ANDHRA UNIVERSITY

DEPARTMENT OF PHYSICS

PROGRAM : M.SC ELECTRONICS(INSTRUMENTATION)

REGULATION AND SYLLABUS

EFFECTIVE FROM 2021-2022 BATCH

DEPARTMENT OF PHYSICS

M. Sc. Electronics (Instrumentation)

(2 Year Self-Finance Programme)

Under Choice Based Credit System (CBCS)
2021-22

PREAMBLE

The Department of Physics is offering M. Sc. Electronics (Instrumentation), Under Choice Based Credit System (CBCS) from the academic year 2017-18 as 2-Year Self-Finance Programme. The curriculum was revised in 2020-21 with programme specific objectives and outcomes in preparing the students in a technology-enabled way to achieve core competencies to face the global challenges successfully.

The curriculum was designed with focus on employability, entrepreneurship, skill development and to suit the professional and personal needs of the students. MOOCs courses are included to enhance the ability and value-added courses are also included. Elective Courses are available for students which improves flexibility.

All the theory and laboratory courses have been designed to have 4 credits each. The student should complete 24 credits each in first and second semesters, 30 credits each in third and fourth semester course work. The project work will be allotted in the third semester and will continue in the fourth semester. The minimum percentage of marks to be earned by a student in each course is 40% with an aggregate of 50% in each semester to complete a Post Graduate Degree Programme from the Department of Physics, Andhra University. Other rules related to attendance and evaluation is as per the prevailing rules of the University.

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2021-22

PROGRAMME OBJECTIVES

The objectives of M.Sc. Electronics Course with Instrumentation as specialization are:

1. To impart skills in design and development of electronics and instrumentation systems for different industrial and research applications.

2. To equip students with excellence in education and skills, and enabling the student to pursue a career of his/her choice.

3. To develop abilities with technical knowledge for professional careers in Electronics, Instrumentation and Control related fields that cater to the needs of industries.

PROGRAMME OUTCOMES

PO1: Upon completion of the programme the student will able to develop extensive knowledge in various areas of Electronics and Instrumentation such as Communication Electronics, Control Systems, Digital Systems Design, Remote Sensing, Bio-medical Instrumentation, Analytical Instrumentation, Industrial Instrumentation, Digital Signal Processing, Microcontrollers, Embedded systems, etc.

PO2: Students will be able to select, install, calibrate and maintain instruments used for measurement and analysis.

PO3: One will be able to design signal analysis and develop the implementation for control schemes used in various industrial processes.

PO4: Apart from this he/her can develop the skill set to execute a Project incorporating Industrial standards.

PO5: The student will be equipped to take up a suitable position in various companies that manufacture electronic test equipment, transducers, process control equipment and recording instruments as well as in process industries.

DEPARTMENT OF PHYSICS

M. Sc. Electronics (Instrumentation)

(2 Year Self-Finance Programme)

Under Choice Based Credit System (CBCS)
2021-22

PROGRAMME SPECIFIC OUTCOMES (PSOs)

Upon completion of M.Sc. Electronics (Instrumentation) Programme, the Post Graduate will be able to:

PSO-1

Design and implementation of various Electronics and Instrumentation systems using analytical knowledge and latest hardware and software tools.

PSO-2

Solve problems and manage different projects in multidisciplinary areas applying acquired skill set.

PSO-3

Get the acquaintance of social and environmental awareness with ethical responsibilities.

M.Sc. Electronics (Instrumentation)
Course Curriculum under CBCS

M.Sc. Electronics (Instrumentation) – I Semester – FIRST YEAR
[Effective from the admitted batch 2021-2022]

THEORY	EL 101	Signals and Systems
	EL 102	EMI & EMC
	EL 103	Advanced Digital Systems & Computer Architecture
	EL 104	Electronic Measurements and Instrumentation
LABORATORIES	EL 105	Advanced Digital Systems Design Laboratory
	EL 106	Programming in MATLAB

SCHEME OF INSTRUCTION AND EXAMINATION UNDER CBCS

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EL 104	Electronic Measurements and Instrumentation	4	-	80	20	100	40	4
EL 105	Advanced Digital Systems Design Laboratory (Practical-80 & Record-20)	-	3	100		100	50	4
EL 106	Programming in MATLAB (Practical-80 & Record-20)	-	3	100		100	50	4
	Total					**600**		**24**

(**T**- Theory Hrs /Week, **P**- Practical Hrs/Week)

M.Sc. Electronics (Instrumentation)
Course Curriculum under CBCS

M.Sc. Electronics (Instrumentation) – II Semester – FIRST YEAR
[Effective from the admitted batch 2021-2022]

THEORY	EL 201	Microcontrollers and Interfacing
	EL 202	Analog and Digital Communications
	EL 203	Digital Signal Processing
	EL 204	Control Systems
LABORATORIES	EL 205	Microcontrollers Laboratory
	EL 206	Electronic Circuit Design Laboratory using OrCAD / LTspice

SCHEME OF INSTRUCTION AND EXAMINATION UNDER CBCS

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THEORY	EL 301	Industrial and Process Instrumentation
	EL 302	Analytical Instrumentation
	EL 303	1. PLC & SCADA
	Elective-1	2. Antenna and Microwave Devices
	EL 304	1. Digital Image Processing
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LABORATORIES	EL 305	Instrumentation Laboratory
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	TOTAL	**600**						**30**

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M.Sc. Electronics (Instrumentation)
Course Curriculum under CBCS

M.Sc. Electronics (Instrumentation) – IV Semester – SECOND YEAR
[Effective from the admitted batch 2021-2022]

THEORY	EL 401	Virtual Instrumentation
	EL 402	Biomedical Instrumentation
	EL 403	1. Remote Sensing Instrumentation
	Elective-1	2. Power Electronics
	EL 404	1. Power Plant Instrumentation
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LABORATORIES	EL 405	Project Work Dissertation
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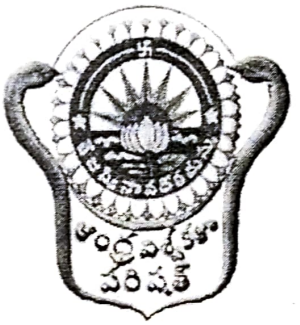
Course Curriculum & Syllabus

Under Choice Based Credit System (CBCS)

[Effective from 2021-2022 Admitted Batches]

M.Sc. Electronics (Instrumentation)



Department of Physics

College of Science and Technology

Andhra University

Visakhapatnam.

AUGUST-2021

DEPARTMENT OF PHYSICS

M. Sc. Electronics (Instrumentation)

(2 Year Self-Finance Programme)

Under Choice Based Credit System (CBCS)

2021-22

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P G Board of Studies Physics
DEPT. OF PHYSICS
AVD College of Science & Technology
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DEPARTMENT OF PHYSICS

M. Sc. Electronics (Instrumentation)

(2 Year Self-Finance Programme)

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M.Sc. Electronics (Instrumentation)
Course Curriculum under CBCS

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[Effective from the admitted batch 2021-2022]

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M.Sc. Electronics (Instrumentation)
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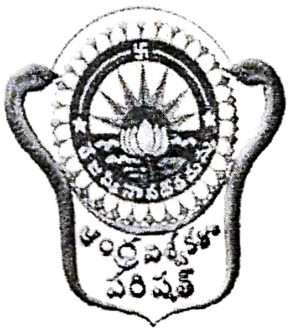
Syllabus and Model Papers

M.Sc. Electronics (Instrumentation)
1st Semester

Under Choice Based Credit System (CBCS)
[Effective from 2021-2022 Admitted Batches]



Department of Physics
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M.Sc. Electronics (Instrumentation)
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DEPT. OF PHYSICS

M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

First Semester

EL 101 – Signals and Systems
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

The aim of the course is for:

- Understanding the fundamental characteristics of signals and systems.
- Understanding the concepts of solution of Differential and Difference Equations, convolution, step response, causality.
- Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
- Development of the mathematical skills to solve problems involving convolution, natural response and forced response of Differential and difference equations, correlation, Causality, Fourier series, Fourier Transform and Laplace transform.

Learning Outcomes:

Students will be able to

- Apply the knowledge of Signals topics classification of signals, operations on signals, Type of signals, Different elementary signals.
- Classify systems based on their properties, operations on systems, and determine the response of LTI system using convolution, Analyse the Time domain of CT and DT Systems.
- Analyse the spectral characteristics of continuous-time periodic signals using Fourier analysis.
- Analyse system properties of Fourier Transform and DTFT.
- Apply the Laplace transform of continuous-time signals and systems, Analysis of Electrical network using LT.

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UNIT-I: Signals & Systems - An Introduction

A signal, Types of signals, standard signals, Representation of Discrete-time signals, Elementary Discrete-time signals, Basic Operations on Signals, Classification of Signals, A System, Classification of Systems, Basic system properties, System Modelling.

UNIT-II: Time Domain Analysis of CT and DT Systems

Introduction, Solution of Differential Equations, Convolution Integral, Properties of Convolution, Impulse Response of Interconnected Systems, Causality, Stability, Step Response, Graphical Procedure to Perform Convolution.

Solution of Difference Equations, Impulse Response, Representation of DT signals in Terms of Impulses, Convolution Sum, Properties of Convolution Sum, Convolution of Two Sequences, Causality, Stability, BIBO Stability Criterion, Step Response, Correlation of Two Sequences, Inverse System and Deconvolution.

UNIT-III: Fourier Series Analysis of CT Periodic Signals

Introduction, Evaluation of Fourier Coefficients, Symmetry Conditions, Cosine Representation, Exponential Fourier Series, Existence of Fourier Series, Properties of CT Fourier Series, Power Representation using the Fourier Series, Fourier Spectrum, Gibb's Phenomenon.

UNIT-IV: Fourier Transform of CT and DT Signals

Existence of FT, Fourier Transform of Some Standard Signals, Properties of Fourier Transform, Fourier Transform of a Periodic Signals, Modulation, System Analysis with FT.

Discrete-time Fourier Transform (DTFT): Existence of DTFT, Properties of DTFT, Frequency response of DTFT, Discrete Fourier Transform (DFT).

UNIT-V: Laplace Transform Analysis of Signals and Systems

Introduction, Convergence of the Laplace Transform, The Unilateral Laplace Transform (ULT), Properties of Unilateral LT, inversion of ULT, Inversion of Bilateral Laplace Transform, Solution of DE using LT, Analysis of Electrical Networks Using LT, Stability, System Realization.

Text Books:

1. Signals and Systems by P. Ramesh Babu and R. Ananda Natarajan, 3'rd Edition Sci tech
2. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall

Reference Books

1. Signals and Systems by K. Gopalan, Cengage Learning (India Edition)
2. Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications
3. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley- India Publications
4. Linear Systems and Signals by B.P.Lathi, Oxford University Press
5. Signal and Systems by Anand Kumar, 3rd Edition, PHI

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M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

First Semester

EL 102 – EMI & EMC
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To familiarize with the fundamentals that are essential for electronics industry in the field of EMI/EMC.
- To understand EMI sources and its measurements.
- To understand various techniques for electromagnetic compatibility.
- Acquire knowledge of various EM radiation measurement techniques.

