Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),

Shivajinagar, Pune - 5

T.Y. B. Sc. Electronic Science Syllabus as per NEP 2024

To be implemented from 2026-27

T.Y. B.Sc. NEP24 Syllabus Framework

T.Y. B.Sc. Semester V

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2+2+2 or 4 + 2+2 or 4 + 4) P(2+2 or 4)	24ScEleU5101	Electronic Instrumentation	2		2		20	30	50
	24ScEleU5102	Fundamentals of Process Control	2		2		20	30	50
	24ScEleU5103	Digital System Design	2		2		20	30	50
	24ScEleU5104	Realization of Digital System with Verilog	2		2		20	30	50
	24ScEleU5105	Lab Course on 24ScEleU5101 & 24ScEleU5102		2		4	20	30	50

	24ScEleU5106	Lab Course on 24ScEleU5103 & 24ScEleU5104		2		4	20	30	50
Major Elective (T/P) (2+2 or 4)	24ScEleU5201	Signals and Systems	2		2		20	30	50
	24ScEleU5202	Lab Course on 24ScEleU5201		2		4	20	30	50
	24ScEleU5203	Principles of Power Electronics	2		2		20	30	50
	24ScEleU5204	Lab Course on 24ScEleU5203		2		4	20	30	50
VSC P(2)	24ScEleU5501	Lab Course on Embedded C		2		4	20	30	50
FP (2)	24ScEleU5001	Field Project II		2		4	20	30	50
Minor (T/P) (2)	24ScEleU5302	Lab Course on C Programming for Arduino		2		4	20	30	50
Total			10	12	10	24			550

T.Y. B.Sc. Semester VI

Course Type	Course Code	Course Title	Credits	Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks			
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2+2+2 or 4+2+2 or 4+4) P(2+2 or 4)	24ScEleU6101	Electronic Communication Systems	2		2		20	30	50
	24ScEleU6102	Fundamentals of Nano-electronics	2		2		20	30	50
	24ScEleU6103	PIC Microcontroller : Architecture and Programming	2		2		20	30	50
	24ScEleU6104	Interfacing with PIC Microcontroller	2		2		20	30	50
	24ScEleU6105	Lab Course on 24ScEleU6101 & 24ScEleU6102		2		4	20	30	50
	24ScEleU6106	Lab Course on 24ScEleU6103 & 24ScEleU6104		2		4	20	30	50
Major Elective (T/P) (2+2 or 4)	24ScEleU6201	Advanced Communication & IoT	2		2		20	30	50
	24ScEleU6202	Lab Course on 24ScEleU6201		2		4	20	30	50

	24ScElU6203	Raspberry Pi programming with Python	2		2		20	30	50
	24ScElU6204	Lab Course on 24ScEleU6203		2		4	20	30	50
VSC P(2)	24ScElU6501	Lab Course on Industrial Automation		2		4	20	30	50
OJT (2)	24ScElU6004	On Job Training		4		8	40	60	100
Total			10	12=	10	16			550

T.Y. B.Sc. (Electronic Science) Semester - V

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU5101 Major Paper I (Theory)

Course Name: Electronic Instrumentation

Teaching Scheme: TH: 2 Hours/Week. **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Course Prerequisites

1) Basic Electrical and Electronic Engineering.
2) Analog Electronics.
3) Digital Electronics Fundamentals.
4) Measurement Fundamentals.

Course Objectives

1) To introduce fundamental concepts of electronic measurement and instrumentation.
2) To understand the working principles and selection of sensors and transducers.
3) To study signal conditioning and data acquisition techniques.

4) To correlate electronic instrumentation with process control systems.

Course Outcomes (COs)

After completion of the course, students will be able to:

1) Explain principles of electronic measurement and instrumentation.
2) Select appropriate sensors for process control applications.
3) Understand signal conditioning and data acquisition techniques.
4) Relate instrumentation with industrial control systems.

Course Contents:

UNIT 1	**Measurement Systems and Performance Characteristics**	**6 L**
	Basic concepts of measurement and instrumentation, Elements of a measurement system, Static characteristics: accuracy, precision, sensitivity, linearity, resolution, Dynamic characteristics: speed of response, fidelity, lag, Errors in measurement and classification, Calibration and standards, Role of instrumentation in process control systems.	
UNIT 2	**Sensors and Transducers for Process Variables**	8 L
	Classification of transducers, Temperature measurement: RTD, thermistor, thermocouple, Pressure measurement: strain gauge, piezoelectric sensors, Level measurement: capacitive, ultrasonic methods, Flow measurement: orifice, turbine, electromagnetic flow meters, Selection of sensors for industrial applications, Interfacing sensors with control systems.	
UNIT 3	**Signal Conditioning and Data Acquisition Systems**	**8L**
	Need for signal conditioning, Amplifiers for instrumentation (instrumentation amplifier basics), Filtering and noise reduction, Isolation techniques, Analog to Digital (ADC) and Digital to Analog (DAC) converters, Data acquisition systems (single and multichannel), Introduction to computer-based measurement systems.	
UNIT 4	**Industrial Instrumentation and Control Elements**	**8 L**
	Final control elements: control valves, actuators, Pneumatic, hydraulic and electrical control elements, Smart sensors and transmitters, Industrial standards and signal ranges (4–20 mA,0–10 V), Introduction to PLC and DCS (overview), Case studies related to process industries	

RECOMMENDED BOOKS:

1. Instrumentation Devices & Systems, C. S. Rangan, G. R. Sarma, V. S. Mani, Tata McGraw-Hill (TMH), 2nd Edition (Indian Edition).
2. Industrial Instrumentation and Control, S. K. Singh, McGraw Hill Education, 2nd Edition.
3. A Course in Electrical and Electronic Measurements and Instrumentation, A. K. Sawhney, Dhanpat Rai & Co., 19th Edition.
4. Electronic Instrumentation, H. S. Kalsi, Tata McGraw-Hill (TMH), 2nd Edition.
5. Modern Electronic Instrumentation and Measurement Techniques, Cooper and Helfrick, PHI Learning, Indian Edition (Reprint).

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU5102 Major Paper II (Theory)

Course Name: Fundamentals of Process Control

Teaching Scheme: TH: 2 Hours/Week.	**Credit: 02**
Examination Scheme: CIA: 20 Marks	**End-Sem: 30 Marks**

Course Prerequisites

Before enrolling in this course, students should have basic knowledge of the following:

1) Basic Electrical Engineering
2) Signals and Systems (Introductory Level)
3) Measurement and Instrumentation Basics
4) Industrial Process Awareness

Course Objectives

1) To introduce basic principles of process control used in industry
2) To understand dynamic modeling and analysis of processes
3) To study various industrial controllers and their applications
4) To correlate theory with real-time industrial control systems

Course Outcomes (COs)

After successful completion of the course, students will be able to:

1) Explain fundamentals and components of process control systems
2) Develop mathematical models of simple processes

3) Analyze system behavior in time and frequency domains
4) Understand working and applications of industrial controllers

Course Contents:

UNIT 1	**Basics of Process Control Systems**	**4 L**
	Definition, scope and importance of process control, Open loop and closed loop control systems, Elements of a process control system, Control objectives: regulation, tracking and optimization, Examples of industrial processes.	
UNIT 2	**Mathematical Modeling & Dynamic Behavior**	**8 L**
	Concept and need of mathematical modeling, Linear and nonlinear systems, Lumped and distributed parameter systems, Transfer function representation, Zero-order, first-order and second-order systems. Time constant, process gain and dead time	
UNIT 3	**Control System Analysis**	**8 L**
	Standard test signals, Time domain response and performance indices, Stability concepts, Frequency response basics, Bode plots (introductory level), Gain margin and phase margin	
UNIT 4	**Industrial Controllers & Applications**	**10 L**
	Introduction, classification: ON–OFF controller, Proportional (P) controller, PI, PD and PID controllers, Comparison, tuning of controllers. Industrial case studies: Temperature, level, flow, speed and pressure control systems.	

