T.Y. B.Sc. Electronic Science Syllabus as per NEP 2020

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

Progressive Education Society's

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

Shivajinagar, Pune - 5

Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU5101 Major core Paper 1 (Theory)

Course Name: Electronic Instrumentation and process control

Teaching Scheme: TH: 4 Hours/Week	**Credit: 04**
Examination Scheme: CIA: 40 Marks	**End-Sem : 60 Marks**

Prerequisite:

- Basics of units, measurements and error estimation
- General idea of any instrumentation system
- Electronic circuits and sensors
- General idea of process control

Course Objectives: This course will enable the students to:

1. To study electronic measurement instrumentation system.
2. To study physical measuring methods converted into electronic measurements.
3. To study applications of transducers and sensors in electronic instrumentation.
4. Learn Process control Principles.
5. Develop Data Acquisition Skills. Learn Process Control Principles.
6. Explore Industrial Automation.

Course Outcomes:

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

1. Classify the instrumentation systems and various measurement errors.
2. Analyse and design voltmeter rcircuits, AC electronic voltmeter, digital frequency meter and current measurement with electronic instruments.
3. Analyse fundamental operation of CRO and some special types of oscilloscopes like DSO, sampling oscilloscope.
4. Use Digital and Analog Measurement Techniques in Practical Applications.
5. Understand control parameters in process automation.
6. Understand different types of process control systems and their characteristics

Course Contents:

Section 1- Electronic Instrumentation

Unit-1 Introduction to Instrumentation system [12 Lectures]

Introduction, Functional Elements of a Measurement System, Analog and Digital Modes of Operation, Null and Deflection Methods, Input Output configuration of Instruments and measuring systems. Classification of Instruments, Methods of measurement, Typical Applications of Instrument Systems, Performance characteristics of Instruments, Errors in measurement, Calibration and Measurement standards.

Unit-2 - Measuring Instruments [10 Lectures]

Voltmeter and Ammeter, Wheatstone bridge, Measurement of resistance, Insulation resistance measurement, AC bridges for inductance and capacitance measurement, Time, Frequency and phase angle measurements using CRO, Digital Storage oscilloscope, Spectrum and Wave analyzer, Digital counter, Frequency meter.

Unit-3- Transducers [8 Lectures]

Transducers, classification & selection of transducers, strain gauges, Thermistors, Thermocouples, LVDT, Inductive & capacitive transducers, Piezoelectric and Hall-effect transducers.

Section 2- Process control

Unit-4 - Fundamentals of Process Control [12 Lectures]

Elements of Process Control: Measurement, Controller, and Actuator, Open-Loop and Closed-Loop Control Systems, Process control principles, Continuous control, discrete state control, composite discrete/continuous control, Process Characteristics, Control system parameters, Architecture of Industrial Automation Systems, Advantages, and limitations of Automation.

Unit-5 - Process Performance Parameters [10 Lectures]

Generalized measurement systems, zero-order System, First-order System, Second–order System, Dead-Time Element, Specifications and Testing of Dynamic Response. Generalized Data Acquisition system- Elements of a data acquisition system, Single channel Data Acquisition system, Multichannel Data Acquisition system and Introduction to LABView.

Unit 6: Process Control Techniques [8 Lectures]

Cascade Control, Ratio Control, and Feedforward Control, Introduction to Distributed Control Systems (DCS) and Programmable Logic Controllers (PLC), Supervisory Control and Data Acquisition Systems(SCADA).

Text/Reference Books:

1 Electrical& Electronic Measurement &Instrument,A K Sawhney, Dhanpat Rai & Sons, India
2 Electronic Instrument &Measurement Technique,W D Cooper, PrenticeHall International
3 Robot Dynamics and Control, Spong and M. Vidyasagar, Wiley Student Edition
4 Robotics:Fundamental Concepts and Analysis, Ashitava Ghoshal,OxfordHigher Education
5 Electronic Instrumentation and Measurements, H S Kalsi, McGrawHill
6 Process Control Instrumentation Technology; Curtis Johnson, Pearson Publication
7 Instrumentation Devices & Systems, C S Rangan, G R Sarma,V S Mani, TMH

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU5102 Major Paper 1 (Theory)

Course Name: Digital Systems Design using Verilog

Teaching Scheme: TH: 4 Hours/Week **Credit: 04**
Examination Scheme: CIA: 40 Marks **End-Sem : 60 Marks**

Prerequisite:

- Basic knowledge of digital fundamentals.
- Idea of sequential and combinational circuits.
- Use of computer and ideas of any programming language.