Learning Outcomes:

- Designing electronic systems that functions without errors or problems related to electromagnetic compatibility.
- Diagnose and solve basic electromagnetic compatibility problems.
- Understand the effect EM noise in system environment and its sources.
- Identifying of EMI hotspot and various techniques like Grounding, Filtering, Shielding, etc.
- Concept of PCB tracing, termination and implementation.
- Understand about the functions of a ground, understanding about cables and connectors.
- Understand various aspects of shielding.
- Understand various aspects of bonding.

Unit-I: EMI Environment

Sources of EMI, conducted and radiated EMI, Transient EMI, EMI – EMC definitions and unit parameters. EMI Coupling Principles conducted, Radiated and Transient Coupling, Common impedance Ground Coupling, Radiated Common Mode and Ground loop coupling, Radiated Differential mode coupling, near field cable to cable to coupling, Power mains and power supply coupling.

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Unit-II: EMI Specification / Standards / Limits

Units of specification, Civilian standards, Military standards. EMI Measurement Open area test site (OATS) – OATS measurements – Measurement of RE, RS, Test site – Antennas – Measurement precautions – TEM cell – Measurements using TEM cell – Reverberating chamber.

Unit-III: Grounding Technique and Bonding

Grounding Principles – Precautions – Measurement of ground resistance – System grounding for EMC –Single-Point, Multi-Point and Hybrid Grounds, Bonding Shape and material for bond strap – Guidelines for good bonds.

Unit-IV: Shielding and Electrical Gaskets and Filtering

Transmission Line Theory of Shielding, Absorption Loss, Reflection Loss, Shielding Effectiveness, Shielding Materials, Apertures in Shielded Walls, Waveguide below Cut-off, The Need for Gaskets, Common Gaskets Material Use, Properties and Characteristics of RF Gaskets, Common-Mode and Differential-Mode Filtering, Basic Filter Component Characteristics, Filtering Guidelines.

Unit-V: EMI Design of PCB

PCB Traces – Cross talk – Impedance control – Power distribution – Decoupling - Zoning mother board – Design and propagation delay performance models.

Text Books

1. Noise Reduction Techniques in Electronic System – Henry W. Ott
2. Engineering EMC Principles, Measurements and Technologies – Kodali, V.P.

Reference Books

1. Principles of Electromagnetic Compatibility – Bernhard Keise

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M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

First Semester

EL 103 – Advanced Digital Systems and Computer Architecture
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To enable the students to design the digital circuits using logic gates.
- To understand the synthesis of Threshold logic circuits
- To understand the classification of finite state machines, state tables and state diagrams and design process.
- To get the knowledge of organization basic computer, addressing modes and different types of instruction formats and instruction sets.
- To understand the I/O interfacing requirements and memory interfacing concepts.

Learning Outcomes:

- Students will be able to design combinational logic circuits after simplification using K-Maps.
- Upon completion of this course, students shall be able to design Mealy and Moore machines by synthesis.
- Student on their own, able to design logic circuits using single and multiple Threshold elements.
- Students shall be able to identify the I/O interface requirements and able to select memory units as per the requirement.

Unit -I: Combinational Logic Circuits

Review of Boolean and De Morgan's laws – Shannon's expansion theorem – Consensus theorem – Encoders – Decoders – Multiplexers – Demultiplexers – SOP and POS Forms – K-maps – Synthesis of multiple output combinational logic circuits by map method – Static and Dynamic Hazards-Design of static hazard free logic circuits.

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Unit-II: Threshold Logic & Programmable Logic Devices

Threshold gate – Realization of conventional gates – Linear separability – Unateness –Threshold logic theorems – Synthesis of single gate and multigate threshold Network

Programmable Logic Devices: Basic concepts – Programmable Read only memory (PROM) – Programmable logic array (PLA) – Programmable array logic (PAL) — Implementation of combinational circuits using PLAs and PALs.

Unit-III: Sequential Logic Circuits

Review of flip-flops and latches (RS, D, JK and Master-Slave JK) – Excitation tables – FF conversions.

Finite state Machines: Mealy Machine-Design and analysis – Moore machine Design and analysis – State Tables and State diagrams – State table minimization – State assignments.

Unit-IV: Computer Architecture

Stored program organization, CPU registers, Bus system, Timing and control, Fetch cycle, execute cycle, Instruction cycle – Instruction Formats – Addressing modes – Instruction Set-Data transfer instructions, Arithmetic instructions, Branch and control Instructions-CISC and RISC system features – Pipelining issues.

Unit-V: I/O organization and Memory Organization

I/O Design: Isolated I/O and Memory mapped I/O - Asynchronous data transfer – Strobe I/O – Hand-shaking I/O - Serial interface – DMA transfer – DMA interface.

Interrupts: Daisy chaining Priority, Parallel priority, Priority encoder,

Memory Design: Memory hierarchy – Associative memory – Cache memory– Mapping functions – Virtual memory

Text Books

1. Digital Logic and Computer Design – M Morris Mano
2. Computer System Architecture – M. Morris Mano.

Reference Books

1. Computer Systems Design and Architecture – Heuring and Jordan
2. Computer Organization and Architecture: Designing for Performance – Stallings

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Electronics (Instrumentation)

SYLLABUS

First Semester

EL 104 – Electronic Measurements and Instrumentation
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To enable the students to understand the basic measurement principles and standards.
- To acquire the knowledge about the indicating instruments and displays.
- To get the knowledge about the instruments for measuring basic parameters.
- To understand the mechanism of oscilloscopes and signal generators.
- To enable the students to understand the types of signal analyses and recording instruments.

Learning Outcomes:

- The student will get complete knowledge about the measuring principles, errors and standards of measuring instruments.
- The student will know about the types of indicating instruments and displays.
- The students will identify the right measuring device for various basic parameters of instruments.
- The student will get complete knowledge on CRO's and their mechanism and how the signal generators work.
- Student will acquire the knowledge about different types of signal analyzers and recorders.

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Unit-I: Measurement Error and Standards

Accuracy and precision – Significant figures – Types of error – Statistical analysis – Probability of errors – Limiting errors – Classification of standards – Standards for mass, length, and volume – Time and frequency standards – Electrical standards – Standards of temperature and luminous intensity – IEEE standards.

Unit-II: Electromechanical Indicating Instruments and Displays

Introduction – Basic Meter Movement – Electro Dynamometer - Permanent-magnet moving-coil (PMMC) mechanism.

Digital Display Systems and Indicators

Classification of Displays - Display devices – LED – LCD – Printers – Classification of Printers – Printer Character Set – Line Printer – Dot-Matrix printer.

Unit-III: Measuring Instruments for basic parameters

DC Ammeter – Multirange Ammeter – RF Ammeter – Limitations – DC Voltmeter – Multirange Voltmeter – Transistor Voltmeter – AC Voltmeter – Ohmmeter - Watt-hour meter – Power-factor meter - True RMS voltmeter – Digital multimeter –LCR meter – Vector impedance meter – Vector voltmeter

Unit-IV: Oscilloscopes and Signal Generators

Principle of CRO – Cathode Ray Tube (CRT) – Vertical deflection system – Horizontal deflection system.

Signal Generators:

Sine wave generator – Frequency-synthesized signal generator – Sweep frequency generator – Pulse and square wave generator – Function generator.

Unit-V: Signal analyzers and Recording Instruments

Frequency selective wave analyzer – Heterodyne wave analyzer – Heterodyne harmonic analyzer – Fundamental-suppression harmonic distortion analyzer – Spectrum analyzer.

Recording instruments:

Analog recorder – X-Y recorder – Galvanometer type recorder, Strip-chart recorder – Magnetic tape recorder – CD/DVD writer.

Text Books

1. Electronic Instrumentation and Measurement Techniques – Helfrick and Cooper
2. Electronic Instrumentation – Kalsi

Reference Books

1. Electronic Instrumentation – Oliver and Cage
2. Electronic Measurement and Instrumentation – A.K.Sawhney

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Electronics (Instrumentation)

First Semester

SYLLABUS

EL 105 – Advanced Digital Systems Design Laboratory

(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- This lab covers all the topics of Digital Design briefly.
- Topics covered will focus on the design of digital systems using combinational and sequential devices.
- Techniques for logic design including asynchronous logic, physical world interfaces to digital systems, and system performance analysis methods will be studied.
- The laboratory houses the equipment for conducting digital system design lab course and integrated circuits lab course.

Learning Outcomes:

- The aim of this laboratory is to acquire the basic knowledge of digital logic levels and to design and verify basic digital electronics circuits.
- After completion of this lab the student will acquire adequate knowledge in digital system design concepts.
- The student will acquire the Ability to design and implement digital circuits under realistic constraints and conditions.
- One will be having the ability to devise, select, and use modern techniques and tools needed for digital system design.

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LIST OF EXPERIMENTS

1. Basic Logic Gates
2. Combinational Gates
3. Dual NAND and Dual NOR Gates
4. Half Adder using Logic Gates
5. Full Adder using Logic Gates
6. Half Subtractor using Logic Gates
7. Full Subtractor using Logic Gates
8. Verification of 8:3 Encoder using IC 74148
9. Verification of 3:8 Decoder using IC 74138
10. Verification of Multiplexer using IC 74151
11. Verification of Demultiplexer using IC 74154
12. Verification of Decade Counter using IC 7490

Text Books:

1. L K Maheswari and M M S Anand, "Laboratory Manual for Introductory Electronic Experiments", New Age, 2010.
2. S Poornachandra Rao and B Sasikala, "Handbook of Experiments in Electronics and Communication Engineering",Vikas publishers, 2003.
3. Website: http://ozark.hendrix.edu/~burch/logisim/

M.Sc. Degree Examination

Electronics (Instrumentation)

First Semester

SYLLABUS

EL 106 – Programming in MATLAB

(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To make the students familiar with MATLAB Software.
- To provide hands-on experience to the students to make them familiar with the working and handling of the programs using MATLAB Software.