RECOMMENDED BOOKS:

1. Process Control Instrumentation Technology, Curtis D. Johnson, Pearson Publication, 8th Edition (Indian Edition).
2. Control Systems, U. A. Bakshi and V. U. Bakshi, Technical Publications, Pune, 1st/2nd Edition (Indian Edition).
3. Industrial Instrumentation and Control, S. K. Singh, McGraw Hill Education (India), 2nd Edition.
4. Control Systems Engineering, S. Salivahanan, R. Rengaraj and G. R. Venkatakrishnan, Pearson Education, 1st Edition (Indian Edition).
5. Control Systems Engineering, I. J. Nagrath, M. Gopal, New Age International Publishers, 7th Edition.

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU5103 Major Paper III (Theory)

Course Name: Digital System Design

Teaching Scheme: TH: 2 Hours/Week.	**Credit: 02**
Examination Scheme: CIA: 20 Marks	**End-Sem: 30 Marks**

Course Prerequisites

Before enrolling in this course, students should have basic knowledge of the following

1. Basic knowledge of digital fundamentals.
2. Idea of sequential and combinational circuits.
3. Use of computer and ideas of any programming language.
4. Elementary mathematics including binary arithmetic and algebra.

Course Objectives

1. Understand sequential and combinational logic design techniques.
2. Analyze and simplify Boolean expressions.
3. Understand and analyze sequential/combinational logic circuits.
4. Design digital systems using Programmable Logic Devices. (PLDs)

Course Outcomes (COs)

After completion of the course, students will be able to:

1. Explain basic digital concepts, number systems, codes, and Boolean algebra used in digital circuit design.
2. Design and analyze combinational/sequential logic circuits and minimize Boolean functions using Karnaugh Maps and Quine–McCluskey techniques.
3. Model sequential systems using state diagrams and state tables based on Mealy and Moore machines.
4. Implement digital circuits using PLDs and FPGAs using VHDL/Verilog and understand synthesis and design flow.

Course Contents:

UNIT 1	**Combinational Circuit Design**	**10 L**
	Revision on Basic Digital Concepts and Boolean algebra, Number Systems, Codes, and Conversion Techniques, Minimization Techniques: Karnaugh Maps and Quine-McCluskey Method, Design and Implementation of Combinational Circuits.	

UNIT 2	**Sequential Circuit Design and Analysis**	**10 L**
	Concept of Sequential Circuits, Synchronous and Asynchronous Sequential Circuits, Mealy and Moore Models for Sequential Circuits, Finite State Machine: State Diagrams, State Tables, Excitation table and State Reduction, Design of Counters and Shift Registers.	
UNIT 3	**Programmable Logic Devices (PLDs)**	**10 L**
	Introduction to PLDs: PROM, PLA, PAL, and GAL, Design and Implementation of Digital Circuits using PLDs, Overview of Field Programmable Gate Arrays (FPGAs) and CPLDs, Programming and Configuring FPGAs using VHDL/Verilog, Design Flow and Synthesis Tools for PLD Implementation, Applications of PLDs and FPGA-based System Design.	

RECOMMENDED BOOKS:

1. Digital Systems Design with FPGAs and CPLDs, Ian Grout, Newnes (Elsevier), 1st Edition (Indian Edition/Reprint).
2. Programmable Logic Handbook: PLDs, CPLDs and FPGAs, Ashok Sharma, McGraw Hill Education (India), 1st Edition.
3. PLD Circuit Design, Thomas L. Floyd, Pearson Education, Indian Edition (Reprint).
4. Modern Digital Electronics, R. P. Jain, McGraw Hill Education (India), 4th Edition.
5. Digital Systems: Principles and Applications, Ronald J. Tocci, Pearson Education, 12th Edition (Indian Edition).
6. Digital Design, M. Morris Mano, Pearson Education, 5th Edition (Indian Edition).

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU5104 Major Paper IV (Theory)

Course Name: Realization of Digital System Using Verilog

Teaching Scheme: TH: 2 Hours/Week. **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Course Prerequisites

1) Basic knowledge of digital fundamentals.
2) Idea of sequential and combinational circuits.
3) Use of computer and ideas of any programming language.
4) Elementary mathematics including binary arithmetic and algebra.

Course Objectives

1) Understand sequential and combinational logic design techniques.
2) Get introduced with VERILOG.
3) Learn PLD, CPLD, FPGA and their applications.
4) Train Students in Simulation, Synthesis, and Implementation

Course Outcomes (COs)

After completion of the course, students will be able to:

1) Design layout for digital system circuit.
2) Write, simulate and implement digital system circuits.
3) Simulate, Synthesize, and Verify Digital Circuits.
4) Analyze Timing and Delays in Digital Circuits and develop FSM-Based Digital Systems.

Course Contents:

UNIT 1	**Digital System Design with VHDL/Verilog**	**10 L**
	Introduction to VHDL/Verilog and Basic Syntax, Modeling Techniques: Structural, Behavioral, and Dataflow Models, Design of Combinational and Sequential Circuits using HDL, Simulation, Synthesis, and Verification of HDL Designs, Testbench Creation and Timing Analysis, Case Study: CPLD- Implementation of a Digital System.	
UNIT 2	**Arithmetic and Advanced Digital Systems**	**10 L**
	Design of Arithmetic Circuits: Adders, Subtractors, Multipliers, and Dividers, High-Speed Arithmetic Techniques and Pipelining Concepts, Design of ALU and Control Units, Introduction to Memory Systems and Cache Design, Error Detection and Correction Techniques.	
UNIT 3	**Fault Detection, Low-Power Design, and Case Studies**	**10 L**
	Introduction to Fault Models and Test Generation, Fault Detection and Diagnosis Techniques, Design for Testability (DFT) and Built-In Self-Test (BIST), Low-Power Design Techniques and Optimization, Case Study: Design and Analysis of Digital Systems	

RECOMMENDED BOOKS:

1. Verilog HDL: A Guide to Digital Design and Synthesis, Samir Palnitkar, 2nd Edition Pearson Education
2. Verilog HDL synthesis: A Practical Primer, J. Bhaskar , 1st Edition Star GalaxyPublishing
3. Digital System Design with VERILOG Design, Stephen Brown, Zvonko Vranesic, 3rd Edition TMH
4. Modern Digital Electronics, R.P. Jain, 4th Edition McGraw Hill
5. Digital systems; Principles and Applications, Ronald J. Tocci 12th Edition, Pearson Education.
6. Digital Design, M. Morris Mano, Pearson Education, 5th Edition (Indian Edition).

