

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL**  
**Credit Based Grading System**  
**Electronics & Communication Engineering, VI-Semester**  
**EC- 6002 Digital signal Processing**

**Unit – I**

**Discrete-Time Signals and Systems**

Discrete-time signals, discrete-time systems, analysis of discrete-time linear time-invariant systems, discrete time systems described by difference equation, solution of difference equation, implementation of discrete-time systems, stability and causality, frequency domain representation of discrete time signals and systems.

**Unit - II**

**The z-Transform**

The direct z-transform, properties of the z-transform, rational z-transforms, inversion of the z transform, analysis of linear time-invariant systems in the z- domain, block diagrams and signal flow graph representation of digital network, matrix representation.

**Unit - III**

**Frequency Analysis of Discrete Time Signals**

Discrete fourier series (DFS), properties of the DFS, discrete Fourier transform (DFT), properties of DFT, two dimensional DFT, circular convolution.

**Unit - IV**

**Efficient Computation of the DFT**

FFT algorithms, decimation in time algorithm, decimation in frequency algorithm, decomposition for 'N' composite number.

**Unit - V**

**Digital filters Design Techniques**

Design of IIR and FIR digital filters, Impulse invariant and bilinear transformation, windowing techniques-rectangular and other windows, examples of FIR filters, design using windowing.

**References:**

1. Oppenheim and Schafer: Digital Signal Processing, PHI Learning.
2. Johnny R. Johnson: Introduction to Digital Signal Processing, PHI Learning.
3. Proakis: Digital Signal Processing, Pearson Education.
4. Rabiner and Gold: Theory and Application of Digital Signal Processing, PHI Learning.
5. Ingle and Proakis: Digital Signal Processing- A MATLAB based Approach, Thompson, Cengage Learning.

**List of Experiments:**

1. Generation, analysis and plots of discrete-time signals.
2. Implementation of operations on sequences (addition, multiplication, scaling, shifting, folding etc).
3. Implementation of Linear time-invariant (LTI) systems and testing them for stability and causality.
4. Computation and plot of DTFT of sequences, verification of properties of DTFT.
5. Computation and plots of z-transforms, verification of properties of z-transforms.
6. Computation and plot of DFT of sequences, verification of properties of DFT.
7. Computation and plots of linear/circular convolution of two sequences.
8. Computation of radix-2 FFT- Decimation in time and Decimation in frequency.
9. Implementation of IIR and FIR filter structures (direct, cascade, parallel etc).
10. Implementation of various window design techniques (Rectangular, Bartlett, Hann, Hamming etc).