

**BHUBANANANDA ORISSA SCHOOL OF ENGINEERING, CUTTACK**

**Lesson Plan of Digital Signal Processing**

**by**

**Sidharth Sekhar Mallick, Lecturer in AE&I**

**Academic Year -2023-24(Summer)**

## **VISION & MISSION OF APPLIED ELECTRONICS & INSTRUMENTATION ENGINEERING DEPARTMENT**

### **VISION OF THE DEPARTMENT:-**

To produce efficient professional in applied electronics & instrumentation engineering and other allied area's with update technical knowledge to meet the challenges of society in relevant sector.

### **MISSION OF THE DEPARTMENT:-**

- To provide the student competent in applied electronics and instrumentation engineering with societal, environmental and human values through quality education, training.
- Provide knowledge of basic science, applied mathematics, instrumentation technology and communicative skills to identify and solve problems related to Applied Electronics and Instrumentation engineering.
- To enable the students to acquire various parameter measurement and automatic control technology used for industrial automation and inculcate quality of leadership, mentorship & teamwork in collaboration with parents, alumni & industry.

### **PROGRAMME EDUCATIONAL OBJECTIVES:**

- To provide students with a solid foundation in basic science, electrical, electronics, instrumentation and interdisciplinary subjects that is necessary to excel in professional career, entrepreneur in future and/or higher education.
- To prepare students to meet the needs and face the challenges of real life as well as industry automation and digitalization in terms of technical, economic and social feasibility.
- To inculcate professionalism, communication skills, attitudes, team work and to adapt to the current trends by engaging in lifelong learning.
- To utilize the technology in domestic, medical, industry and community for proper utilization of instrument for measurement & control.

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|-----------------------------------------------------------------------|-----------------------------------|--------------------------------------------------------------|
| <b>Discipline:</b> Applied Electronics & Instrumentation Engineering. | <b>Semester :</b> 6 <sup>th</sup> | <b>Name of the teaching faculty:</b> Sidharth Sekhar Mallick |
| <b>Subject:</b> Digital Signal Processing                             | No. of Days/per week class        | Semester From Date:- 16-01-2024 To Date:- 26-04-2024         |

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|                 | allotted: <b>04 periods/per week</b> (MON ,TUE, WED , THU :- 1 Period each) | No. of weeks: <b>15 weeks</b>                                                                                                                                                                                                                                        |
| <b>Week</b>     | <b>Class Day</b>                                                            | <b>Theory Topics</b>                                                                                                                                                                                                                                                 |
| 1 <sup>st</sup> | 16/01/2024                                                                  | Introduction, syllabus discussion and previous year question discussion                                                                                                                                                                                              |
|                 | 17/01/2024                                                                  | <b>Ch.:-1.Introduction of Signals, Systems &amp;Signal processing</b><br>1.1 Basics of Signals, Systems &Signal processing-basic elements of a digital signal processing system-Compare the advantages of digital signal processing over analog signal processing.   |
|                 | 18/01/2024                                                                  | 1.2 Classify Signals-Multi Channels &Multi-dimensional signal, continuous time verses Discrete-valued signals.<br>1.3 Concepts of Frequency in continuous time &discrete time's signals, continuous-time Sinusoidal signal-Harmonically related complex exponential. |
| 2 <sup>nd</sup> | 22/01/2024                                                                  | 1.4 Analog to Digital & Digital to Analog Conversion & explain the following.<br>a. Sampling of Analog Signal.<br>b. The sampling theorem. Continuing...                                                                                                             |
|                 | 24/01/2024                                                                  | c. Quantization of continuous amplitude Signals.<br>d. Coding of quantized sample.                                                                                                                                                                                   |
|                 | 25/01/2024                                                                  | e. Digital to Analog Conversion.<br>f. Analysis of digital system Signals vs. discrete time signals systems.                                                                                                                                                         |
| 3 <sup>rd</sup> | 29/01/2024                                                                  | <b>Ch.:-2. DISCRETE TIMES SIGNALS &amp; SYSTEMS.</b><br>2.1 Concept of Discrete time signals.<br>2.1.1 Elementary Discrete time signals.                                                                                                                             |
|                 | 30/01/2024                                                                  | 2.1.2 Classification Discrete time signals.<br>2.1.3 Simple manipulation of discrete time signals                                                                                                                                                                    |
|                 | 31/01/2024                                                                  | <b>2.2 Discrete time system.</b><br>2.2.1 Input-output of system.                                                                                                                                                                                                    |
|                 | 01/02/2024                                                                  | 2.2.2Block diagram of discrete-time systems                                                                                                                                                                                                                          |
|                 | 02/02/2024                                                                  | 2.2.3Classify discrete time system                                                                                                                                                                                                                                   |
| 4 <sup>th</sup> | 05/02/2024                                                                  | 2.2.4Inter connection of discrete-time systems.                                                                                                                                                                                                                      |
|                 | 7/02/2024                                                                   | 2.3Discrete time-invariant system.<br>2.3.1Different techniques for the Analysis of linear systems                                                                                                                                                                   |
|                 | 8/02/2024                                                                   | 2.3.2Resolution of a Discrete time signal in to impulse.                                                                                                                                                                                                             |