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU5105 Major Paper I (Practical)

Course Name: Lab Course on 24ScEleU5101 & 24ScEleU5102

Teaching Scheme: TH: 4 Hours/Week.	**Credit: 02**
Examination Scheme: CIA: 20 Marks	**End-Sem: 30 Marks**

Course Prerequisites

Before enrolling in this course, students should have basic knowledge of the following

1) Basic Electronics
2) Measurement & Instrumentation Fundamentals
3) Analog Signal Processing
4) Sensors and Transducers Basics

Course Objectives

1) To familiarize students with industrial sensors and standard transmission
2) To introduce signal conditioning and data conversion techniques
3) To provide practical understanding of dead time, compensators, and controllers
4) To develop hands-on skills in controlling real electromechanical systems

Course Outcomes (COs)

After successful completion of this practical course, students will be able to:

1) Demonstrate the dynamic response of first-order instruments
2) Analyze the working and characteristics of ADCs and DACs
3) Implement and study different industrial controllers

4) Control speed, direction, and position of stepper and servo motors,

List of Practicals: (any 12 of the followings)

1. Study of RTD Characteristics.
2. Design of temperature measurement system using Thermocouple.
3. Pressure Measurement Using Strain Gauge/Pressure Sensor (Load cell)
4. Moisture Measurement Using Capacitive Sensor.
5. Instrumentation Amplifier using three OP-Amps.
6. Study of Industrial Sensors and Transmitters (4 to 20 mA)
7. Study of Step Response of First Order System.
8. Study of Dynamic Response of Second Order System.
9. Frequency Response of second Order System (Filters) .
10. Frequency response analysis of LEAD and LAG compensating network.
11. Study of ON–OFF Controller.
12. Study of PID Controller characteristics.
13. PWM based speed control of DC motor.
14. Speed and direction control of Stepper motor.
15. Position control of servo motor.

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Course Code: 24ScEleU5106 Major Paper II (Practical)

Course Name: Lab Course on 24ScEleU5103 & 24ScEleU5104

Teaching Scheme: TH: 4 Hours/Week.	**Credit: 02**
Examination Scheme: CIA: 20 Marks	**End-Sem: 30 Marks**

Course Prerequisites

Before enrolling in this course, students should have basic knowledge of the following

1. Basic knowledge of digital fundamentals.
2. Idea of sequential and combinational circuits.
3. Use of computer and ideas of any programming language.
4. Elementary mathematics including binary arithmetic and algebra.

Course Objectives

1. To enable Hands-on Experience with Digital System Prototyping.
2. To train Students in Simulation, Synthesis, and Implementation.
3. To introduce VERILOG.
4. Learn PLD, CPLD, FPGA and their applications.

Course Outcomes (COs)

1. Simulate, Synthesize, and Verify Digital Circuits..
2. Analyze Timing and Delays in Digital Circuits.
3. Develop applications using programmable logic devices.
4. Implement digital circuits using PLDs and FPGAs using VHDL/Verilog and understand synthesis and design flow.

List of Practicals: (any 12 of the followings)

1) Study of TTL Logic Family (74xx Series)
2) Study of CMOS Logic Family (40xx / 74HCxx Series)
3) Design 4 to 1 line MUX/ 1 to 4 DEMUX.
4) Design of binary to decimal decoder.
5) Arithmetic circuits: Half adder, Full adder and Parallel adder.
6) Design of RS, D and T flip-flops.
7) Design of 4-bit Shift register.
8) Code converter – Hexadecimal to Decimal and Decimal to Hexadecimal.
9) Code converter – Binary to Gray and Gray to Binary.
10) Design of 4-bit binary Up /down counter.
11) Design of Ring Counter.
12) Design of Johnson Counter
13) Design of Stepper motor controller
14) FPGA-Based Traffic Light Controller
15) Comparative Study of PROM, PLA, PAL, and GAL

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU5201 Major Elective Paper 1 (Theory)

Course Name: Signals and Systems

Teaching Scheme: TH: 2 Hours/Week.	**Credit: 02**
Examination Scheme: CIA: 20 Marks	**End-Sem: 30 Marks**

Course Prerequisites

1. Basic knowledge of mathematics – Algebra, trigonometry, differentiation and integration
2. knowledge of basic electrical quantities (voltage, current, resistance)
3. Basic knowledge of Simple RC, RL, RLC circuits.

Course Objectives

1. To introduce the fundamental concepts of signals and systems.
2. To understand classification and representation of signals in both time and frequency domains.
3. To study system properties such as linearity, time invariance, causality, and stability.
4. To study Fourier series, Fourier transform, and Laplace transform as tools for signal and system analysis.

Course Outcomes (COs)

After completion of the course, students will be able to

1. Identify and analyse different types of systems, and determine their properties.
2. Represent periodic signals using Fourier series and analyze signals using Fourier transform techniques.
3. Apply Laplace transform methods to determine the time response of LTI systems.
4. Explain the principles of sampling.

Course Contents:

UNIT 1	**Introduction to Signals**	**5 L**
	Definition of signal and system, Classification of signals: Continuous-time (CT) and Discrete-time (DT), Even & Odd, Energy & Power signals, Deterministic & Random signals. Elementary signals: Unit step, unit impulse, unit ramp, Exponential and Sinusoidal signals	
UNIT 2	**Fundamentals of Systems**	**8 L**
	Introduction and Classification of systems: Continuous and Discrete-time systems, Static and Dynamic, Time-variant vs Time-invariant, Linear and Non-linear, Causal and Non-causal, Impulse response and step response concepts, Convolution sum (DT) and convolution integral (CT), Properties of convolution, Stability of systems.	
UNIT 3	**Fourier Series and Fourier Transform**	**12 L**
	Definition, Definition of periodic function, Evaluation of Fourier Coefficient, Fourier series for square wave, triangular, sawtooth wave, half wave & full wave rectified signals. Fourier Transforms**:** Deriving Fourier transform	

	from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Properties of Fourier transforms.	
UNIT 4	**Laplace Transform**	**5 L**
	Definition, Laplace transform of simple functions, properties of L.T. (Linearity, shifting, change of scale), Advantages of L.T. over differential equations, Inverse L.T., Applications: Series RC circuit, RL circuit, RLC circuit for dc/ac input.	

Text/ Reference Books:

1. Network Analysis – G. K. Mithal & Ravi Mittal, *Khanna Publishers*, New Delhi, 14th Edition
2. Network Analysis – M. E. Van Valkenburg, *Dorling Kindersley (India) Pvt. Ltd.*, 3rd Edition
3. Network Analysis and Synthesis – Umesh Sinha, *Satya Prakashan*, Delhi, Latest Edition
4. Signals and Systems – R. P. Singh & S. D. Sapre, *McGraw Hill Education (India) Pvt. Ltd.*, New Delhi, Latest Edition

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(Course under NEP 2024)

Course Code: 24ScEleU5202 Major Elective Paper 1 (Practical)

Course Name: Lab course on 24ScEleU5201

Teaching Scheme: TH: 4 Hours/Week. **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Course Prerequisites

1. Basic knowledge of mathematics – Algebra, trigonometry, differentiation and integration
2. knowledge of basic electrical quantities (voltage, current, resistance)
3. Basic knowledge of Simple RC, RL,RLC circuits.

Course Objectives:

1. Understand fundamental concepts of signals and systems

2. Study transient and steady-state responses of electrical circuits (RC, RL, RLC) using analytical and transform methods.
3. Develop simulation skills using software tools to model signals, systems, and circuit responses.
4. Verify theoretical properties of convolution, Fourier transform, and system characteristics through experiments and simulations.

Course Outcomes (CO)

After completion of the course, students will be able to

1. Classify and graphically represent different types of signals
2. Determine impulse response and step response of systems and circuits, particularly RC circuits.
3. Verify system properties such as linearity, time-invariance, additivity, and homogeneity experimentally and via simulation.
4. Analyze electrical circuits (RC, RL, RLC) using Laplace Transform to obtain transient responses.

