Devi Ahilya University, Indore, India Institute of Engineering & Technology				**II Year B.E. (Electronics and Telecommunication Engg.)**			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
4ETRG2 DIGITAL SIGNAL PROCESSING	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
	3	**1**	**0**	**3**	**1**	**0**	**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

Pre requisites: 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.

Learning Outcomes:

Upon Completing the Course, Student will able to:

- Students will be able to analyses discrete time signals in time and frequency domains mathematically.
- Students will be able to design digital filters.
- 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.