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| 5 <sup>th</sup>  | 12/02/2024 | 2.3.3 Response of LTI system to arbitrary inputs using convolution sum.                                                                  |
|                  | 13/02/2024 | 2.3.4 Convolution & interconnection of LTI system - properties.                                                                          |
|                  | 15/02/2024 | 2.3.5 Study Systems with finite duration and infinite duration impulse response.                                                         |
| 6 <sup>th</sup>  | 19/02/2024 | 2.4 Discrete time system described by difference equation.<br>2.4.1 Recursive & non-recursive discrete time system.                      |
|                  | 20/02/2024 | 2.4.2 Determine the impulse response of linear time invariant recursive system.                                                          |
|                  | 21/02/2024 | 2.4.3 Correlation of Discrete time signals                                                                                               |
|                  | 22/02/2024 | <b>Revision on Chapter 1 &amp; 2</b>                                                                                                     |
| 7 <sup>th</sup>  | 26/02/2024 | <b>Class Test-1</b>                                                                                                                      |
|                  | 27/02/2024 | <b>Ch.-3. THE Z-TRANSFORM &amp; ITS APPLICATIONS TO THE ANALYSIS OF LTI SYSTEM.</b><br>3.1 Z-transform & its applications to LTI system. |
|                  | 28/02/2024 | 3.1.1 Direct Z-transform.                                                                                                                |
|                  | 29/02/2024 | 3.1.2 Inverse Z-transform.                                                                                                               |
| 8 <sup>th</sup>  | 04/03/2024 | 3.2 Various properties of Z-transform continue...                                                                                        |
|                  | 06/03/2024 | 3.2 Various properties of Z-transform                                                                                                    |
|                  | 07/03/2024 | <b>3.3 Rational Z-transform.</b><br>3.3.1 Poles & zero.                                                                                  |
| 9 <sup>th</sup>  | 11/03/2024 | 3.3.2 Pole location time domain behavior for casual signal. Continue...                                                                  |
|                  | 12/03/2024 | 3.3.2 Pole location time domain behavior for casual signal. Continue...                                                                  |
|                  | 13/03/2024 | 3.3.3 System functions of a linear time invariant system.                                                                                |
|                  | 14/03/2024 | 3.4 Discuss inverse Z-transform.                                                                                                         |
| 10 <sup>th</sup> | 18/03/2024 | 3.4.1 Inverse Z-transform by partial fraction expansion.                                                                                 |
|                  | 19/03/2024 | 3.4.2 Inverse Z-transform by counter integration                                                                                         |
|                  | 20/03/2024 | <b>Ch.-4 DISCUSS FOURIER TRANSFORM: ITS APPLICATIONS PROPERTIES.</b><br>4.1 Concept of discrete Fourier transforms.                      |
|                  | 21/03/2024 | 4.2 Frequency domain sampling and reconstruction of discrete time signals.                                                               |
| 11 <sup>th</sup> | 27/03/2024 | 4.3 Discrete Time Fourier transformation (DTFT) continue..<br>4.4 Discrete Fourier transformation (DFT).                                 |
|                  | 28/03/2024 | 4.5 Compute DFT as a linear transformation.<br>4.6 Relate DFT to other transforms.                                                       |

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| 12 <sup>th</sup> | 02/04/2024 | 4.7 Property of the DFT.                                                                                                                                                                             |
|                  | 03/04/2024 | <b>Internal Assessment</b>                                                                                                                                                                           |
|                  | 04/04/2024 | <b>Internal Assessment</b>                                                                                                                                                                           |
| 13 <sup>th</sup> | 08/04/2024 | 4.8 Multiplication of two DFT & circular convolution                                                                                                                                                 |
|                  | 09/04/2024 | <b>Ch.:-5 FAST FOURIER TRANSFORM ALGORITHM &amp; DIGITAL FILTERS.</b><br>5.1 Compute DFT & FFT algorithm.<br>5.2 Direct computation of DFT.<br>5.3 Divide and Conquer Approach to computation of DFT |
|                  | 13/04/2024 | 5.4 Radix-2 algorithm. (Small Problems)                                                                                                                                                              |
| 14 <sup>th</sup> | 15/04/2024 | 5.5 Applications of FFT algorithms.                                                                                                                                                                  |
|                  | 16/04/2024 | 5.6 introduction to digital Filters.(FIR Filters)& general considerations                                                                                                                            |
|                  | 18/04/2024 | 5.7 Introduction to DSP architecture, familiarization of different types of processor                                                                                                                |
| 15 <sup>th</sup> | 22/04/2024 | <b>Revision on Chapter1,2,3 4&amp;5</b>                                                                                                                                                              |
|                  | 23/04/2024 | <b>Revision on Chapter1,2,3 4&amp;5</b>                                                                                                                                                              |
|                  | 24/04/2024 | <b>Class Test-2</b>                                                                                                                                                                                  |
|                  | 25/04/2024 | <b>Previous year question discussion</b>                                                                                                                                                             |