Learning Outcomes:

- At the end of this laboratory, the students will be skilled enough to handle and understand the use of MATLAB programs

LIST OF EXPERIMENTS

1. Perform basic operations of matrix (addition, subtraction, multiplication, division)
2. Perform basic operation of matrix (Transpose, size, inverse of matrix)
3. Implement dot division and dot power array
4. Perform scalar and dot product of vectors
5. Program using while loop, what is greater value n that can be used in sum 1+2+3+…..+n and get less than 100
6. To find area of triangle.
7. To find biggest of 3 numbers
8. To generate Fibonacci series of N numbers
9. Generate Cos and sine graphs in a single graph
10. Generate for different graphs in a single graph
11. Plot a graph using surf and mesh functions

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12. Plot an overlaying plot
13. Generate Butterworth high pass filter
14. Generate Butterworth low pass filter
15. Generate Butterworth band pass filter

Text Books:

1. Programming in MATLAB ®: A problem-solving approach, 1e, Ram N. Patel and Ankush Mittal, Publisher: Pearson.
2. MATLAB-A Practical Introduction to Programming and Problem Solving-3Rd Edition, Attaway, Elsevier (2014)
3. MATLAB: A Practical Introduction to Programming and Problem Solving (Hahn and Attaway Bundle) Publisher: Butterworth-Heinemann
4. MATLAB Programming for Engineers, 6E, Stephen J. Chapman, Publication: Cengage
5. Basics of MATLAB Programming, R. Balaji
6. Programming in MATLAB: With Applied Numerical Methods for Engineers and Scientists, Naresh M. Chadha

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M.Sc. Electronics (Instrumentation) Programme

Matrix Mapping of PO's vs CO's

(FIRST SEMSTER)

EL 101: SIGNALS AND SYSTEMS

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1					
PO-2					
PO-3	✓		✓		
PO-4	✓				
PO-5					

EL 102: EMI & EMC

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1					✓
PO-2	✓				
PO-3		✓			
PO-4					
PO-5					

EL 103: ADVANCED DIGIITAL SYSTEMS AND COMPUTER ARCHITECTURE

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2		✓	✓		
PO-3					
PO-4				✓	
PO-5					

EL 104: ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2		✓	✓		
PO-3				✓	
PO-4					
PO-5					

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EL 105: ADVANCED DIGITAL SYSTEMS DESIGN LABORATORY

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓	✓			
PO-2					
PO-3				✓	
PO-4			✓		
PO-5					

EL 106: PROGRAMMING IN MATLAB

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2	✓				
PO-3					
PO-4	✓				
PO-5					

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Syllabus and Model Papers

M.Sc. Electronics (Instrumentation)
2nd Semester

Under Choice Based Credit System (CBCS)
[Effective from 2021-2022 Admitted Batches]

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M.Sc. Electronics (Instrumentation)
Course Curriculum under CBCS

M.Sc. Electronics (Instrumentation) – II Semester – FIRST YEAR
[Effective from the admitted batch 2021-2022]

THEORY	EL 201	Microcontrollers and Interfacing
	EL 202	Analog and Digital Communications
	EL 203	Digital Signal Processing
	EL 204	Control Systems
LABORATORIES	EL 205	Microcontrollers Laboratory
	EL 206	Electronic Circuit Design Laboratory using OrCAD / LTspice

SCHEME OF INSTRUCTION AND EXAMINATION UNDER CBCS

M.Sc. Electronics (Instrumentation) – II Semester – FIRST YEAR
[Effective from the admitted batch 2021-2022]

Theory Code	Title of the Paper	T	P	Semester End Exam Marks	Mid Exam Marks	Total Marks	Pass Minimum	Credits
EL 201	Microcontrollers and Interfacing	4	-	80	20	100	40	4
EL 202	Analog and Digital Communications	4	-	80	20	100	40	4
EL 203	Digital Signal Processing	4	-	80	20	100	40	4
EL 204	Control Systems	4	-	80	20	100	40	4
EL 205	Microcontrollers Laboratory (Practical-80 & Record-20)	-	3	100		100	50	4
EL 206	Electronic Circuit Design Laboratory using OrCAD / LTspice (Practical-80 & Record-20)	-	3	100		100	50	4
	Total					**600**		**24**

(**T**- Theory Hrs /Week, **P**- Practical Hrs/Week)

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M.Sc. Degree Examination
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SYLLABUS

Second Semester

EL 201 – Microcontrollers and Interfacing
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To understand the architectural features of Intel microcontroller 8051.
- To get the knowledge of interfacing requirements and complexities of different modules and sensors to 8051 microcontrollers.
- To understand the features of Atmel Microcontrollers 89C51 and 89C2051 and their applications.
- To understand various features of PIC microcontrollers, Addressing modes and instructions.
- To learn about various processor modes of ARM processors. Thumb instruction set and tightly coupled memory concepts.

Learning Outcomes:

- The student will get complete knowledge about Intel microcontroller 8051, register banks and special function registers, memory organization. Also, able to write simple programmes using instructions.
- The student upon completion of this course, able to interface different modules to 8051, like Keyboard, LCD, ADC and sensors etc.
- Student shall be able to use Atmel microcontroller for different applications.
- The student will be able to differentiate various microcontrollers. Learn about PIC microcontroller features, registers and instructions.
- Student will get the knowledge of ARM processors, modes of operation and Different instructions.

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Unit-I: Overview of 8051 microcontroller

Microprocessors Vs Microcontrollers-Harvard and von Neumann architectures- An overview of Architecture of 8051 microcontrollers-Pin description-8051 instruction set - Addressing modes -assembling and running an 8051-assembly language program-data types and directives-loops and counters-I/O port programming

Unit-II: Microcontroller 8051 Interfacing

Programming 8051 timers-Counter programming - RS232 Max buffer – NULL modem connectors Max232 - Serial port programming-8051 interrupts-programming the 8051 interrupts-LCD interfacing-keyboard interfacing-ADC, DAC and Sensor interfacing-external memory interfacing-8255 interfacing-Stepper motor interfacing

Unit-III: ATMEL Microcontrollers

Architecture of Atmel 89C51 and 89C2051-Pin description of 89C51 and 89C2051-Power saving options

Applications of Atmel89C51 and 89C2051: Precision analog comparator-square wave generator using 89C51-ADC using 89C2051-Staircase Ramp generator using 89C2051-Pulse width measurement.

Unit-IV: PIC Microcontrollers

PIC microcontroller's overview and features- Architecture of 16C6X/7X- Memory structure- Instructions-addressing modes-I/O ports – interrupts in PIC16C61/71 - PIC 16C61/71 TimersPIC 16F877 Flash Microcontrollers: Pin Diagram-Registers-memory structure- interrupts - I/Oports-timers

Capture/compare/PWM Modules in PIC16F877-ON chip ADC and DAC-MSSP Module-USART

Unit-V: ARM CONTROLLER

ARM controller Architecture –Programming model: data types-processor modes-Registers- ARM Instruction set - THUMB instruction set –Addressing modes- memory system architecture-memory hierarchy-Cache and write buffers-Tightly coupled memory.

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Text Books:

1. 8051 Microcontroller & Embedded System – Mohammad Ali Mazidi
2. Design with PIC Microcontrollers – Peatman

Reference Books:

1. Microcontrollers [Theory and Applications]-Ajay V Deshmukh
2. ARM architecture reference manual-ARM limited
3. The 8051 Microcontroller – Kenneth J Ayala

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M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Second Semester

EL 202 – Analog and Digital Communications
(Effective from the admitted batch of 2021-2022-CBCS)

Course objectives:

- To develop ability to analyze system requirements of analog and digital communication systems.
- To understand the generation, detection of various analog and digital modulation techniques.
- To acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
- To understand the concepts of baseband transmissions.

Learning Outcomes:

- Analyze and design of various continuous wave and angle modulation and demodulation techniques.
- Understand the effect of noise present in continuous wave and angle modulation techniques.
- Attain the knowledge about AM, FM Transmitters and Receivers.
- Analyze and design the various Pulse Modulation Techniques.
- Understand the concepts of Digital Modulation Techniques and Baseband transmission.

Unit-I: Random Processes and Waveform Coding

Introduction, Random processes, Stationary processes – Mean, correlation and covariance functions, Ergodic processes, Transmission of a random process through a linear time invariant filter – Power spectral density – Gaussian process - Noises, Narrowband noise, Noise Temperature, Noise Figure – Representation of narrow band noises – Sine wave plus narrowband noise.

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Unit-II: Analog Modulation

Overview of Analog and Angle Modulation, Sampling theorem for low pass, band pass signals, Natural and Flat-top sampling - Quantization process, PAM, PWM and PPM, Pulse Code Modulation, PCM systems, Companding, Delta modulation, Differential PCM, Noise in PCM, DM, DPCM Systems - Time Division Multiplexing, FDMA.

Unit-III: Digital Modulation and Detection

Conceptualized model of a digital communication systems, Gram Schmidt procedures, Matched filter, correlation receivers, likelihood function and maximum likelihood detection, Digital modulation formats, BPSK, QPSK, FSK and MSK schemes bit and symbol error properties, performance comparisons.

Unit-IV: Information theory and Coding

Discrete Messages, The concept of amount of information, Average Information, Entropy, Information Rate, source-coding theorem, Discrete Memoryless channels, Channel Capacity, Channel-coding theorem. Coding: introduction, Parity Check bit coding for error detection, coding for error detection and correction, Linear block codes, hamming codes, cyclic codes, CRC codes, BCH codes, RS codes, Convolution coding and decoding.

Unit-V: Data Communications

Introduction, History of Data communications, Standards Organizations for data communication, data communication circuits, data communication codes, Error control, Error Detection, Error correction.

Text Books

1. Communication Systems - Simon Haykins
2. Principles of Communication System – Herbert Taub and D L Schilling

Reference Books

1. Digital Communication – Simon Haykin
2. Advanced Electronic Communication Systems - Wayne Tomasi
3. Modern Digital and Analog Communication Systems – B P Lathi

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SYLLABUS

Second Semester

EL 203 – Digital Signal Processing
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objective:

- Digital Signal Processing is an excellent communication tool which helps us to process the signals. Signals needed to be processed so that the information they contain can be displayed, analysed or converted to another type of signal that may be of use.
- It is a programmable device which is used for various applications and one can create their own software or use the software provided by ADI.
- Digital Signal Processing here deals with the signal phenomenon, filter designing, transformations and many others.

Learning Outcomes:

After successfully completing the course students will be able to

- Know about the digital domain analysis using Fourier Representations
- Identify the importance of Z transformations and DTS structures
- How to classify IIR and FIR Filters
- Different noises present in the system
- The outcome of this tutorial will have a good balance between theory and mathematical precisions.

Unit - I: Time, Signals and Systems

Sampling of analog signals - Basic sequences and sequence operations - Aliasing Standard discrete time signals - Classification - Discrete time systems - Linear time invariant stable casual discrete time systems - Classification methods - Linear and circular convolution - Difference equation representation - DFS, DTFT, DFT - FFT computations using DIT and DIF algorithms

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Unit – II: Z- transforms and Structures for Discrete - Time Systems

Z - transforms and its properties - Inverse Z - transforms - Time response and frequency response analysis of discrete time systems to standard input signals. Signal flow graph representation of linear constant coefficient difference equations - Basic IIR structures - Transposed forms - Basic structures for FIR systems Overview of finite - precision numerical effects.

Unit - III: Infinite Impulse Response Digital Filters

Review of design of analogue Butterworth and Chebyshev Filters - Frequency transformation in analogue domain - Design of IIR digital filters using impulse invariance technique - Design of digital filters using bilinear transform - Pre - warping - Frequency transformation in digital domain - Realization using direct, cascade and parallel forms.