List of Practicals: (Any 12 of the followings)

1. Study of Signal Classification & Graphs
2. Convolution: Performing convolution of discrete & continuous signals (manual/using tools)
3. Verification of Linearity of a System.
4. Step Response of an RC Circuit.
5. Impulse Response of an RC Circuit
6. Transient Response of RL Circuit.
7. Response of RLC Circuit.

Software based practicals:

8. Verification of Linearity of a System.
9. Simulation of Impulse Response and Step Response of an LTI System
10. Fourier Series Representation of a Square Wave,
11. Fourier Series Representation of a Triangular and Sawtooth Waves.
12. Fourier Transform study of Standard Signals
13. Verification of Properties of Fourier Transform
14. Laplace Transform and Inverse Laplace Transform.
15. Study of Step Response of RC Circuit Using Laplace Transform

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(Course under NEP 2024)

Course Code: 24ScEleU5203 Major Elective Paper II (Theory)

Course Name: Principles of Power Electronics

Teaching Scheme: TH: 2 Hours/Week. **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisites:

1. Basic knowledge of electronics circuits.
2. Basic knowledge of electrical engineering concepts.
3. Fundamental knowledge of power electronics.

Course Objective:

1. Understand Applications of power electronic circuits.
2. Understand Fundamentals of Power Electronics:
3. Analyze Power Semiconductor Devices:
4. Examine Power Converters for AC-DC and AC-AC Conversion.

Course Outcomes:

On completion of the course, student will be able to–

1. Distinguish between the power electronic devices
2. Understand DC-DC and DC-AC Conversion Techniques.
3. Explore Applications of Power Electronics in Real-World Systems
4. Use PWM techniques for controlling inverters

Course Contents:

UNIT 1	**Introduction to Power Electronics**	**4 L**
	Definition and significance of power electronics in modern electrical systems, Classification of Power Electronic devices, Control Characteristics of Power devices. Conduction and switching losses in power devices. Types of Power Converters, Applications of power electronics.	
UNIT 2	**Power Semiconductor devices**	**6 L**
	Power Diode: Symbol, Construction, Types and switching behavior, Power E- MOSFET: Symbol, Construction, IV characteristics and Switching characteristics, Thyristor: Symbol, Construction, Two transistor model, IV characteristics, Turn on Methods and Switching	

	characteristics, Power Diac and Triac: Symbol, Construction and IV characteristics.	
UNIT 3	**Power Converters- I**	**10 L**
	AC to DC Conversion: Introduction and classification. Single phase-Controlled Rectifiers: Input and output waveforms, average and RMS values of output voltage and current, Applications of Rectifiers.AC to AC Conversion: Introduction and classification, AC Voltage controllers: Phase-controlled and On-Off type, Cycloconverters: Single phase to single phase with R load. Applications of AC to AC converter.	
UNIT 4	**Power Converters- II**	**10 L**
	DC-DC Converters: Introduction and types of DC-DC converters: Buck, Boost, Buck-Boost, and Cuk, Applications of DC-DC Converters. DC to AC Conversion: Introduction and types. Voltage Source Inverter (VSI) and Current Source Inverter (CSI), Half bridge and Full Bridge inverters. PWM (Pulse Width Modulation) Techniques: Square, Quasi-square and Sinusoidal PWM (SPWM) , Applications of Inverters.	

Textbooks and References:

1. "Power Electronics: Converters, Applications, and Design" by Ned Mohan, Tore M. Underland, William P. Robbins 3rd Edition (John Wiley & Sons)
2. "Fundamentals of Power Electronics" by Robert W. Erickson and Dragan Maksimovic (Springer), 2nd Edition
3. "Power Electronics Handbook" by Muhammad H. Rashid 5th Edition (Academic Press)
4. "Modern Power Electronics" by Bimal K. Bose 1st Edition (Pearson Education)

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(Course under NEP 2024)

Course Code: 24ScEleU5204 Major Elective Paper II (Practical)

Course Name: Lab course on 24ScEleU5203

Teaching Scheme: TH: 4 Hours/Week. **Credit: 02**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite:

1. Basic knowledge of electronics circuits.
2. Basic knowledge of electrical engineering concepts.
3. Fundamental knowledge of power electronics.

Course Objectives: This course will enable the students to:

1. To Understand working and applications of power semiconductor devices.
2. To explore and understand different types of rectifiers.
3. To study and evaluate single-phase AC voltage controllers.
4. To study the working principles and applications of SMPS and offline UPS systems.

Course Outcomes:

At the end of the course the student should be able to:

1. Analyze and interpret the V-I characteristics of SCR, Power MOSFET, Diac, and Triac.
2. Evaluate the performance of single-phase half and full-controlled rectifiers with different load conditions.
3. Analyze the working of AC voltage controllers and single-phase cyclo-converters.
4. Apply PWM techniques to control the speed of DC motors efficiently.

List of Practicals: (Any 12 of the followings)

1. Study of V-I characteristics of SCR.
2. V-I characteristics study of Power MOSFET.
3. Study of V-I characteristics of Diac and Triac.
4. Design, built and test RC/UJT trigger circuit for SCR.
5. Single-phase half wave controlled rectified with resistive and inductive load with and without freewheeling diode.
6. Single-phase full wave-controlled rectifiers with resistive and inductive loads.
7. Single-phase ac voltage controller with resistive and inductive loads.
8. PWM speed control of DC motor.
9. MOSFET/IGBT based single-phase bridge inverter.
10. SCR based battery charging circuit.
11. AC and DC static switches.

12. Built and test Solid State Relay.
13. Study of SMPS.
14. Study of off-line UPS.
15. Study of single phase to single phase Cycloconverter.

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU5501 VSC (Practical)

Course Name: Lab course on Embedded C

Teaching Scheme: TH: 4 Hours/Week.	**Credit: 02**
Examination Scheme: CIA: 20 Marks	**End-Sem: 30 Marks**

Prerequisites:

1. Strong basics of C programming (loops, arrays, functions, pointers).
2. Basic understanding of microcontroller architecture (e.g., 8051 Microcontroller /Arduino Uno).
3. Familiarity with compiling, debugging, and IDE usage.

Course Objectives:

This course will enable the students to:

1. Develop proficiency in Embedded C programming.
2. Understand register-level programming concepts.
3. Implement control logic using timers, interrupts, and communication modules.
4. Build efficient and optimized embedded programs.

Course Outcomes:

At the end of the course the student should be able to:

1. Write structured Embedded C programs for microcontrollers
2. Use registers and bit manipulation effectively
3. Implement timing, interrupts, and communication via code
4. Develop modular and reusable embedded programs.

List of Practicals: (any 12 of the following)

1. Study of Embedded C program structure (main, header files, macros) & programs using data types, operators, and macros.
2. Program using control structures (if-else, switch, loops).

3. Bitwise operations (set, clear, toggle, mask bits), register-level programming (port configuration) and Program to manipulate individual bits of a register.
4. Writing modular programs using functions, passing parameters and returning values.
5. Programs using arrays.
6. String handling in embedded systems.
7. Pointer-based memory access.
8. Software delay implementation using loops and Timer programming (delay generation using registers).
9. Basic interrupt service routine (ISR) structure and External interrupt handling.
10. Timer interrupt programming.
11. UART initialization and data transmission program, UART receive and echo program.
12. I2C protocol programming (data send/receive logic). I2C LCD communication programming.
13. SPI communication programming. EEPROM data handling operations.
14. Programming temperature measurement system.
15. Study of line following robot.

