COURSE HANDOUT

DIGITAL SIGNAL PROCESSING (ECE-502)

BE-5th SEMESTER

ACADEMIC YEAR (2024-25)

Prof (Dr) Ashok Kumar

Dean Academics, MIET

Ms. Gurpreet Kaur

Assistant Professor

Department of Electronics and Communication Engineering

Department of Electronics and Communication Engineering

Model Institute of Engineering & Technology (Autonomous)

Kot Bhalwal, Jammu - 181122

www.mietjmu.in

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
ECE-502	Digital Signal Processing	PCC	4	3	1	0	50	100	150

COURSE OUTCOMES

At the end of the course the student will be able to:	
CO1	Understand the discrete nature of the signals and its importance.
CO2	Realize a digital system with the help of mathematical relations.
CO3	Evaluate response of a system using frequency transformation technique.
CO4	Implement the basic structures for digital linear systems.
CO5	Design FIR and IIR filters with different specifications.

Unit-I

Representation/ Classification of Signals and Systems: Introduction, Classification of continuous time and discrete time signals, Classification of Systems, Properties of system. Discrete-Time Signal Representation: Analysis of linear time Invariant system, Properties of Linear time invariant systems. Recent Advancements in Digital Signal Processing.

(10 Hours)

Unit-II

Discrete Transforms: Z- transform and its properties, Inversion of Z-transform, one sided Z- transform and solution of differential equations. Relationship between Z-transform and Fourier transform.

Frequency Selective Filters: All pass filters, minimum-phase, maximum-phase and mixed- phase systems, applications of Z-Transform.

(12Hours)

Unit-III

Frequency Domain Sampling and DFT: DTFT, DFT, properties, Linear filtering using DFT, radix 2 FFT-Decimation in time FFT algorithms & decimation in frequency FFT algorithms.

Implementation Structures of Discrete Time Systems: Direct form, cascade, transposed form structures for FIR systems. Direct forms, transposed form, cascade and parallel form structures for IIR systems.

(12 Hours)

Unit- lV

Design of FIR Filters: Characteristics of practical frequency selective filters, types of FIR filters, filter design specifications such as peak pass band ripple, minimum stop band attenuation etc. Design of FIR filters using windowing method, frequency sampling method.

(10 Hours)

Unit-V

Design of IIR Filters: Design of IIR filters from analog filters, Impulse invariance method, bilinear Z transformation method, QMF filter, Butterworth filter and Chebyshev analog filters.

(10 Hours)

Textbooks

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Digital Signal Processing	John G Proakis DG Manolakis	Pearson	4th (2014)
2.	Digital Signal Processing	S Salivahanan	McGraw-Hill	4th (2019)
3.	Digital Signal Processing	A Anand Kumar	PHI	2nd (2015)

Reference Books

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Digital Signal Processing: A computer based approach	S K Mitra	McGraw-Hill	2nd (2011)
2	Digital Signal Processing	Alan V. Oppenheim and Ronald W. Schafer	Prentice Hall	2nd (1999)

COURSE PLAN		
Unit-I Discrete Time Signal & System		
S.No	**Topics**	**Recommended Books**
1	Introduction, Classification of discrete time signal	Book 1, Ch.1
2	Discrete-time system	Book 1, Ch.1
3	Analysis of linear time Invariant system	Book 1, Ch.1
4	Properties of LTI system, Problems on properties of LTI system	Book 1, Ch.2
5	Causality, Stability condition, Numerical problems	Book 2, Ch.3
6	Correlation of discrete time system with numerical problems	Book 2, Ch.2
7	Recursive & Non-recursive structures	Book 2, Ch.2
Unit-II Z-transforms and Linear Digital Structures		
8	Introduction, Definition, Properties of Z-Transform with associated numerical problem	Book 2, Ch.2
9	Significance and calculation of region of convergence for the given system	Book 2, Ch.2
10	Evaluation of the Inverse Z-Transform, power series expansion method.	Book 2, Ch.3
11	Evaluation of the Inverse Z-Transform, Partial fractions method	Book 2, Ch.2
12	Frequency selection filters	Book 2, Ch.3
Unit-III Frequency Domain sampling and DFT		
13	Introduction, Properties of DFT	Book 2, Ch.4
14	IDFT and Problems	Book 3, Ch.4
15	Linear convolution using DFT	Book 3, Ch.4
16	Circular convolution	Book 3, Ch.4
17	Discrete time Fourier transform (DTFT)	Book 3, Ch.5
18	Fast Fourier transform (FFT)	Book 3, Ch.5
19	Decimation in time FFT algorithms, Computational consideration	Book 3, Ch.5
20	Decimation in frequency algorithms, Computational consideration	Book 3, Ch.5
21	Basic structures for IIR systems	Book 3, Ch.5
22	Basic structure for FIR systems	Book 3, Ch.5
Unit-IV Design of FIR filters		
23	Generation consideration	Book 2, Ch.7
24	Design of FIR filter	Book 2, Ch.7
25	Digital circuit realization	Book 2, Ch.7
Unit-V Design of IIR filters		

26	Design of IIR filter-Impulse Invariant method	Book 2, Ch.8
27	Bilinear transformation	Book 2, Ch.8
28	Design of IIR filter	Book 2, Ch.8
29	QMF filter	Book 2, Ch.8
30	Butterworth filter	Book 2, Ch.8

ADDITIONAL WEB RESOURCES

1.	**Nptel Link:-** ***https://www.youtube.com/watch?v=6dFnpz_AEyA*** Introduction to Digital Signal Processing.
3.	**Video Link:** https://www.khanacademy.org/science/electrical-engineering/ee-signals Fourier Series and transform
4.	**Video Lecture:-** http://www.nptelvideos.in/2012/12/digital-signal-processing.html Digital signal processing (Complete syllabus videos)
5.	**Nptel Link** :-https://youtu.be/qPpNYGAQf20 https://youtu.be/gkC7cXa8ewk https://youtu.be/BAfdk3mwByM Z-Transform and Inverse Z-transform

GRADING AND ASSESSMENT

- **Sessional Test**: 20 marks
- **Assignment**: 20 marks
- **Attendance**: 10 marks
- **Final Examination**: 100 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.
- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.
- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

FACULTY INFORMATION

- **Office Hours**

  Tuesday (12:05 PM - 12:55 PM)
  Friday (12:05 PM - 12:55 PM)

- **Contact Information**
  gurpreet.ece@mietjammu.in