Unit - IV: Finite Impulse Response Digital Filters

Symmetric and anti - symmetric FIR filters - Linear phase FIR filters - Design using Frequency sampling technique - Window design using Hamming - Hanning and Blackmann Windows - Concept of optimum equi - ripple approximation - Realization of FIR filters - Transversal, Linear phase and Polyphase realization structures.

Unit - V: Finite Word Length Effects

Quantization noise - Derivation for quantization noise power - Fixed point and binary floating point number representations - Comparison - Overflow error - Truncation error - Coefficient quantization error - limit cycle oscillations- Signal scaling - Analytical model of sample and hold operations

Text Books:

1. Digital Signal Processing - Oppenheim and Schaffer
2. Digital Signal Processing - A. Nagoor Kani

Reference Books:

1. Digital Signal Processing - A Computer Based Approach - Sanjit K. Mitra
2. Digital Signal Processing - P. Ramesh Babu
3. Digital Signal Processing - Algorithms and Applications - Proakis and Manolakis

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M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Second Semester

EL 204 – Control Systems
(Effective from the admitted batch of 2021-2022-CBCS)

Course objectives:

- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
- To assess the system performance using time domain analysis and methods for improving it
- To assess the system performance using frequency domain analysis and techniques for improving the performance
- To design various controllers and compensators to improve system performance

Learning Outcomes:

After completion of this course the student is able to

- Improve the system performance by selecting a suitable controller and/or a compensator for a specific application
- Apply various time domain and frequency domain techniques to assess the system performance
- Apply various control strategies to different applications (example: Power systems, electrical drives etc...)
- Test system Controllability and Observability using state space representation and applications of state space representation to various systems.

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Unit-I: General Concepts and Transfer Functions, Block Diagrams and Signal-Flow Graphs

Introduction- Concept of Control systems - Open- and closed-loop control systems – Types of Feedback systems - Effect of feedback systems- Transfer function concept – Transfer functions of common networks – Block diagram reduction rules and examples – Signal flow diagrams – Mason's theorems – Reduction of signal flow diagrams – Application of signal flow diagram to multiple feedback systems

Unit-II: State-Variable Analysis and State Equations of Physical Systems

State space concepts – Stare space model for differential equation - Transfer function from state space model -controllability and observability - State variable diagram – Transition matrix and its properties – State space model from Transfer function - Transfer function and state space representation of typical mechanical, electrical, hydraulic and thermal systems -Application of state space method.

Unit-III: Time Domain analysis of Standard test signals, Stability and Root-Locus of control systems

Time response - Standard test signals - Time response of first order system for standard test signals - Stability – Sensitivity – Static accuracy- Computation of steady state errors - step response of second order systems - time domain specifications of second order systems- Routh - Hurwitz stability criterion and examples - special case when routh's Tabulation terminate prematurely - Root-Locus technique - Construction of Root-loci.

Unit-IV: Frequency-Domain Analysis

Frequency-Domain specifications -Frequency-domain specifications of second order systems- Relationship between time and frequency response- Effects of adding a Zero and Pole to the forward-path transfer function - Polar plots - Bode plots - Nyquist stability criterion - Relative stability using Nyquist criterion – gain and phase margin.

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Unit-V: Design of control systems

Introduction – Design with the PD Controller – Design with the PI Controller – Design with the PID Controller – Design with phase lead, Phase lag, Lead lag controller – Forward and feed forward controllers – Design of Robust control systems – Minor loop feedback control

Text Books:

1. Automatic Control Systems – Benjamin C. Kuo
2. Modern Control Engineering – Ogata

Reference Books:

1. Modern Control System Theory and Application – Shinners
2. Control Systems – Nagarath and Gopal

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SYLLABUS

Second Semester

EL 205 – Microcontrollers Laboratory
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- Imparting on hands on exposure to the students in the usage of development tools and to make them proficient in building 8051 based applications.
- To study programming based on 8051 microcontroller.
- To study 8051 microcontroller based Keil programming using arithmetic, logical and shift operations. To study to interface 8051 with Timer0 and Timer1
- To study parallel and serial communication using 8051 microcontroller.
- To study generation of square wave on ports

Learning Outcomes:

- Select and use a standard IDE for editing, compiling, debugging and simulation of ALP/C programs (program development).
- Adjudicate the right usage of assembly language instructions and Embedded C features.
- Write programs for simple I/O, delay generation and standard interfaces.
- Demonstrate ability to handle sorting operations and using assembly language programming in keil IDE.
- Demonstrate ability to handle parallel and serial communication using keil IDE
- Construct different square waveforms using 8051 microcontrollers.

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LIST OF EXPERIMENTS

1. Write a C program for 8051 to toggle the bits of port P1 continuously with a 250 ms delay.
2. Write an assembly program to add the first ten natural numbers and save the result in RAM location 40H.
3. Write a program to create a square wave on bit '0' of port 1
4. Write a program to convert hexadecimal number to decimal number
5. Write a program to convert a binary to ASCII
6. With a frequency of 11.0592 MHz, generate a frequency of 100 KHz on pin P1.3 by using timer 1 model
7. Write an 8051 C program to transfer the message DSD serially at 9600 band rate, continuously
8. Write a program for blinking of LED using AT 89C51
9. In a semester, a student has to take six courses. The marks of the student (out of 25) are stored in RAM locations from 47H onwards. Write a program to find the average marks and output it on port 1.
10. Write an ALP to arrange the numbers in ascending order/ descending order
11. Write a program to make 8*1 multiplexer with enable signal.
12. Write a program to take parallel input from part1 and convert it into serial and sent it via P0.0
13. Write a program to take input from P0 and count number of ones in input.
14. Write a program to blink LED on P2.0 for 5 seconds using timer 1.

Reference Books:

3. 8051 Microcontroller & Embedded System – Mohammad Ali Mazidi
4. Design with PIC Microcontrollers – Peatman
5. Microcontrollers [Theory and Applications]-Ajay V Deshmukh
6. ARM architecture reference manual-ARM limited
7. The 8051 Microcontroller – Kenneth J Ayala

M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Second Semester

EL 206 – Electronic Circuit Design Laboratory using OrCAD / LTspice
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- The objective is to introduce the SPICE simulator/ Lab view simulator to ECE at basic level with minimum amount of time and effort. A course on basic circuits should be a pre-requisite.
- To familiarize the electronic components and basic electronic instruments.
- To make familiar with PCB design and various processes involved.
- To provide the knowledge in assembling and testing of the PCB based electronic circuits.

Learning Objectives:

- The students will be able to design a system, component, or process to meet desired needs
- The students are taught to design and simulate various PCB circuits using industry standard PCB design software tools like OrCAD and LTspice.
- The students will have the ability to identify, formulate, and solve engineering problems associated with assembly and testing of electronic circuits
- The students are taught to use advance components assembly process machines, troubleshooting using instruments and equipment.

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LIST OF EXPERIMENTS

1. To measure the voltage and current at various node of resistor network.
2. To study the working and construction of half wave rectifier
3. To study the working and construction of full wave rectifier.
4. To study the working and construction of full wave bridge rectifier
5. To analyze negative clipper circuit and positive clipper circuit.
6. Study of negative and positive clamper circuit.
7. To verify the diode characteristics using OrCAD / LTspice.
8. To verify the BJT characteristics using OrCAD / LTspice.
9. To verify the BJT Amplifier characteristics using OrCAD / LTspice.
10. To implement RC high pass & low pass circuits using OrCAD / LTspice.
11. To implement the given Boolean equation using different gates & verify the output.
12. To implement the half adder using OrCAD / LTspice.
13. To implement NAND as universal gate.
14. To implement NOR as universal gate.

NOTE: The students will be required to perform at least eight experiments in the semester.

Reference Books:

1. Electronic Circuit Analysis using LTSpice XVII Simulator A Practical Guide for Beginners - By Pooja Mohindru, Pankaj Mohindru Copyright Year 2022.
2. LTspice IV Basic Lab Class – By Presented by Thomas Mosteller ADI FAE
3. Electronics Circuit Spices Simulation with LTspice : A Schematic Based approach - Amith Kumar Singh, Rohith Singh.

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M.Sc. Electronics (Instrumentation) Programme

Matrix Mapping of PO's vs CO's

(SECOND SEMSTER)

EL 201: MICROCONTROLLERS AND INTERFACING

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2		✓			
PO-3					
PO-4				✓	
PO-5					✓

EL 202: ANALOG AND DIGITAL COMMUNICATIONS

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				✓
PO-2					
PO-3		✓			
PO-4					
PO-5					

EL 203: DIGITAL SIGNAL PROCESSING

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2					
PO-3		✓		✓	
PO-4					✓
PO-5					

EL 204: CONTROL SYSTEMS

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2					
PO-3		✓			
PO-4			✓		
PO-5					

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EL 205: MICROCONTROLLERS LABORATORY

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓			✓	
PO-2					✓
PO-3					
PO-4					
PO-5					

EL 206: ELECTRONIC CIRCUIT DESIGN LABORATORY USING OrCAD / LTspice

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2		✓			
PO-3					
PO-4			✓	✓	
PO-5					

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Syllabus and Model Papers

M.Sc. Electronics (Instrumentation)
3rd Semester

Under Choice Based Credit System (CBCS)
[Effective from 2021-2022 Admitted Batches]

Department of Physics
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M.Sc. Electronics (Instrumentation)
Course Curriculum under CBCS

M.Sc. Electronics (Instrumentation) – III Semester – SECOND YEAR
[Effective from the admitted batch 2021-2022]

THEORY	EL 301	Industrial and Process Instrumentation
	EL 302	Analytical Instrumentation
	EL 303 **Elective-1**	1. PLC & SCADA 2. Antenna and Microwave Devices
	EL 304 **Elective-2**	1. Digital Image Processing 2. VLSI Design
LABORATORIES	EL 305	Instrumentation Laboratory
	EL 306	PLC & SCADA Laboratory
	EL 307	MOOCS Paper
	EL 308	Value Added Paper (IPR Chair Paper)

SCHEME OF INSTRUCTION AND EXAMINATION UNDER CBCS

M.Sc. Electronics (Instrumentation) – III Semester – SECOND YEAR
[Effective from the admitted batch 2021-2022]

Theory Code	Title of the Paper	T	P	Semester End Exam Marks	Mid Exam Marks	Total Marks	Pass Minimum	Credits
EL 301	Industrial and Process Instrumentation	4	-	80	20	100	40	4
EL 302	Analytical Instrumentation	4	-	80	20	100	40	4
EL 303	Elective - I	4	-	80	20	100	40	4
EL 304	Elective – II	4	-	80	20	100	40	4
EL 305	Instrumentation Laboratory (Practical-80 & Record-20)	-	3	100		100	50	4
EL 306	PLC & SCADA Laboratory (Practical-80 & Record-20)	-	3	100		100	50	4
EL 307	MOOCS Paper	ON LINE MODE						4
EL 308	VALUE Added Paper (IPR Chair Paper)	Total 30 hours learning, No Examination						2
	TOTAL	**600**						**30**

(**T**- Theory Hrs /Week, **P**- Practical Hrs/Week)

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M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Third Semester

EL 301 – Industrial and Process Instrumentation
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To understand measuring systems and characteristics.
- To get the knowledge of different types of sensors/Transducers for the measurement of Pressure and Temperature.
- To understand the flow and level measuring techniques.
- To learn about different processes, their characteristics and various modes of control.
- To understand about final control elements of process, valves and instrumentation diagrams.