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(Course under NEP 2024)

Course Code: 24ScEleU5001 Field Project (FP/CEP)

Course Name: Major Electronics project

Teaching Scheme: TH: 4 Hours/Week.	**Credit: 02**
Examination Scheme: CIA: 20 Marks	**End-Sem: 30 Marks**

Prerequisite Courses:

1. Basic ideas of electronic components and circuits
2. Use of test and measuring instruments
3. Skills for design ,built , simulate and test electronic circuits
4. Proper reference work for the topic of the project work selected
5. Scientific report writing for project work

Course Objectives:

1. The object of Project /Internship work is to enable the student to take up investigative study in the broad field of Electronics, either fully theoretical/practical or involving both theoretical and practical work to be

assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor.
2. Students learn to work on their individual skills regarding critical thinking and problem solving, creativity and innovation, collaboration/teamwork and leadership, communications, learning self-reliance and project management.
3. They will get practical confidence for understanding, developing and making the clear idea of electronics applications.
4. It is expected by student choice they can experience and learn their favourite application or concept on their own at the third-year project.
5. Proper planning, referencing, analysis, review, various experimentations, modifications and finally scientific technical reporting of the project work.
6. Collaborations to work in Teams**.**

Course Outcomes:

On completion of the course, student will be able to–

1. Select and plan a project work
2. Design and Develop Innovative Solutions.
3. Execute the project work systematically in time bound period
4. Use his/her skills for executing project work, this may help in getting job
5. Report any experimentation or projects work in technical format
6. Demonstrate Problem-Solving and Critical Thinking

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU5302 Minor Paper (Practical)

Course Name: C- programming for Arduino

Teaching Scheme: TH: 4 Hours/Week.	**Credit: 02**
Examination Scheme: CIA: 20 Marks	**End-Sem: 30 Marks**

Prerequisites:

1. Basic knowledge of Programming.
2. Knowledge of basic concepts in electronics.
3. Fundamentals of sensors and transducers

Course Objectives: This course will enable the students to:

1. Understand installing, configuring of Arduino IDE
2. Write basic C programs to control peripherals like LEDs and sensors using Arduino.
3. Develop Sensor-Based Projects
4. Interface and control DC motors, servo motors, and relay drivers using Arduino.

Course Outcomes:

At the end of the course the student should be able to:

1. Install and configure Arduino IDE for programming and hardware interfacing.
2. Write and upload C programs to control LEDs and other peripheral devices.
3. Establish bidirectional communication between Arduino and a computer.
4. Implement delay and interrupt functions for time-based applications.

List of Practical: (any 12 of the followings)

1. Arduino IDE: Installing, configuring, and using the Arduino IDE for writing, compiling, and uploading code.
2. Write a C program to generate different LED patterns.
3. Reading digital inputs from buttons / switches to control an LED.
4. Build a project using a potentiometer to control the brightness of an LED.
5. Sending and receiving data between Arduino and a computer.
6. Use of "Built in interrupt functions" to implement car parking system.
7. Interfacing of LCD / I2C LCD display model.
8. Interfacing temperature sensors LM35/ DHT 11 sensor.
9. Interfacing of HC-05 Bluetooth module
10. Interfacing distance sensors (Ultrasonic).
11. Interfacing DC motor.
12. Use of Inbuilt libraries for servo motor interfacing.
13. Study of line following robot.
14. Interfacing RTC module DS3211.
15. Communication between two Arduino boards.

T.Y. B.Sc. (Electronic Science) Semester - VI

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU6101 Major core Paper I (Theory)

Course Name: Electronic Communication System

Teaching Scheme: TH: 2 Hours/Week.	**Credit: 02**
Examination Scheme: CIA: 20 Marks	**End-Sem: 30 Marks**

Prerequisite Courses:

1. Basics of electronic components
2. Basics of electronic circuits like rectifier, amplifier, filter etc
3. Preliminary idea of electronic communication from various appliances

Course Objectives:

1. To study fundamental concepts and basic building blocks of communication systems.
2. To understand amplitude modulation techniques, their generation, detection, and performance parameters.
3. To understand frequency modulation, its characteristics, generation, and detection methods.
4. To understand operation of AM and FM transmitters and receivers.

Course Outcomes:

On completion of the course, student will be able to–

1. Understand the basic structure of communication systems, classify different communication techniques
2. Know various techniques for sending and receiving messages in electronic communication
3. Analyze frequency modulation in terms of bandwidth, modulation index,
4. Understand functioning of electronic communication transmitter and receiver

Course Contents:

UNIT 1	**Basics of Communication Systems**	**4 L**
	Block diagram of communication system, types of communication system: simplex, duplex, analog and digital communication, Electromagnetic spectrum, baseband and broadband communication. Noise concept and types, signal	

	to noise ratio, noise figure, noise temperature. Problems based on noise calculations.	
UNIT 2	**Amplitude Modulation**	**10 L**
	Need of modulation, concept of modulation, AM waveform, mathematical expression of AM, concept of sideband, Definition and problems: modulation index, power distribution, AM modulators: Diode, Transistor Modulator, Balanced Modulator- using diodes & FETs, SSBSC modulator- Filter Method & Phase shift method, AM demodulator: Diode demodulator, Synchronous demodulator, Product demodulator	
UNIT 3	**Frequency Modulation**	**8 L**
	FM modulation: definition, mathematical representation, frequency spectrum, bandwidth, modulation index, frequency deviation and average power, problems based on FM parameters, FM modulator using Varactor diode, Indirect method of FM generation, FM Detector: Slope detector, Foster-Seeley discriminator.	
UNIT 4	**Transmitter and Receiver**	**8 L**
	AM transmitters: Block diagram, Specifications, AM Receiver: TRF and super-heterodyne receiver, characteristics of receiver: Selectivity, Sensitivity, Image frequency and Dynamic range, FM transmitters: Block diagram, Specifications, FM Receiver: block diagram.	

Text/Reference Books:

1. Communication Systems by R. P. Singh, S. D. Sapre, 3rd Edition McGraw Hill.
2. Electronic Communication by Dennis Roddy & John Coolean, 4th Edition Pearson Education.
3. Electronic Communication systems by Kennedy & Davis, 4th Edition Tata McGraw Hill.
4. Principles of Communication Systems by Taub Schilling, McGraw Hill.
5. Communication Electronics: Principles and Applications, Frenzel, Mc Graw Hill, 3rd Edition.

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU6102 Major core Paper II (Theory)

Course Name: Fundamentals of Nano-electronics

Teaching Scheme: TH: 2 Hours/Week.	**Credit: 02**
Examination Scheme: CIA: 20 Marks	**End-Sem: 30 Marks**

Prerequisite Courses:

1. Basics of electronic components
2. Preliminary idea of electronic communication from various appliances
3. Idea of nanotechnology and its applications.

Course Objectives:

1. To introduce the basics of Nano-science and nanotechnology.
2. To understand properties of materials at the nanoscale.
3. To study synthesis techniques of nanomaterials.
4. To study physical and optical properties of Nanomaterials.

Course Outcomes:

On completion of the course, student will be able to–

1. Explain fundamental principles of nanotechnology
2. Identify different types of nanomaterials and their properties.
3. Understand synthesis techniques for nanomaterials.
4. Understand characterisation techniques for physical and optical properties study.

