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|  | **NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY**  **(An Autonomous under VTU)**  **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.**  6th Semester 2019-2020  **COURSE HANDOUT** |

**Course Code : 17ECT61**

**Course Title : Digital Signal Processing**

**Course Teachers : Dr. Wilfred John Waz & Mr. Shashikiran R**

**Course Co-ordinator : Mr. Shashikiran R**

**1. COURSE DESCRIPTION:**

This course provides an introduction to processing of discrete-time (DT) signals. Fundamental principles of DT systems and signals, in both time and Fourier domains, are presented. These are followed by modern applications of digital signal processing Throughout the course, the focus is on developing techniques for solving discrete-time signal processing problems.

**2. This course will enable students to:**

* Understand the importance of Fourier Transform and its relation with other transform.
* Explain the filtering of long data sequence using various methods.
* Understand the concept of FFT algorithms to compute DFT.
* Design the digital FIR filters using various window methods.
* Analyze the basics of designing IIR filter using different methods.
* Explain the concept of Multi-rate signal processing and sample rate conversion.

**3. COURSE PLAN:**

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| --- | --- | --- | --- | --- |
| **Class Sl No** | **Module and Title / Page No.** | **Topics to be covered** | **% of portions covered** | |
| **Covered in the chapter** | **Cumulative** |
|  | **Module I**  **Discrete Fourier Transform**  **T1. Page No. 449-495.**  **R1. Page No. 567- 624** | Introduction to Fourier Transform | 20% | 20% |
|  | DFT as a linear transformation |
|  | DFT in relationship with other transforms |
|  | Properties of DFT |
|  | Multiplication of two DFTs – circular convolution |
|  | Circular convolution |
|  | DFT in linear filtering |
|  | overlap-save method |
|  | overlap-save method |
|  | overlap-add method |
|  | **Module II**  **FFT Algorithm T1. Page No.**  **511-540.**  **R1. Page No.**  **465-508** | Introduction to Radix-2 Fast Fourier Transform(FFT) | 20% | 40% |
|  | Problems on Radix-2 Fast Fourier Transform(FFT) |
|  | Problems on Radix-2 Fast Fourier Transform(FFT) |
|  | Problems on Radix-2 Fast Fourier Transform(FFT) |
|  | Decimation in Time FFT Derivation |
|  | Problems on Decimation in Time FFT |
|  | Problems on Decimation in Time FFT |
|  | Decimation in Frequency FFT Derivation |
|  | Problems Decimation in Frequency FFT |
|  | Problems Decimation in Frequency FFT |
|  | **Module III**  **FIR Filters**  **Structures for FIR Systems**  **T1. Page No.565-582**  **& T1. Page 654-700.** | Symmetric and anti-symmetric FIR filters | 20% | 60% |
|  | Symmetric and anti-symmetric FIR filters |
|  | Design of linear-phase FIR filters using windows |
|  | Design of linear-phase FIR filters using windows |
|  | Design of linear-phase FIR filters using windows |
|  | Design of linear-phase FIR filters using windows |
|  | Frequency sampling methods. |
|  | Frequency sampling methods. |
|  | Direct-Form Structures |
|  | Cascade-Form Structures |
|  | Lattice Structures. |
|  | **Module IV**  **IIR Filters and Structures**  **T1. Page No.582-601**  **& T1. Page No.701-733.** | Analog filter specifications | 20% | 80% |
|  | Butterworth and Chebyshev filters |
|  | Butterworth and Chebyshev filters |
|  | Frequency transformations |
|  | Frequency transformations |
|  | Design of analog filters |
|  | Digital IIR filter design using impulse invariant method.. |
|  | Digital IIR filter design using impulse invariant method, bilinear transformation method. |
|  | Digital IIR filter design using impulse invariant method, bilinear transformation method, Matched Z-transform methods. |
|  | Direct form (I and II), Cascade and Parallel structures. |
|  | Direct form (I and II) Transposed structures. |
|  | **Module V**  **Multi-Rate Signal Processing Fundamentals T1. Page No.**  **751-789.** | Basic sample rate alteration devices | 20% | 100% |
|  | Basic sample rate alteration devices |
|  | Multi-Rate Structures for sampling rate Converters |
|  | Multi-Rate Structures for sampling rate Converters |
|  | Multi-Rate Structures for sampling rate Converters |
|  | Multistage design of decimator and Interpolator |
|  | Multistage design of decimator and Interpolator |
|  | Multistage design of decimator and Interpolator |
|  | Applications of Multirate Signal Processing. |
|  | Applications of Multirate Signal Processing. |

**4. TEXT BOOK:**

1. J. G. Proakis, D. G. Manolakis: “Digital Signal Processing: Principles, Algorithms and Applications”, 4th Edition, Pearson Education Asia/Prentice Hall of India, 2002, ISBN-10: 0131873741, ISBN-13: 978-0131873742.

2. Sanjit K. Mitra: “Digital Signal Processing”, 4th Edition, Tata McGraw Hill, 2006, ISBN-10: 0073380490, ISBN-13: 978-0073380490.

**5. REFERENCE BOOKS:**

**R1**. Oppenheim, Schafer: “Discrete Time Signal Processing”, 3rd Edition, Pearson Education, 2003, ISBN-10: 0131988425, ISBN-13: 978-0131988422.

**6. EVALUATION SCHEME:**

|  |  |  |
| --- | --- | --- |
| **Component** | **Weightage** | **Date** |
| CIE 1 | 20% |  |
| CIE 2 | 20% |  |
| Makeup CIE | 20% |  |
| AAT-1 (Quiz) | 5% |  |
| AAT 2 (Surprise Test) | 5% |  |
| SEE | 50% |  |

**7. COURSE OUTCOMES:**

On completion of this course, students should be able to:

• Implement DFT using linear filtering.

• Implement DFT using Fast Fourier Transforms.

• Design and analyze digital FIR filters and structure of FIR filters.

• Design and analyze digital IIR filters and structure of IIR filters.

• Explain the concept of Multi-rate signal processing and sample rate conversion.

**Course Teachers HOD**

Dr. Wilfred John WazDr. Nagesh K N

Mr. Shashikiran R