Learning Outcomes:

- The student shall be able to identify the characteristics of measuring systems like accuracy, sensitivity, dead zone and errors.
- The student can select the right sensor/transducer for the measurement of pressure and Temperature as per the design requirement.
- Student can understand the flow characteristics and working principles of various sensors for flow and level systems.
- The student will get the knowledge about process types and response of process variables and control schemes.
- The student will be able to select the valve according to the characteristics and requirements

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Unit-I: Qualities of measurement

Functional units-Static characteristics - Accuracy-sensitivity-precission-static error-Dead zone - Dynamic characteristics - Speed of response-fidility – lag - errors of measurement. Displacement measurement: Strain gauge - LVDT-capacitive gauges-piezoelectric transducer.

Unit-II: Pressure and Temperature Measurement

Manometers – Elastic types – Bourdon tubes – Diaphragm Elements – Bellows elements – Electricaltypes.

Temperature Measurement: Solid expansion type – Fluid expansion type – Electrical type: RTDs – Thermocouples – Thermistor– Radiation and optical pyrometers.

Unit-III: Flow and Level Measurement

Head types – Pilot tube – Area flow meters – Electrical type – Magnetic types – Ultrasonic or acousticvelocity flow meter – Hot wire anemometer.

Level measurement: Float type – Displacer type – Hydrostatic – Electrical methods.

Unit-IV: Process Control

Process variable – Batch process and continuous process – Self regulation – Basic control actions –Characteristics of on off – Proportional – Single speed floating – Integral and derivative control modes

– Composite control modes – P+I, P+D, P+I+D, response of controllers for different types of inputs –Tuning of controllers- ratio control – Cascade control.

Unit-V: Final Control Elements

I/P & P/I converter – Valve positioners/actuators – Control valve – Characteristics – Globe – Butterfly-Diaphragm – Ball valves- valve sizing – Instrumentation diagrams.

Text Books:

1. Principles of Industrial Instrumentation – Patranabis
2. Principles of Process Control – Patranabis

Reference Books:

1. Principles of Industrial Instrumentation – Eckman
2. Automatic Process Control – Eckman

M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Third Semester

EL 302 – Analytical Instrumentation
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To impart a basic knowledge about analytical instruments, its concepts, and its technique.
- To give a vast knowledge about different types of spectroscopic analysis.
- To study about different types of chromatographic analysis.
- To study important methods of analysis of industrial gases, Awareness and control of pollution in the environment is of vital importance.
- To bring out the latest ideas on ion-selective electrodes, calomel electrode and combination Electrode which have potential applications in medica field, food and beverage industries

Learning Outcomes:

- Graduate will be able to identify, understand and define the fundamentals of Analytical instruments: can you illustrate the elements of Absorption Spectroscopy Graduate will able to sketch various types of photometry.
- Graduate will be able to compare and evaluate the performance of Mass, NMR, DTA, DSC, X-ray Spectrometers.
- Graduate will be able to describe and articulate various aspects of Gas and Liquid Chromatography.
- Graduate will be able to deduce the relevance with deeper understanding of pH meters, conductivity meters, Dissolved Oxygen Meters: They will be able to choose the appropriate method.

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Unit-I: Analytical Instruments & Absorption Spectroscopy

Elements of an analytical instrument – PC based analytical instruments -- Classification of the methods of analysis –Electromagnetic radiation- Electromagnetic spectrum- Laws relating to absorption of radiation. Absorption spectroscopy: Absorption instruments – Radiation sources- Optical filters- Monochromators- Detectors -- Ultra violet and visible absorption spectroscopy-- IR spectrometer-- FTIR.

Unit-II: NMR, ESR and X-ray Spectrometers

NMR spectroscopy: Principle of NMR-- Types of NMR-- Constructional details of NMR-- Applications of NMR, X-ray Spectrometers: X – ray spectrum –Instrumentation for x –ray spectrometry -- X-ray diffractometers- X-ray absorption meters- X- ray fluorescence spectrometry. ESR Spectrometers: Basic ESR spectrometer – Electron spectroscopy: Instrumentation for electron spectroscopy.

Unit-III: Atomic Spectroscopy, pH meter and Electrochemical Instruments

Flame photometry – AAS, ICP-AES, ICP-MS spectrometers. pH meter: principle of pH Measurement-- Electrodes for pH measurement--types of pH meters -Selective Ion Electrodes Potentiometry – Conductivity – Polarography.

Unit-IV: Thermo-analytical and Chromatographs

Thermogravimetry – Differential thermal analysis – Differential scanning calorimetry. Gas chromatography – GC-MS – High performance liquid chromatography (HPLC) – LC-MS.

Unit-V: Environmental Pollution Monitoring Instruments

Air pollution monitoring systems for carbon monoxide, sulphur dioxide, Hydrocarbons – Water pollution monitoring instruments.

Text Books:

1. Handbook of Analytical Instruments – R.S Khandpur
2. Instrumental Methods of Analysis – Willard

Reference Books:

1. Instrumental Methods of Chemical Analysis – Sharma

M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Third Semester

EL 303 – ELECTIVE PAPER
1. PLC and SCADA
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objective:

- A Programmable Logic controller or a PLC is an Industrial Digital Computer which has been adapted for controlling the manufacturing process and process fault diagnosis. It is designed to configure input components and process the controller to produce a desired output through various techniques. Ladder programming is one of the approaches to design and manipulate a PLC.
- SCADA on the other hand is a collection of equipment that will provide an operator at remote location with enough information to determine the status of a particular piece of an equipment or entire substation and cause actions to take place regarding the equipment or network.

Learning Outcomes:

- The student will be much benefited while programming the PLC components, which will be useful for them in industrial applications.
- They will be able to formulate the applications in Real Time applications.
- Logic gates implementation for various applications, Delay formulation, counters and many logics can be developed using PLC hardware.
- The student will be able to learn Different Remote terminal units necessary to connect a SCDA via a communication system.
- At the end one might acquire the knowledge of Industrial Instrumentation for manufacturing process using Remote access locations by developing the programming skills in PLC and SCADA.

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Unit-I: Overview of PLCs. PLC Hardware Components

Brief history of PLCs, what makes PLCs work, PLCs configurations, System Block diagrams, basic components and symbols, PLCs system, PLCs controllers, Internal Architecture, Hardware, PLCs number and codes,

Unit-II: Logic Fundamentals, Basic PLC Programming

Physical components Vs Programme components, Lighting control, Internal relays, Disagreement circuits, oscillators, holding, always ON & always OFF contacts, Input Devices, output devices, I/P and O/P units, Signal conditioning, remote connections, Networks, commercial system example, processing inputs, I/O addresses, Discrete Output models, TTL o/p modules, analog o/p modules, Fundamentals of ladder diagram, conventional ladders Vs PLCs ladder logic

Unit-III: PLC Wiring Diagrams & Ladder Logic Programs

Overview of logic and logic functions, ladder functions, latching, multiple outputs, entering outputs, function blocks, Series logics (AND, 3 I/P AND), Parallel logics (OR, NOT,) Analysis of Rung #1, Analysis of Rung #2, Ex-OR, Ex-OR logic, combinational logic, Types of Timers, ON delay, OFF delay, Pulse and Retentive Timers, Form of counters, up and down counting, Timers with Counters, sequences.

Unit-IV: Introduction to SCADA

Scada, Introduction, Types of SCADA, SCADA Architecture, Protocols in SCADA communications, SCADA Hardware, SCADA Software, Functionality, Data Manipulations Instructions, Data transfer instructions, special function instructions

Unit-V: Data Manipulation, Encoders, Transducers, Sensors, Introduction to SCADA software.

Temperature, liquid level, pressure, flow, inclination, acceleration, angle position, Linear Displacement, SCADA fundamentals, Overview of SCADA software.

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Text Books:

1. Programmable logic controllers- W.Bolton.
2. Introduction to Programmable logic Controllers, (Delmar Publisher)- Gary Dunning

Reference Books

1. Programmable logic controllers Hardware, software and Applications- George.L..
2. Programmable logic Controllers, (Prentice Hall of India)- Webb & Reis.
3. Programmable Logic Controller – Principles and Applications- J. W. Webb.
4. Programmable Logic Controller – Programming methods and Applications- Hackworth John R. and Hackworth Frederick D. Jr.
5. Programmable Controllers, Theory and Implementations—L.A Bryan, E.A Bryan.

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M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Third Semester

EL 303 – ELECTIVE PAPER
2. Antenna and Microwave Devices
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- Understand basic terminology and concepts of Antennas.
- To attain knowledge on the basic parameters those are considered in the antenna design process and the analysis while designing that.
- Analyze the electric and magnetic field emission from various basic antennas and mathematical Formulation of the analysis.
- To have knowledge on antenna operation and types as well as their usage in real time filed.
- To study the microwave sources and amplifiers.
- To introduce microwave diodes and waveguides

Learning Outcomes:

Student will be able to

- Aware of antenna parameter considerations
- Capable to analyze the designed antenna and field evaluation under various conditions and formulate the electric as well as magnetic fields equation set for far field and near field conditions
- Understand the array system of different antennas and field analysis under application of different currents to the individual antenna elements
- Understand the design issues, operation of fundamental antennas and their operation methodology in practice. Design a lens structure and also the bench set up for antenna parameter measurement of testing for their effectiveness
- Knowledge about the means of Microwave devices
- Understand with microwave diodes, waveguides and amplifiers.

UNIT -I: Antenna Basics

Introduction, Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Illustrative Problems. Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Antenna Theorems, Radiation, Retarded Potentials – Helmholtz Theorem. Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area, Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths, Illustrative Problems.

UNIT –II: VHF, UHF and Microwave Antennas

Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas –Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.

Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip Antennas. Impact of Different Parameters on Characteristics

Reflector Antennas – Introduction, Flar Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features, Illustrative Problems.

UNIT –III: Antenna Arrays and Measurements

Point Sources – Definition, Patterns, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions –General Considerations and Binomial Arrays, Illustrative Problems.