Course Contents:

UNIT 1	**Nanoscience and Nanotechnology.**	**8 L**
	Introduction to Nanoscience and Nanotechnology. Significance of nanoscale: Surface area, Quantum confinement effect. Different types of nonmaterial: Metals, Semiconductors, Composites, Ceramics and Polymers. Classifications of nanomaterials, Properties, Importance and Applications of Nanomaterials.	
UNIT 2	**Synthesis techniques of Nanomaterials.**	**10 L**
	Top-down approach, Bottom-up approach, Nanomaterial Synthesis: Solgel, Solution, coprecipitation Method , Thin Film coating: Physical Vapor deposition, Chemical Vapor deposition, Spray Pyrolysis, Solgel: Spin and dip coating	

UNIT 3	Characterization techniques.	12 L
	X-ray Diffraction technique, Fourier Transform Infrared Spectroscopy (FTIR), UV-Visible Spectroscopy, Scanning Electron Microscopy, Atomic Force Microscopy. Energy Dispersive X-ray Analysis, Photoluminescence, Electroluminescence. Photoconductivity, Electrical measurement techniques: Resistivity, Polarization, Dielectric properties.	

Text/ Reference Books:

1. Fundamentals of nanoelectronics, George W. Hanson, LPE, Pearson Education V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio Vladimir 1st Edition
2. "Introduction to Nanoelectronics Science, nanotechnology, Engineering and Applications" Cambridge University Press 2008 1st Edition
3. NANO: The Essentials, T. Pradeep ,McGraw Hill Education, 6th Edition.
4. Nanotechnology: Principles and Practices, Sulbha K. Kulkarni, Springer Publications,3rd Edition.

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU6103 Major Paper III (Theory)

Course Name: PIC Microcontroller: Architecture and Programming

Teaching Scheme: TH: 2 Hours/Week. **Credit: 2**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite:

1. Basics of Analog Circuits
2. Basics of Digital Circuits
3. C Programming
4. Basics of microcontroller unit

Course Objectives:

This course will enable the students to:

1. To understand registers and modules of PIC controller.
2. To understand basics of interfacing concepts.
3. To learn software techniques to embed codes into the systems.

4. To interface different peripherals to PIC controller.

Course Outcomes:

At the end of the course the student should be able to:

1. Understood various modules of PIC microcontroller.
2. Write and debug programs for PIC microcontrollers using C.
3. Interface external devices with PIC microcontrollers. (sensors, motors, displays).
4. Use simulation tools and hardware to test and debug PIC programs.

Course Contents:

UNIT 1	**Fundamentals of PIC18F**	**10 L**
	PIC microcontroller overview, PIC18F: Special features, Architecture and SFRs, Oscillator Configurations, Reset of PIC microcontroller, Memory Organization : Program Memory, Data Memory ,Flash Program Memory and Data EEPROM Memory, Interrupts and I/O Ports.	
UNIT 2	**Peripherals of PIC18F**	**10 L**
	Timer module, CCP module, ADC module, Comparator module, 10-Bit Analog-to-Digital Converter (A/D), Communication protocols: Enhanced Universal Synchronous Asynchronous Receiver Transmitter (EUSART), Master Synchronous Serial Port (MSSP) Module, I2C and SPI.	
UNIT 3	**PIC18F Programming in C**	**10 L**
	Introduction to Embedded C for PIC18F, Structure of C Program, Data Types, Conditional Statements and Loops, arrays, structures and pointers, I/O Ports, and Bit Manipulation, User defined functions, simple programming applications.	

Text/ Reference Books:

1. PIC Microcontrollers, by Lucio Di Jasio, Tim Wilmshurst, Dogan Ibrahim, John Morton, Martin P. Bates, Jack Smith, D. W. Smith, Chuck Hellebuyck. 1st Edition.
2. Programming and Customizing the PIC Microcontroller, by Myke Predko, 3rd Edition McGraw Hill.
3. PIC Microcontroller and Embedded Systems, Mazidi, Mckinlay and Causey, Pearson Education. 1st Edition .
4. Design with PIC Microcontrollers, John B. Peatman, Prentice Hall 1st Edition.

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(Course under NEP 2024)

Course Code: 24ScEleU6104 Major Paper IV (Theory)

Course Name: Interfacing with PIC Microcontroller

Teaching Scheme: TH: 2 Hours/Week. **Credit: 2**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite:

1. Basics of Analog Circuits
2. Basics of Digital Circuits
3. C Programming
4. Basics of microcontroller unit

Course Objectives:

This course will enable the students to:

1. To understand registers and modules of PIC controller.
2. To learn software techniques to embed codes into the systems.
3. To interface different peripherals to PIC controller.
4. To learn communication standards and protocols

Course Outcomes:

At the end of the course the student should be able to:

1. Write and debug programs for PIC microcontrollers using C.
2. Interface external devices with PIC microcontrollers (e.g., sensors, motors, displays).
3. Design embedded systems using PIC microcontrollers.
4. Use simulation tools and hardware to test and debug PIC programs.

Course Contents:

UNIT 1	**Timer, Counter, and Interrupts**	**10 L**
	Timers and Counters in PIC18F, Programming of Timer- 0 in 8-bit and 16-bit for Delay Generation. Programming timer-0 as counter, Interrupts and its types, External and Internal Interrupts programming, Timer and Interrupt Applications.	
UNIT 2	**Peripheral Interfacing**	**10 L**
	Interfacing LEDs, Switches, Relays, DC motor, stepper motor and servo motor, UART serial interface programming.	

UNIT 3	Real-Time Applications of PIC18F[10 lectures]	10 L
	Thumb wheel switch and seven segment display (bank token system), LM35 and LCD system (temperature indicator), DHT11 and LCD system (temperature and humidity measurement), MQ series (gas measurement) and moisture measurement system.	

Text/ Reference Books:

1. PIC Microcontrollers, by Lucio Di Jasio, Tim Wilmshurst, Dogan Ibrahim, John Morton, Martin P. Bates, Jack Smith, D. W. Smith, Chuck Hellebuyck. 1st Edition.
2. Programming and Customizing the PIC Microcontroller, by Myke Predko, 3rd Edition McGraw Hill.
3. PIC Microcontroller and Embedded Systems, Mazidi, Mckinlay and Causey, Pearson Education, 1st Edition.
4. Design with PIC Microcontrollers, John B. Peatman, Prentice Hall 1st Edition.

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU6105 Major Paper I (Practical)

Course Name: Lab course on 24ScEleU6101 and 24ScEleU6102

Teaching Scheme: TH: 4 Hours/Week. **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite:

- Basic idea of Amplitude modulation
- Basic idea of frequency modulation.
- Basic knowledge of nano electronics.

Course Objectives:

1. Understand the Principles of Modulation and Demodulation:
2. Analyze FM Modulation Using VCO ICs:
3. To learn Antenna Characteristics:
4. To understand lithography techniques.

Course Outcomes:

At the end of the course the student should be able to:

1. Analyze and evaluate the performance of AM demodulation circuits.
2. Analyze the frequency variation and modulation index of FM signals.
3. Evaluate the frequency response and bandwidth of tuned amplifiers.
4. Determine optical band gap of nano materials.

