B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER -VI

DIGITAL SIGNAL PROCESSING (Core Subject)

Subject Code	15EE63	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits - 04

Course objectives:

- To define Discrete Fourier transform and its properties.
- To evaluate DFT of various signals using properties of DFT.
- To explain different linear filtering techniques**.**
- To explain the evaluation of DFT and inverse DFT using fast and efficient algorithms
- To discuss impulse invariant transformation, bilinear transformation techniques and their properties.
- To design infinite impulse response Butterworth digital filters using impulse invariant and bilinear transformation techniques.
- To design infinite impulse response Chebyshev digital filters using impulse invariant and bilinear transformation techniques.
- To discuss direct, cascade, parallel and ladder methods of realizing a digital IIR filter.
- To discuss window functions used for the design of FIR filters.
- To discuss windowing technique of designing FIR filter.
- To discuss frequency sampling technique of designing FIR filter.
- To discuss direct, cascade and linear phase form of realizing a digital FIR filter. ■

Module-1		**Teaching Hours**
Discrete Fourier Transforms: Definitions, properties-linearity, shift, symmetry Properties- circular convolution – periodic convolution, use of tabular arrays, circular arrays, Stock ham's method, linear convolution – two finite duration sequence, one finite & one infinite duration, overlap add and save methods**.** ■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering,L_2 – Understanding,L_3 – Applying,L_4 – Analysing. L_5 – Evaluating	
Module-2		
Fast Fourier Transforms Algorithms: Introduction, decimation in time algorithm, first decomposition, number of computations, continuation of decomposition, number of multiplications, computational efficiency, decimation in frequency algorithms, Inverse radix – 2 algorithms.■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing. L_5– Evaluating	
Module-3		
Design of IIR Digital Filters: Introduction, impulse invariant transformation, bilinear transformations, All pole analog filters- Butterworth & Chebyshev filters, design of digital Butterworth filter by impulse invariant transformation and bilinear transformation, Frequency transformations. ■		**10**
Revised Bloom's Taxonomy Level	L1- Remembering, L2 – Understanding, L3 – Applying. L4 – Analysing. L5 – Evaluating	
Module-4		
Design of IIR Digital Filters (Continued): Design of digital Chebyshev –type 1filter by impulse invariant transformation and bilinear transformation, Frequency transformations. **Realization of IIR digital systems:** direct form, cascade form and parallel form, Ladder structures for equal degree polynomial.■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing, L_5– Evaluating	

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15EE63 DIGITAL SIGNAL PROCESSING (Core Subject) (continued)

Module-5	**Teaching Hours**
Design of FIR Digital Filters: Introduction, windowing, rectangular, modified rectangular. Hamming, Hanning, Blackman window, **design of FIR digital filters by use of windows, Design of FIR digital filters-**frequency sampling techniques. **Realization of FIR systems:** direct form, cascade form, linear phase form■	**10**
Revised Bloom's Taxonomy Level L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing, L_5– Evaluating	

Course outcomes:

At the end of the course the student will be able to:

- Compute the DFT of various signals using its properties and linear filtering of two sequences.
- Apply fast and efficient algorithms for computing DFT and inverse DFT of a given sequence
- Design infinite impulse response Butterworth digital filters using impulse invariant / bilinear transformation technique.
- Design infinite impulse response Chebyshev digital filters using impulse invariant or bilinear transformation technique.
- Realize a digital IIR filter by direct, cascade, parallel and ladder methods of realization.
- Discuss different window functions and frequency sampling method used for design of FIR filters.
- Design FIR filters by use of window function or by frequency sampling method.
- Realize a digital FIR filter by direct, cascade, and linear phase form. ■

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem analysis, Design/ Development of Solutions, Modern Tool Usage.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.Each full question consisting of 16 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbook

1	Introduction to Digital Signal Processing	Jhonny R. Jhonson	Pearson	1st Edition, 2016

Reference Books

1.	Digital Signal Processing – Principles, Algorithms, and Applications	Jhon G. Proakis Dimitris G. Manolakis	Pearson	4th Edition, 2007.
2.	Digital Signal Processing	A.NagoorKani	McGraw Hill	2nd Edition, 2012
3	Digital Signal Processing	Shaila D. Apte	Wiley	2nd Edition, 2009
4	Digital Signal Processing	Ashok Amberdar	Cengage	1st Edition, 2007
5	Digital Signal Processing	Tarun Kumar Rawat	Oxford	1st Edition, 2015