Antenna Measurements: Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods)

UNIT – IV: Waveguides

Rectangular waveguides – TE waves solution – TM waves solution – Dominant mode – Degenerate modes – Power flow in rectangular waveguides – Attenuation in rectangular waveguides – Methods of excitation of modes – Circular waveguides – Ridge waveguides – Surface waveguides – Dielectric rod waveguides – Excitation of dielectric waveguides.

UNIT – V: Microwave vacuum tubes and solid-state devices

High frequency limitations of conventional tubes – Klystron – Reentrant cavities – Velocity modulation process – Bunching process – Output power – Reflex klystron – Velocity modulation – Power output and efficiency – Cylindrical magnetron – Gunn diode – Two-valley model theory – High-field domain – Modes of operation – PIN diode – Crystal detector – GaAs FET.

Text Books:

1. Antennas and Wave Propagation – J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed., 2000.
3. Microwave Devices and Circuits – Samuel Y. Liao

Reference Books:

1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.
2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.
3. Microwave Engineering – Annapurna Das & S K Das
4. Electronic Communication Systems – George Kennedy

M.Sc. Degree Examination
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SYLLABUS

Third Semester

EL 304 – ELECTIVE PAPER
1. Digital Image Processing
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- Image processing methods are enrooted from two principal application areas for improvement of pictorial representation for human interpretation and processing of image data for storage, transmission, and representation for machine perception.
- The field of digital image processing refers to processing digital images by means of a digital computer and the digital image is represented by the elements called picture elements, image elements, pels, pixels.

Learning Outcomes:

After successfully completing the course students will be able to

- Learn the outcomes of Image acquisition and the relationships of Pixels in Geometric and morphological representations.
- Acquire knowledge in processing of Histograms and filtering in frequency domain and Homomorphic.
- Discrimination of discontinuities and segmentation. Analyzing and extraction of data.
- Wavelet transform representation and image compression techniques are learned.
- Various applications of Image Processing can be learnt.

Unit-I: Fundamentals of Image Processing

Introduction – Steps in image processing systems – Image acquisition – Sampling and Quantization – Pixel relationships – Colour fundamentals and models, File formats, Image operations – Arithmetic, Geometric and Morphological.

Unit-II: Image Enhancement

Spatial Domain: Gray level Transformations – Histogram processing – Spatial filtering smoothing and sharpening. Frequency Domain: Filtering in frequency domain – DFT, FFT, DCT – Smoothing and sharpening filters –Homomorphic Filtering.

Unit-III: Image Segmentation and Feature Analysis

Detection of Discontinuities – Edge operators – Edge linking and Boundary Detection – Thresholding – Region based segmentation – Morphological Watersheds – Motion Segmentation, Feature Analysis and Extraction.

Unit-IV: Multi Resolution Analysis and Compressions

Multi Resolution Analysis: Image Pyramids – Multi resolution expansion – Wavelet Transforms. Image compression: Fundamentals – Models – Elements of Information Theory – Error free compression – Lossy Compression –Compression Standards.

Unit-V: Applications of Image Processing

Image classification – Image recognition – Image understanding – Video motion analysis – Image fusion –Steganography – Digital compositing – Mosaics – Colour Image Processing.

Text Books:

1. Digital Image Processing - Rafael C. Gonzalez and Richard E. Woods - 2nd Edition, Pearson Education, 2003.
2. Fundamentals of Digital Image Processing - Anil K. Jain - Pearson Education, 2003.

Reference Books:

1. Image Processing, Analysis and Machine Vision - Milan Sonka, Vaclav Hlavac and Roger Boyle – 2ndEdition, Thomson Learning, 2001.

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M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Third Semester

EL 304 – ELECTIVE PAPER
2. VLSI Design
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- Be able to use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnect.
- Be able to create models of moderately sized CMOS circuits that realize specified digital functions.
- Be able to apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects.
- Have an understanding of the characteristics of CMOS circuit construction.
- To introduce the concepts and techniques of modern integrated circuit design and testing (CMOS VLSI).
- Be able to design static CMOS combinational and sequential logic at the transistor level, including mask layout.
- Compare the trade-offs of sequencing elements including flip-flops, transparent latches, and pulsed latches

Learning Outcomes:

- Be able to use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnect.
- Be able to create models of moderately sized CMOS circuits that realize specified digital functions.
- Be able to apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects.

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- Have an understanding of the characteristics of CMOS circuit construction and the comparison between different state-of-the-art CMOS technologies and processes.

Unit-I: MOS Transistor Theory

Gajski Chart in VLSI design domain - MOS structure - Biasing and operation of MOS - Scaling in MOS Circuits - Small geometry effects - MOS capacitances - Mobility variations - Hot electron effect.

Unit-II: MOS Inverter Design and Optimization

Static and switching characteristics - Resistive load inverters - Inverter with n-type MOSFET load - CMOS inverters - Introduction to switching characteristics - Inverter delay time definitions and calculations - Delay constraints in inverter.

Unit-III: CMOS Combinational / Sequential Logic Design

Introduction - MOS logic circuits with depletion MOS load - CMOS NAND and NOR gates - Complex gate design - Pass transistor logic - Transistor gate logic

CMOS Sequential Logic Design

Bistable elements - SR latch circuit - Clocked latch and flip-flop circuits - CMOS D-latch edge triggered flip-flop - CMOS SRAM design - CMOS DRAM design.

Unit-IV: Dynamic Logic and Clocking Circuits

Dynamic pass transistor circuits - Dynamic transmission gate design - High performance dynamic logic circuits (Dynamic CMOS logic, C^2MOS logic, CMOS Domino logic, NP domino, Zipper CMOS circuits) - Setup and hold time - Clock skew in CMOS circuits - PLL technique for clock synchronization.

Unit-V: CMOS Chip Design Options and I/O Design

Programmable Logic, Programmable Logic Structures, Programmable Interconnect, Reprogrammable Gate Arrays, Sea-of-Gate and Gate Array Design, Standard Cell Design, I/O Design-Introduction, ESD Protection, Input Circuits, Output Circuits and L(*di/dt)* noise, Latch-Up prevention.

Text Books:

1. CMOS VLSI Design – Sung Mo Kang, Yusuf Leblebici
2. Principles of CMOS VLSI Design: A System Perspective – Weste H.E., Kamran Eshrigian Neil.

Reference Books:

1. Digital Integrated Circuits – Jan M. Rabey
2. Digital Integrated Circuits: A Design Perspective – Rabaey, Chandrakasan, Nikolic
3. Principles of CMOS-VLSI Design: A Systems Perspective – WesteEshragh

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M.Sc. Degree Examination
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SYLLABUS

Third Semester

EL 305 – Instrumentation Laboratory
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- Instrumentation lab introduces the students with the theory and methods for conducting experimental work in the laboratory
- and calibration of various instruments for measuring pressure, temperature, displacement, speed, vibration etc.
- Measurement of linear and angular displacement
- Calibration of Bourdon tube using dead-weight tester for Measurement of pressure
- Measurement of gauge factor
- Measurement of temperature using RTD, thermistor, thermocouples
- Response characteristics of first and second order instruments

Learning Outcomes:

- Demonstrate the use of instruments for measuring pressure, displacement and temperature
- Calibrate the Bourdon tube pressure gauge
- Students will be able to select proper measuring instrument and know requirement of calibration, errors in measurement etc. They can perform accurate measurements.

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LIST OF EXPERIMENTS

1. Calibration of resistive transducers
2. Calibration of capacitive transducers
3. Calibration of inductive transducers
4. Calculation of gauge factor (strain gauge transducer)
5. Characteristics of LVDT
6. Calibration of Bourdon tube using dead-weight tester
7. Calibration of temperature meters using RTDs
8. Calibration of temperature meters using thermistors
9. Measurement of temperature using thermocouples
10. Response characteristics of first-order instruments
11. Response characteristics of second-order instruments
12. Temperature transmitter characteristics
13. Current to Pressure converters
14. Pressure to Current converters

Reference Books:

1. Electronic Instrumentation, 2nd Edition, H.S.Kalsi.
2. Principles of Electronic Instrumentation by Patranabis.
3. A Course in Electrical and Electronic Measurements and Instrumentation by A.K.Sawhney
4. Principles of Industrial / Instrumentation by Patranabis.

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M.Sc. Degree Examination
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SYLLABUS

Third Semester

EL 306 – PLC and SCADA Laboratory
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To build the strong foundation in PLC programming in students needed for the field of electronics and Instrumentation.
- To provide students with fundamental Ladder logics necessary to do industrial Automation.
- To learn the interfacing and simulation hardware necessary for future scopes.

Learning Outcomes:

After successful completion of the course student will be able to:

- Have a flair knowledge in Ladder programming.
- To program and simulate process automation.
- Learn about Level measurement using OLC simulation.
- Able to program on Pressure level systems using PLC simulation tool.
- To be able to program on Temperature and Flow measurements.

LIST OF EXPERIMENTS

1. To study Ladder logic programming of a industrial PLC like SEIMENS / FATEK / MICROLOGIX
2. To study step sequence in a PLC.
3. To write programme for control of Drinks machine.
4. To write a programme and interface simulated hardware unit of PRESSURE control.
5. To write a programme and interface simulated hardware unit of Tank LEVEL control.
6. To write a programme and interface simulated hardware unit of FLOW control.
7. To write a programme and interface simulated hardware unit of TEMPERATURE control.
8. To write a programme and interface & temperature control system using analog outputs of a PLC.
9. To write a programme and interface and control speed of a DC motor using PLC.
10. To write a programme and interface and control a traffic light using PLC.
11. To write a programme& interface & control a conveyer belt using PLC.
12. To write a programme& interface & control a simulated elevator control using PLC.

Note: The students will be required to perform at least eight experiments in the semester.

Text Books:

1. LogixPro PLC Lab Manual for Programmable Logic Controllers – Frank. D. Petruzella
2. Programming Logic Controllers – Hardware and Programming – Max Rabiee
3. PLC Programming – A practical Guide to Ladder Logic – Nathan Clark.
4. Ladder Logic Programming Fundamentals – A. J. wrights.