List of practicals: (any 12 of the followings)

1. Amplitude modulation and demodulator
2. FM modulator using VCO IC 555/ 566
3. Tuned amplifier.
4. Antenna Characteristics.
5. Analog multiplexer using 4051;
6. Study of balanced modulator using diodes/FET.
7. Generation of FM signal using function generator or trainer kit.
8. Implementation of FM modulator using varactor diode
9. Substrate cleaning
10. Thin film deposition by spin coating
11. Thickness measurement by feasible method
12. XRD Analysis of nanomaterials
13. Determination of optical band gap
14. SEM image analysis
15. Study of lithography technique

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(Course under NEP 2024)

Course Code: 24ScEleU6106 Major Paper II (Practical)

Course Name: Lab course on 24ScEleU6103 and 24ScEleU6104

Teaching Scheme: TH: 4 Hours/Week. **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite:

1. Basics of Digital Circuits.
2. C Programming
3. Basics of microcontroller unit

Course Objectives:

This course will enable the students to:

1. To understand registers and modules of PIC controller.
2. To understand the working and programming of microcontroller 8051
3. To get practice in C programming for microcontroller
4. To use microcontroller for various interfacing applications

Course Outcomes:

At the end of the course the student should be able to:

1. Understood various modules of PIC microcontroller.
2. Get various skills for interfacing peripherals with microcontroller.
3. Use of microcontroller with C language programming for developing various applications
4. Use of different motor interfacing with PIC microcontroller.

List of Practicals: (any 12 of the followings)

1. Study of PIC18F4520 target board and IDE.
2. Delay Generation using register/timer.
3. Switch Interfacing: Single key interface result on LED
4. LED bank interfacing to PIC microcontroller
5. SSD Interfacing to PIC microcontroller
6. Alphanumeric LCD panel interfacing to PIC microcontroller
7. Interfacing of stepper motor with PIC microcontroller
8. DC motor speed control using CCP module.
9. Interfacing I2C based RTC (DS1307) to PIC Microcontroller
10. Temperature Sensor Interfacing.
11. Serial Communication with PIC
12. External interrupt input switch press, output at relay.
13. 4x4 Keyboard interfacing to display pressed key on LCD.
14. Read an analog input (potentiometer / LDR) using on chip ADC and display value on LCD.
15. External EEPROM interface to PIC.

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU6201 Major Elective Paper I (Theory)

Course Name: Advanced Communication & IoT

Teaching Scheme: TH: 2 Hours/Week. **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

1. Basic information of electronic circuit components and circuits
2. Basic idea of analog electronic communication

3. Basic knowledge of computer networks and its operation

Course Objectives:

1. Understand Antenna and Wave Propagation
2. To study the digital communication system
3. To study basics of Internet of Things.
4. Understand IoT Challenges and Applications

Course Outcomes:

On completion of the course, student will be able to–

1. Understand electromagnetic wave propagation, transmission and reception through antennas
2. Understand digital communication systems
3. Understand concept of IoT, its characteristics and its application
4. Apply IoT concepts to real-world applications by evaluating relevant case studies.

Course content-

UNIT 1	**Antenna & Propagation**	**8 L**
	Propagation of Waves: Ground (Surface waves), sky wave propagation, space waves, Tropospheric scatter propagation. Antenna: Basic consideration, Evolution of Dipole antenna, UHF & Microwave antenna, Wide-band & special purpose antennas,	
UNIT 2	**Digital Communication Systems**	**7 L**
	Block diagram of digital communication system, advantages of digital communication system, bit rate, baud rate and bandwidth , Serial and parallel communication, concept of sampling, Sampling theorem, concept of ASK, PSK, FSK, PAM, PWM, PPM, PCM, Concept of FDM and TDM,	
UNIT 3	**Mobile Communication**	**5 L**
	Evolution of cellular telephone system- 2G, 3G, 4G, VoLTE&5G, Cellular systems -characteristics and applications, Base station and small cell	
UNIT 4	**Introduction to IoT**	**10 L**
	Introduction to IoT, Evolution of IoT, Role of cloud in IoT, cloud topologies, Cloud access Protocols in IoT, Cross connectivity across IoT system components, Device to	

	Gateway-short range Wireless: cell phone as gateway, dedicated wireless Access points, Gateway to cloud: Long range connectivity, Direct Device to Cloud connectivity Networking technologies, Low power local area networking (LPLAN), Low power wide area networking (LPWAN) technologies, LoRa. Challenges in IoT: Power consumption, Physical security, durability, Secure Connectivity, Secure Data Storage, Data volume, Scalability, Applications of IoT one or two case study examples.	

Text/ Reference Books:

1. Communication Systems by R. P. Singh, S. D. Sapre, 2nd Edition McGraw Hill.
2. Principles of Electronic Communication System, Louis Frenzel, McGraw Hill Education. 4th Edition.
3. Internet of Things: Principles and Paradigms, Rajkumar Buyya and Dastjerdi, MK publishers. 1st Edition.
4. Internet of Things, Mayur Ramgir, Pearson publication. 1st Edition.
5. Antenna Theory: Design & Analysis By Balanis, Wiley Eastern, 4th Edition.

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU6202 Major Elective Paper 1 (Practical)

Course Name: Advanced Communication & IoT lab

Teaching Scheme: TH: 4 Hours/Week. **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite:

1. Basic information of electronic circuit components and circuits
2. Basic idea of analog electronic communication
3. Basic knowledge of computer networks and its operation

Course Objectives: This course will enable the students to:

1. To understand and analyze analog modulation techniques.
2. To design and implement different pulse modulation techniques.
3. To explore signal multiplexing and transmission techniques. (FDM and TDM)

4. To introduce wireless transceivers and IoT communication protocols.

Course Outcomes:

At the end of the course the student should be able to:

1. Analyze and demonstrate amplitude and frequency modulation techniques.
2. Explain the working and applications of superheterodyne receivers.
3. Demonstrate the use of wireless transceivers for communication.
4. Set up and program IoT devices using Raspberry Pi/ESP8266/NodeMCU.

List of Practicals (any 12 of the followings)

1. DSB-SC generation using AD633.
2. Study of FM Modulator.
3. To study FSK modulator.
4. BPSK modulator study.
5. Study of Super heterodyne AM/ FM receiver.
6. To study PN sequence generator.
7. Pulse modulation – PAM/PWM/PPM.
8. Pulse code modulation.
9. Study of TDM technique.
10. Study of Wireless transceivers (Bluetooth HC-05).
11. Basic arithmetic operations using python.
12. Introduction to IoT and Setting Up Raspberry Pi/ESP32.
13. Reading Data from a DHT11 Sensor (Temperature and Humidity).
14. Interfacing PIR Sensor for Motion Detection.
15. Home Automation using Pi/ESP32.

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU6203 Major Elective Paper II (Theory)

Course Name: Python programming for Raspberry Pi

Teaching Scheme: TH: 2 Hours/Week. **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite:

1. Basic knowledge of C Programming.

2. Basic knowledge of Embedded System.

Course Objectives:

1. Learn basics of python programming.
2. Learn library functions of Python
3. Learn fundamentals of Raspberry Pi.
4. Learn architecture of Raspberry Pi.

