Devi Ahilya University, Indore, India Institute of Engineering & Technology				II Year B.E. (Electronics and Instrumentation Engg.)			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
4EIRC1	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
DIGITAL SIGNAL PROCESSING	**3**	**1**		**3**	**1**	**-**	**4**
Duration of Theory Paper: 3 Hours							

Learning Objectives:

- Familiarize students with different types of discrete time signals and systems with their mathematical representation.
- Learning of different transforms used to analyse 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.

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

Expected Outcomes:

1. Students will be able to analyse discrete time signals in time and frequency domains mathematically.
2. Students will be able to design digital filters.
3. Students will be able to use MATLAB for analysis of discrete time signals in time and frequency domains and for filter design designs .

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.