M.Sc. Electronics (Instrumentation) Programme

Matrix Mapping of PO's vs CO's

(THIRD SEMSTER)

EL 301: INDUSTRIAL AND PROCESS INSTRUMENTATION

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2			✓		
PO-3				✓	
PO-4					✓
PO-5		✓			

EL 302: ANALYTICAL INSTRUMENTATION

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2		✓		✓	
PO-3					
PO-4			✓		
PO-5					

EL 303: ELECTIVE PAPER: 1. PLC & SCADA

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2		✓			
PO-3				✓	
PO-4					
PO-5					✓

EL 303: ELECTIVE PAPER: 2. ANTENNA AND MICROWAVE DEVICES

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1					
PO-2	✓	✓			
PO-3			✓		
PO-4					
PO-5					✓

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EL 304: ELECTIVE PAPER: 1. DIGITAL IMAGE PROCESSING

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1					
PO-2			✓		
PO-3	✓				
PO-4		✓			
PO-5					

EL 304: ELECTIVE PAPER: 2. VLSI DESIGN

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2			✓		
PO-3					
PO-4					
PO-5				✓	

EL 305: INSTRUMENTATION LABORATORY

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2			✓		
PO-3					
PO-4					
PO-5		✓			

EL 306: PLC & SCADA LABORATORY

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1					
PO-2		✓			
PO-3					
PO-4					
PO-5			✓	✓	✓

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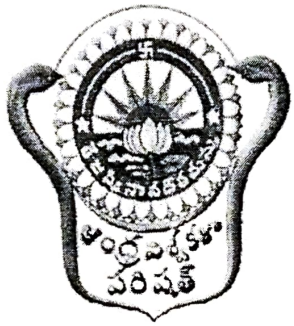
Syllabus and Model Papers

M.Sc. Electronics (Instrumentation)
4th Semester

Under Choice Based Credit System (CBCS)
[Effective from 2021-2022 Admitted Batches]



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M.Sc. Electronics (Instrumentation)
Course Curriculum under CBCS

M.Sc. Electronics (Instrumentation) – IV Semester – SECOND YEAR
[Effective from the admitted batch 2021-2022]

THEORY	EL 401	Virtual Instrumentation
	EL 402	Biomedical Instrumentation
	EL 403 **Elective-1**	1. Remote Sensing Instrumentation 2. Power Electronics
	EL 404 **Elective-2**	1. Power Plant Instrumentation 2. Embedded Systems Design
LABORATORIES	EL 405	Project Work Dissertation
	EL 406	Project Work Viva
	EL 407	MOOCS Paper
	EL 408	Value Added Paper (Research Methodology / Skill Development Module)

SCHEME OF INSTRUCTION AND EXAMINATION UNDER CBCS

M.Sc. Electronics (Instrumentation) – IV Semester – SECOND YEAR
[Effective from the admitted batch 2021-2022]

Theory Code	Title of the Paper	T	P	Semester End Exam Marks	Mid Exam Marks	Total Marks	Pass Minimum	Credits
EL 401	Industrial and Process Instrumentation	4	-	80	20	100	40	4
EL 402	Analytical Instrumentation	4	-	80	20	100	40	4
EL 403	Elective - I	4	-	80	20	100	40	4
EL 404	Elective – II	4	-	80	20	100	40	4
EL 405	Project Work Dissertation	-	-	100		100	50	4
EL 406	Project Work Viva	-	-	100		100	50	4
EL 407	MOOCS Paper	ON LINE MODE						4
EL 408	VALUE Added Paper (Research Methodology / Skill Development Module)	Total 30 hours learning, No Examination						2
	TOTAL	**600**						**30**

(**T**- Theory Hrs /Week, **P**- Practical Hrs/Week)

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M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Fourth Semester

EL 401 – Virtual Instrumentation
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To provide knowledge on design of process control by using virtual instrumentation techniques
- To provide knowledge in process analysis by VI tools.
- To give basic knowledge in describing function analysis.
- Get adequate knowledge VI tool sets

Learning Outcomes:

- To describe about virtual instrumentation.
- Identify the analysing tools and simple programming in VI
- To describe data acquisition
- To get introduced to VI programming techniques
- To understand VI programming techniques
- To get an adequate knowledge application of virtual instrumentation

Unit -I: Virtual Instrumentation & Basic of LabVIEW

Virtual Instrumentation –Virtual instrumentation model - VI Architecture - History of VI -- traditional Vs Virtual Instruments-- Advantages of VI – Introduction of LabVIEW – Advantages of LabVIEW -- Conventional & Graphical Programming – components of LabVIEW – Tools & Palettes – Pop-up menus – colour Coding – code debugging- creating sub VIs.

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Unit-II: Programmable Logics of LabVIEW

FOR & While loops – loop behaviour and interloop communication- local and global variables- shift registers -feedback - auto indexing - loop timing -timed loops - various structures

Arrays & Clusters: Creating Array Controls and indicators-multi dimensional arrays- Array operations - crating cluster controls and indicators - cluster operations -Inter Conversion of Arrays and clusters

Graphs & Charts: Waveform chart -Resetting plots- Waveform Graph - X-Y graph

Unit-III: File Input/ Output, State Machine and String Handling

File Input / Output: File Formats - File I/O functions - Path Functions - Sample VIs to demonstrate file write and read - Generating Filenames Automatically

State Machine: State machine- A Simple state machine - Event structures - The full State Machine

String Handling: String Functions - LabVIEW sting formats - Some more functions - Parsing of Strings

Unit-IV: Data Acquisition Techniques and Implementation

Introduction – classification of signals – Real world Signal – Analog Interfacing – Connecting the signal to the board - Guidelines -- Practical vs Ideal Interfacing – Measurement and Automation.

Unit-V: Instrument Interfacing Assistants Techniques

Introduction – DAQ Assistance – Analysis Assistant – Instrument Assistant – RS232 vs GPIB. Handshaking – GPIB Interfacing – RS232/RS485 – Standard Commands Programmable Instruments- VISA.

Text Books:

1. Virtual Instrumentation using LabVIEW - Sanjay Guptha.
2. Virtual Instrumentation using LabVIEW- Sanjay Guptha and Jerome.

Reference Books:

1. Virtual Instrumentation - LabVIEW manual - National Instrument.

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M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Fourth Semester

EL 402 – Biomedical Instrumentation
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To understand different types of electrodes for the measurement of bio medical signals.
- To get the knowledge of bio medical recorders. ECG electrodes, Placement of electrodes for EEG recording, Muscle electrical activity
- To understand different blood flow measuring techniques. Student will know the parameters to be measured for pulmonary function analysis.
- To learn about modern imaging systems like CT scan, MRI imaging techniques, Ultra sound scan and their applications.
- To understand the working of Pace makers, pacing modes, implant requirements, Defibrillators and functions of Kidneys.

Learning Outcomes:

- Upon completion of this course, the student shall be able to know about Bio-potential electrodes and bio-chemical electrodes, resting and action potentials and their measurement.
- The student shall be able to understand the working of biomedical recorders, identify the abnormalities of ECG waveforms, Brain waves and their nature, nerve reflexes.
- The student will get the knowledge of different blood flow measuring techniques. The student can evaluate the Lung capacities and volumes.
- The student will identify different scanning methods, relative merits and demerits, applications
- The student will be able to identify implant requirements for pacemakers, defibrillation methods, functions and working of the kidneys and dialysing techniques.

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Unit-I: Human Physiological systems

components of biomedical instrument system- General characteristics of medical instrument- Nature of medical data – Human cell-Resting and action potentials- Polarised and non-polarised electrodes-Half cell potential- Biopotential electrodes – Biochemical electrodes

Unit-II: Biopotential Recorders

Characteristics of recording system- – Electrocardiograph (ECG) – Electroencephalograph (EEG) – Electromyograph (EMG).-Electroretinography(ERG) and Electrooculography(EOG)

Unit-III: Measurement and Analysis Techniques

Electromagnetic blood flow meter – Ultrasonic blood flow meter – NMR blood flow meter – Laser Doppler blood flow meter – Impedance technique for cardiac output measurement – Pulmonary function analysis – Lung volumes and capacities – Spirometer – Plethysmograph – Gas analyzer – Coulter counter for blood cell counting – Basic audiometer.

Unit-IV: Modern Imaging Systems

X-ray machine – X-ray computed tomography (CT scanner) – NMR imaging system – Ultrasonic imaging system.

Unit-V: Therapeutic Equipment

Cardiac pacemakers – Cardiac defibrillators – Function of the kidneys – Dialyser– Surgical diathermy.

Text Books:

1. Biomedical Instrumentation and Measurements – Cromwell, Weibell, and Pfeiffer
2. Biomedical Instrumentation by Dr.M..Arumugam

Reference Books:

1. Handbook of Biomedical Instrumentation – Khandpur

M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Fourth Semester

EL 403 – ELECTIVE PAPER
1. Remote Sensing Instrumentation
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To enable the students to understand the fundamentals of remote sensing systems
- To get the knowledge about Radar systems qnd its applications
- To acquire knowledge about basic Sodar systems and types of Sodar systems
- To enable the student to understand about the evolution of Global positioning systems and laws concerned to GPS
- To understand about Geo information systems and types of maps used for acquiring information

Learning Outcomes:

- The students will have knowledge on the basics of remote sensing systems, remote sensors and data analysis
- The student will acquire knowledge on basic radar system and its applications
- Student will be enabled to know about basics of sodar and types of sodar systems
- The student will acquire knowledge on evolution of GPS and laws concerned with it.
- The student will get to know about Geo information systems and how the information is acquired using different laws and maps

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UNIT - I: Fundamental of remote sensing

Introduction - sun and atmosphere - concept of signatures - Multi - spectral concept - Remote sensing systems - remote sensors - remote sensing platforms - data products generation - data product generations - Data analysis & end utilizations - Indian remote sensing Program.

UNIT - II: Radar Systems

Basic Radar - Block diagram - Radar Frequencies - Application of Radar - Radar Equation - Detection of signals in Noise - RN & SNR - Probability Density Function - Detection of False Alarm - Integration of Radar Pulses - Radar Cross sections of Targets and Fluctuations - Transmitter Power - Pulse Repetition Frequency - System loses

UNIT - III: Sodar systems

Introductions of sodar - Sodar equation - Mono static & Bi - static sodar systems - Doppler shift from sodar - continuous and pulsed sodar systems

UNIT - IV: Global Positioning Systems

GPS history - Evolution of GPS - NAVSTAR GPS - working principle - configurations - Satellite signal generation - Signal Power - Kepler's Laws - Satellite Orbital Parameters - Orbital perturbations - GPS observables - Equation for finding user Position - Pseudo range Measurement in Receiver - User Position Determination from Pseudo ranges - Indian GPS aided GEO augmented Navigation (GAGAN)

UNIT - V: Geo Information Systems

Geographic information system - components of GIS - hardware, software and organizational context - data - spatial and non - spatial maps - types of maps - projection- types of projection - data input digitizer, scanner, editing - raster and vector data structures - comparison of raster and vector data structure - analysis using raster and vector data - retrieval, reclassification, overlaying, buffering - data output - printers and plotters.

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Test Books:

1. Fundamentals of Remote Sensing - George Joseph / Donathi - Universities Press Publications - 2003 Edition.
2. Navigation Satellite Systems - G.S. Rao - Tata - McGraw Hill publications - Global -2010 edition.

Reference Books:

1. Introduction to Radar Systems - Merrill L. Skolnik - Tata - McGraw Hill publications - Third Edition.
2. Atmospheric Acoustic Remote Sensing - Stuart Bradley
3. Remote sensing and Geographical systems - Anji Reddy - BS Publications.

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M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Fourth Semester

EL 403 – ELECTIVE PAPER
2. Power Electronics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To understand and acquire knowledge about various power semiconductor devices.
- To prepare the students to analyse and design different power converter circuits
- To analyse three phase and single-phase converters
- Describe the control schemes of choppers.
- Study and analyse inverters and power controllers.

