<table>
<tr><td colspan="5">Devi Ahilya Vishwavidhyalaya, Indore, India
Institute of Engineering & Technology</td><td colspan="2">II Year B.Tech. (Electronics and Instrumentation Engineering)</td></tr>
<tr><td>Course Code & Name</td><td colspan="6">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="3">4REPC5

DIGITAL SIGNAL PROCESSING</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">90</td><td rowspan="2">3</td></tr>
<tr><td>20</td><td>10</td><td>0</td><td>60</td></tr>
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Course Learning Objectives:

- Familiarize students with different types of discrete time signals and systems with their mathematical representation.
- Learning of different transforms used to analyze discrete time signals in frequency domain such as Z transform & Discrete Fourier Transforms.
- Learning of Fast and efficient computation of FFT.
- Digital filter design

Prerequisites: Knowledge of mathematical representation of continuous time signals, Fourier transforms for continuous time signals

COURSE CONTENTS

UNIT I INTRODUCTION

Classification of signals: continuous and discrete, energy and power, analog and digital etc. mathematical representation of discrete time signals, Properties of discrete time signals, Classification of systems: linear, causal, stable, dynamic, recursive, time varying; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Problem solving using Matlab.

UNIT II Z TRANSFORM

Z-transform and its properties, inverse z-transforms; difference equation, its solution by using Z-transform, application of Z transforms to discrete time systems : Stability analysis, frequency response analysis, Convolution, Discrete Time Fourier transform, its magnitude and phase representation. Problem solving using Matlab.

UNIT III DISCRETE FOURIER TRANSFORM & FFT

Discrete Fourier Transform its properties, Circular convolution, magnitude and phase representation, Computation of DFT using FFT algorithm, DIT & DIF using radix 2 FFT, Butterfly structure. Problem solving using Matlab.

UNIT IV DESIGN OF FIR FILTERS

Definition of FIR & IIR filters, Properties of FIR filters, Design techniques for FIR filters: Fourier series method, frequency sampling method, Window techniques: Rectangular,

Hamming, Hanning, Blackman, Barlett window functions. Limitations of FIR filters. Problem solving using Matlab.

UNIT V DESIGN OF IIR FILTERS

Filter design techniques: Approximation of derivatives, Impulse invariant method, Bilinear transformation, frequency warping. Design of Butterworth and Chebyshev approximations low pass.

Realization of FIR & IIR filters: Direct form I, Direct form II, Cascade and Parallel form realization, and transposed forms. Problem solving using Matlab.

Course Outcomes:

CO.No.	CO
CO1	Explain and classify discrete-time signals and systems and analyze their properties in time and frequency domains.
CO2	Apply Z-transform and DTFT to analyze discrete-time systems and signals.
CO3	Compute and analyze the DFT and implement FFT algorithms (DIT and DIF) for spectral analysis.
CO4	Design and analyze FIR digital filters using Fourier series, frequency sampling and window techniques.
CO5	Design and realize IIR digital filters using classical approximation methods and various realization structures.

BOOKS RECOMMENDED:

[1]. Alan V. Oppenheim, Ronald W. Schafer, Digital Signal Processing, Pearson Education, 3rd edition, 2011.

[2]. John Proakis, Dimitris Manolakis, Digital Signal Processing, Prentice Hall, 4th edition, 2007.

CO-PO-PSO Relationship

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
4REPC5.CO1	3	3		2								3	1	2
4REPC5.CO2	3	3		2	1							3	1	2
4REPC5.CO3	2	2			3							2	3	2
4REPC5.CO4	2	2	3		3							2	3	3
4REPC5.CO5	2	2	3		3							2	3	3