Course Outcomes:

At the end of the course the student should be able to:

1. Understood basics of Python
2. Understood basics of raspberry
3. Understand Raspberry Pi and interfacing.
4. Communicate raspberry with protocols

Course Contents:

UNIT 1	**Python Programming**	**6 L**
	Need of Python program and interpreter, Python syntax, variables, and data types, Control structures (if, loops) and functions, list , tuples, File handling and exception, handling, Working with modules and libraries.	
UNIT 2	**Raspberry Pi Fundamentals**	**8 L**
	Introduction: Raspberry Pi, Features of Raspberry Pi, History of Raspberry Pi, Architecture Overview, CPU Pipeline Stages, Branch Prediction and Folding, Essential Input Output Devices, Setting Up Raspberry Pi, Raspbian OS, Linux commands for Raspberry Pi.	
UNIT 3	**Python programming on Raspberry Pi**	**6 L**
	GPIO Pins, Configuring GPIO Pins, Python programming on Raspberry Pi platform, patch modules of Python Raspberry Pi, GPU Overview, Importing Libraries, Python and Hardware Access.	
UNIT 4	**Interfacing of Raspberry Pi using Python Programming**	**10 L**
	Interfacing of LED, SSD, Switches, Alphanumeric LCD, ADC, Servo Motor, Stepper Motor with Raspberry Pi. Use of built in Functions for PWM generation, I2C, SPI and Raspberry Pi Camera.	

Text / Reference Books:

1. Programming the Raspberry Pi Getting Started with Python, Simon Monk, The McGraw Hill Companies. 3rd Edition.
2. Python for Everybody, Dr. Charles R. Severance. 1st Edition.
3. Raspberry Pi User Guide by Eben Upton, Greath Halfacree John Wiley Publication 3rd Edition.
4. Python Crash Course: A Hands-On, Project-Based Introduction to Programming Raspberry Pi Robotic Projects - Third Edition Machine Learning For Absolute Beginner 3rd Edition.
5. Learning Python with Raspberry Pi by Alex Bradbury, Ben Everard 1st Edition.

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU6204 Major Elective Paper II (Practical)

Course Name: Lab Course on 24ScEleU6203

Teaching Scheme: TH: 4 Hours/Week. **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite:

- Basic knowledge of Electronics.
- Basic knowledge of C programming.
- Understanding of interfacing.

Course Objectives: This course will enable the students to:

1. Learn basic python programming.
2. Learn interfacing with Raspberry Pi.
3. Learn general input and Output connection.
4. Understand and apply Python syntax and semantics in program development.

Course Outcomes:

At the end of the course the student should be able to:

1. Understood python programming.
2. Understand and apply Python syntax and semantics in program development.

3. Setting up the development environment
4. To understand Variables and data types

List of Practicals: (any 12 of the followings)

1. Program to find square root of a number using Python programming.
2. Find prime number using Python programming.
3. Find smallest /largest from 5 numbers.
4. Program the Raspberry Pi to control light emitting diodes (LEDs) attached to the GPIO pins.
5. To Interface Buzzer with Raspberry Pi
6. To interface Push Button / Digital Sensor (IR/LDR) with Raspberry Pi
7. Program the Raspberry Pi to get feedback from a switch connected to the GPIO pins.
8. Program the Raspberry Pi to get the temperature from a sensor
9. Program the Raspberry Pi to detect room light from a photocell sensor
10. Program the Raspberry Pi for Motion detection.
11. Program the Raspberry Pi for interfacing the Camera.
12. Program the Raspberry Pi for water level monitor.
13. To interface DHT11 sensor with Raspberry Pi
14. To interface DC motor using relay with Raspberry Pi
15. To interface Bluetooth module with Raspberry Pi.

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),

Shivajinagar, Pune - 5

Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU6501 VSC (Practical)

Course Title: Lab Course on Industrial Automation

Teaching Scheme: TH: 4 Hours/Week. **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Course Prerequisites

Before enrolling in this course, students should have basic knowledge of the following

1) PLC Hardware & Programming Fundamentals
2) PLC-Based Control Applications
3) Motor Control & Drives

4) Computer skills for PLC programming software and simulation tools

Course Objectives:

1) To introduce the basic architecture and hardware components of PLC systems
2) To develop hands-on skills in PLC digital input and output interfacing
3) To study the operation and applications of PLC timers and counters
4) To design and implement PLC-based control applications

Course Outcomes (COs):

After successful completion of this practical course, students will be able to:

1) Identify and explain the functions of PLC hardware components
2) Interface digital input and output devices with PLCs
3) Develop and execute ladder logic programs
4) Implement timers and counters in PLC
5) Design and test PLC-based automation systems
6) Demonstrate practical skills in automation system integration, testing, and troubleshooting

List of practicals: (any 12 of the followings)

PLC Hardware & Programming Fundamental

1. Study of PLC Hardware Architecture
2. Study of PLC Digital Input–Output Interfacing (Interfacing switches, lamps, relays)
3. Study of PLC Programming Using Ladder Logic (NO, NC, latch, unlatch)
4. Study of PLC Timers.
5. Study of Counters.
6. Study PLC Arithmetic and Comparison Instructions. PLC-Based Control Applications
7. Traffic Light Control System Using PLC
8. Water Tank Level Control Using PLC
9. Conveyor Belt Control Using PLC
10. Automatic Bottle Filling System
11. Sorting System Using Sensors and PLC
12. Automatic Packaging System Motor Control & Drives
13. Star-Delta Starter Control Using PLC
14. Forward and Reverse Control of Induction Motor
15. Speed Control of DC Motor Using PLC and PWM
16. Position Control of Servo Motor Using PLC

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Modern College of Arts, Science and Commerce (Autonomous),

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Third Year of B.Sc.

(Course under NEP 2024)

Course Code: 24ScEleU6004 (OJT)

Course Name: On Job Training

Teaching Scheme: TH: 8 Hours/Week. **Credit: 04**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Course Objectives: This course will enable the students to:

1. To provide practical exposure to industry operations and technologies.
2. To develop technical and problem-solving skills in relevant domains.
3. To enhance communication, teamwork, and professional skills.
4. To familiarize students with industrial standards, safety protocols, and work ethics.
5. To improve adaptability and decision-making in a dynamic work environment.
6. Apply theoretical concepts to real-world industry scenarios.

Course Outcomes:

At the end of the course the student should be able to:

1. Gain hands-on experience and practical knowledge in the chosen domain.
2. Develop professional skills such as teamwork, communication, and collaboration.
3. Enhance problem-solving and decision-making abilities.
4. Manage time and resources effectively to meet deadlines.
5. Prepare for future career opportunities by gaining practical insights.
6. Document and present project reports and findings effectively.

Course Overview:

The **On-Job Training (OJT)** for Third Year B.Sc. (TY B.Sc.) is designed to provide students with hands-on industry experience and practical knowledge in their respective fields. This program bridges the gap between academic knowledge and real-world applications, enabling students to develop technical expertise, problem-solving skills, and professional ethics. The training allows students to apply theoretical concepts learned in the classroom to industry scenarios and prepares them for future careers.

Program outcome

After completion of B. Sc. In Electronic Science, students are able to

1. Design, analyse and implement analog and digital circuits.
2. Program microprocessors and microcontrollers for real-world applications.
3. Design embedded systems using PIC, Arduino, and Raspberry Pi.
4. Develop applications using programming languages such as C, Python, for electronic applications. Use simulation tools like PSPICE, Multisim, for circuit analysis.
5. Analyse and understand analog and digital communication systems.
6. Understand real-time processing and interfacing with sensors.
7. Design and implement power converters and inverters.
8. Gain knowledge of industry trends such as IoT, VLSI, and Artificial Intelligence.
9. Develop and implement mini-projects for practical exposure.
10. Understand professional ethics in electronics and technology and develop entrepreneurial skills to start an electronics-based business.
11. Work effectively in teams and communicate technical knowledge effectively.
12. Recognize the impact of development in electronic technology on society.