Learning Outcomes:

After studying this course, the students would gain enough knowledge

- Acquire knowledge about fundamental concepts and techniques used in power electronics.
- Ability to analyse various single phase and three phase power converter circuits and understand their applications.
- Foster ability to identify basic requirements for power electronics-based design application.
- To develop skills to build, and troubleshoot power electronics circuits.
- Foster ability to understand the use of power converters in commercial and industrial applications.

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Unit-I: Power Semiconductor Devices

Classification – Characteristics – Ratings – Typical power electronic system – Types of power electronic circuits – Power diodes – Thyristors – Switching characteristics of thyristors – Thyristor gate characteristics – Thyristor commutation methods – Thyristor protection – Thyristor ratings – Series and parallel operation of thyristors – Triggering of thyristors – Heat sinks, heating, cooling and mounting of thyristors – TRIAC – DIAC – LASCR – Power transistor – Power MOSFET – Insulated Gate Bipolar Transistor (IGBT) – MOS controlled thyristor (MCT).

Unit-II: AC to DC Converters

The principle of phase control – Converter classifications – Single phase half wave thyristor rectifier with RL load – Single phase half wave thyristor rectifier with RL load and free-wheeling diode – Single phase half wave thyristor rectifier with RLE load – Single phase full wave mid-point thyristor converter – Single phase full wave bridge converters – Full wave bridge rectifier feeding RLE load – Single phase semi-converter – Calculation of active and reactive power inputs – Three-phase half wave thyristor converter – Three phase full converters – Three phase semi-converters.

Unit-III: AC to AC Converters

Types of AC voltage controllers – Single phase AC voltage controller supplying R loads (Phase control, Integral cycle control) – Three phase AC voltage controller – Single - phase transformer tap changer – Cycloconverters – Single phase to single phase cycloconverters – Three phase to single phase cyclo-converters – Three-phase to three-phase cycloconverters.

Unit-IV: DC to DC converters

Principle of chopper operation – Control schemes – Step-up choppers – Chopper circuits – Steady state time domain analysis of type A chopper – Thyristor-based chopper circuits – multi-phase choppers.

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Unit-V: Inverters and Power Controllers

Classification – Parallel inverters – Series inverters – Single-phase bridge voltage source inverter – Three-phase bridge inverters. DC motor speed control – Stepper motor – synchronous motor – three phase-controlled rectifier – Switch mode power supply – Uninterrupted power supply.

Text Books:

1. Introduction to Power Electronics – Jagannathan
2. Industrial and Power Electronics – Mithal and Gupta

Reference Books:

1. Power Electronics – Bhimbra
2. Power Electronic Circuits, Devices and Applications – Rashid M.H.
3. Power Electronics Systems – Jai P.Agarwal

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M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Fourth Semester

EL 404 – ELECTIVE PAPER
1. Power Plant Instrumentation
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To acquire good knowledge of power generation using various methods.
- To acquire good knowledge of Instrumentation involved in Power generation.
- To know the basics of Turbine supervisory instrumentation and control.

Learning Outcomes:

- Describe power generation using various methods and explain the working of thermal power plant in detail and its classification. Describe power development in India.
- Explain the techniques for measurement and control of four basic parameters like level, temperature, pressure and flow for power station. Describe essentials of steam power plant equipment.
- Describe the types of various boilers and its advantages.
- Explain the importance and classification of steam turbines, its advantages, performance, testing and specifications.
- Explain the gas turbine power plant classification, its elements and operation.

Unit-I: Fundamental of Power Plant

Introduction – Concept of Power-plants – Classification of power plants – Energy-types of Energy – powerResources of Power Generation – Power Development in India – Thermodynamic Cycles – Classification of Power plant cycle – Fuels and Combustion – Steam Generators – Steam Movers – Steam condensers – Water Turbines.

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Unit-II: Steam Power Plant Instrumentation

Introduction – Essential of Steam Power Plant Equipment's – Coal Handling – Fuel Burning Furnaces – Method of fuel firing – Automatic Boiler control – Pulverized Coal – Pulverized coal firing – Pulverized coalburners – water walls – Ash Disposal – Smoke and dust Controller – Types of Dust controllers.

Unit-III: Steam Generator Instrumentation

Introduction – Types of Boilers – Cochran Boilers – Lancashire Boiler – Locomotive Boiler – Babcock WilcoxBoiler – Industrial Boiler – Merits and demerits of water Tube boilers over Fire tube boilers merits – high Pressure Boilers.

Unit-IV: Steam Turbine Instrumentation

Principle of Operation of Steam Turbine – classification of steam turbines – Impulse turbine – Compoundingof Impulse turbine – Pressure Compounding of Impulse turbine – simple velocity Compounding of Impulseturbine – Pressure and velocity Compounding of Impulse turbine – Impulse response Turbine – Advantages of steam turbine over steam engine – Steam Turbine capacity and capability – steam turbine Governing – Steam Turbine Performance – Steam Turbine testing – choice of steam turbines – steam turbine specifications.

Unit-V: Gas Turbine Power Plant

Classification of Gas Turbine Power Plant – Elements of Gas Turbine Power Plant – Control of Gas Turbines – Gas Turbine efficiency – Operations and maintenance performance.

Test Books:

1. Power Plant Engineering - A.K Raja, A.P. Srivastava, M. Dwivedi - New age international (p) limited, publishers.
2. Handbook of Instrumentation and controls - Howard P. Kallen, first edition - McGraw-Hill Publications.

Reference Books:

1. Power plant control and Instrumentation, the Control of Boiler Systems - D. Lindsley, McGraw Hill - New York, 1991.
2. The Control of Boilers - S. G. Dukelow, 2nd ed., ISA Press, New York, 1991
3. Power Station Instrumentation - M. J. Jervis, Butterworth Heinemann, Oxford, 1993

M.Sc. Degree Examination
Electronics (Instrumentation)

SYLLABUS

Fourth Semester

EL 404 – ELECTIVE PAPER
2. Embedded Systems Design
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one real time operating system tool

Learning Outcomes:

At the end of the syllabus the students will be able to Acquire knowledge on

- About fundamentals of basic microcontrollers and embedded systems.
- About programming and system control to perform a specific task.
- About devices and buses used in embedded networking
- Developing programming skills in embedded systems for various applications.
- About Life cycle of embedded design and its testing.

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Unit-I: Processor and Memory Organization

An embedded system, processor, hardware unit, software embedded into a system, Example of an embedded system, OS services, I/O, N/W, O/S, Real time and embedded OS, Structural unit in as processor, processor selection for an embedded system.

Unit-II: Memory Devices and I/O devices

Memory devices, memory selection for an embedded system, allocation of memory to program statements and blocks and memory map of a system. Direct memory accesses, I/O devices, serial communication using FC, CAN devices, device drivers,

Unit-III: Buses for Device Networks

Parallel port device driver in a system, serial port device driver in a system, device driver for internal programmable timing devices, interrupt servicing mechanism, context and periods for switching networked I/O devices using ISA, PCI, deadline and interrupt latency and advanced buses.

Unit-IV: Programme Modelling Concepts in Single and Multi-Processor Systems

Software development process, modelling process for software analysis before software implementation, programming model for the event controlled or response time constrained real time programs, modelling of multiprocessor system.

Unit-V: Inter-Process Communication and Synchronization of Processors

Tasks and threads; multiple process in an application, problems of sharing data by multiple tasks and routines, inter process communications. RTOS task scheduling models interrupt literacy and response times, performance metric in scheduling models, standardization of RTOS, list of basic functions, fifteen-point strategy for synchronization.

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Text Books:

1. Embedded Systems Design: Introduction to Processes, Tools & Techniques – Arnold S.Berger
2. Embedded Systems Architecture, Programming and Design – Raj Kamal

Reference Books:

1. Embedded Systems Building Blocks – Jean J. Labrosse
2. Programming Embedded Systems In C and C++ - Michael Barr,O'Reilly
3. Computers as Components – Principles of Embedded Computing System Design – Wayne Wolf
4. Embedded Microcomputer System – Real Time Interfacing – Valvano

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SYLLABUS

M.Sc. Degree Examination
Electronics (Instrumentation)

Fourth Semester

EL 405 & EL 406 – Project Work Dissertation and Viva
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

- To demonstrate the personal abilities and skills required to produce and present a project.
- To apply technical knowledge and skills in circuit analysis, microcontroller-based systems, and development of software for operation, testing and evaluation and IOT.
- To Design, develop, implement, and evaluate electronic circuits, different transducers, Analytical instruments and Bio-medical systems.
- To Apply project management techniques to electrical/electronic(s) systems

Learning Outcomes:

- Student will be able to analyze, design, and implement electronic systems, control systems, instrumentation systems, communication systems and computer systems.
- Be engaged in learning the new practices, principles, and techniques and committed to continuous improvement, quality, and timely action.
- Maintain ethical standards, environmental concerns and social awareness.
- Acquire the working knowledge on latest technologies and industrial standards.

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AREAS OF PROJECT WORK

1. Microprocessors
2. Microcontrollers
3. Process Instrumentation
4. Control Instrumentation
5. Digital Signal Processing
6. Analog Signal Processing
7. Mixed Signal Processing
8. Biomedical Instrumentation
9. Telecommunication Instrumentation
10. Neural Networks
11. Fuzzy Logic
12. Antennas
13. Industrial Instrumentation
14. Electronic Communications
15. Analytical Instrumentation
16. Power Electronics
17. PLCs
18. SCADA
19. Embedded Systems
20. Remote Sensing Instrumentation
21. Telecommunication Networks
22. Optoelectronics
23. Software Engineering
24. Virtual Instrumentation
25. PC-Based Instrumentation
26. Sensors and Transducers

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M.Sc. Electronics (Instrumentation) Programme

Matrix Mapping of PO's vs CO's

(FOURTH SEMSTER)

EL 401: VIRTUAL INSTRUMENTATION

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2		✓			
PO-3					
PO-4			✓		
PO-5					

EL 402: BIOMEDICAL INSTRUMENTATION

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2				✓	
PO-3		✓			
PO-4					
PO-5					✓

EL 403: ELECTIVE PAPER: 1. REMOTE SENSING INSTRUMENTATION

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2		✓			
PO-3					
PO-4					
PO-5					✓

EL 403: ELECTIVE PAPER: 2. POWER ELECTRONICS

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2					
PO-3					
PO-4				✓	
PO-5		✓	✓		

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EL 404: ELECTIVE PAPER: 1. POWER PLANT INSTRUMENTATION

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1					
PO-2		✓		✓	
PO-3					
PO-4					
PO-5	✓				

EL 404: ELECTIVE PAPER: 2. EMBEDDED SYSTEMS DESIGN

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓		✓		
PO-2		✓			
PO-3					
PO-4					
PO-5				✓	