH Education
2. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
3. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH Publishing Co.