Course Objectives: This course will enable the students to:

1. To understand sequential and combinational logic design techniques
2. To introduce VERILOG
3. To learn various digital circuits using VERILOG
4. To learn PLD, CPLD, FPGA and their applications
5. To enable Hands-on Experience with Digital System Prototyping
6. To train Students in Simulation, Synthesis, and Implementation

Course Outcomes:

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

1. Design layout for digital system circuit.
2. Write, simulate and implement digital system circuits.
3. Develop applications using programmable logic devices.
4. Simulate, Synthesize, and Verify Digital Circuits
5. Analyze Timing and Delays in Digital Circuits
6. Develop FSM-Based Digital Systems

Course Contents:

Section I: Digital Systems Design

Unit 1: Introduction to Digital Design and Logic Circuits [10 Lectures[

Review of 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 Logic Circuits, Logic Families: TTL, CMOS, and ECL Characteristics. Introduction to HDL (VHDL/Verilog) for Logic Design

Unit 2: Sequential Logic Design and Analysis [10 Lectures]

Introduction to Sequential Circuits and Flip-Flops, Synchronous and Asynchronous Sequential Circuits, State Diagrams, State Tables, and State Reduction, Mealy and Moore Models for Sequential Circuits, Design of Counters, Shift Registers, and Sequence Generators, Hazards, Races, and Synchronization Techniques

Unit 3: Design Using Programmable Logic Devices (PLDs) [10 Lectures]

Introduction to PLDs: PROM, PLA, PAL, and GAL, Design and Implementation of DigitalCircuits using PLDs, Overview of Field Programmable Gate Arrays (FPGAs) and

PLDs, Programming and Configuring FPGAs using VHDL/Verilog, Applications of PLDs and FPGA-based System Design, Design Flow and Synthesis Tools for PLD Implementation

Section II: Realization of Digital System Using Verilog

Unit 4: Digital System Design with VHDL/Verilog [10 Lectures]
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 5: Arithmetic and Advanced Digital Systems [10 Lectures]
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 6: Fault Detection, Low-Power Design, and Case Studies [10 Lectures]
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,

Text/Reference Books:

1. Verilog HDL: A Guide to Digital Design and Synthesis, Samir Palnitkar, Pearson Education
2. Verilog HDL synthesis: A Practical Primer, J. Bhaskar , Star Galaxy Publishing
3. Digital System Design with VERILOG Design, Stephen Brown, Zvonko Vranesic, TMH
4. Modern Digital Electronics, R.P Jain ,McGraw Hill
5. Digital systems ; Principles and Applications ,To cci , Pearson Education

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU5103 Major Paper 1I (Practical)

Course Name: Lab Course on Electronic Instrumentation, Process Control and Digital System

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

Prerequisite:

- Basic knowledge of electronic instrumentation.
- Basic knowledge of digital electronics.

Course Objectives: This course will enable the students to:

1. To enable Hands-on Experience with Digital System Prototyping
2. To train Students in Simulation, Synthesis, and Implementation
3. To introduce VERILOG
4. To study electronic measurement instrumentation system
5. To study physical measuring methods converted into electronic measurements
6. Learn Process Control Principles

Course Outcomes:

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

1. Simulate, Synthesize, and Verify Digital Circuits
2. Analyze Timing and Delays in Digital Circuits
3. Develop applications using programmable logic devices.
4. Analyse fundamental operation of CRO and some special types of oscilloscopes like DSO, sampling oscilloscope.
5. Use Digital and Analog Measurement Techniques in Practical Applications
6. Understand different types of process control systems and their characteristics

Course Contents:

1. Design 4 to 1 line MUX/ 1 to 4 DEMUX.
2. Design 2-4 decoder.
3. Arithmetic circuits: Half adder, Full adder and Parallel adder.
4. Design of flip-flops using: RS, D and T.
5. Design of 4-bit Shift register.
6. Code converter – hex to decimal and decimal to hex.
7. Code converter – binary to gray and gray to binary.
8. Design of 4-bit binary Up/down counter.
9. Design of Ring Counter.
10. Measurement of temperature by PT-100.
11. Measurement of load using strain gauge-based load cell.
12. Measurement of displacement using LVDT.
13. Study of Characteristics of Thermocouple.
14. Study of ON/OFF controller.
15. Temperature control using P, PI, PD, and PID controllers–Study of output response.

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU5201 Major Elective Paper 1 (Theory)

Course Name: C and MATLAB Programming

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

Prerequisite Courses:

1. Idea regarding software and their applications
2. Basic information regarding any programming language

Course Objectives:

1. To understand fundamentals of C language.
2. To develop algorithm/flowcharts for problem solving and writing programs.
3. To learn to use functions, arrays, pointers and file handling in C language
4. To learn features of MATLAB as a programming tool.
5. To promote a new teaching model that will help to develop programming skills and techniques to solve mathematical problems.
6. To understand Laplace Transform and its applications.

Course Outcomes:

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

1. Know the Basics of Programming.
2. Understand how todevelop logical algorithms and "C" program for executing that logic.
3. Understand use of programming in day to day Applications.
4. Use various features in MATLAB in solving the problems with MATLAB program.
5. Apply Fourier series and Laplace transform analysis in solving circuit analysis problems using MATLAB programs.
6. Simulate and study characteristics of electronic components and basic circuits .

Course Contents:

UNIT 1 - Basics of C Programming language [6 lectures]

Introduction to flowchart and algorithm, C character set, constants variables and Keywords, types of C constants and variables, C instructions with examples, Function in C input and output functions, user defined functions, operators and expressions, decision making statements if, if-else, nested if-else, switch-case, Loops in C - while loop, do-while loop and for loop, nested loop.

UNIT 2- Arrays, Pointers String, Structure and File [8 lectures]

Definition and declaration of an array- one and two dimensional arrays, passing array elements to a function, Pointers declarations, passing pointers to a function, call by value and call by reference, Defining string, string functions - String length, string size, string copy, string concatenation, string compare, Declaring a Structure, Accessing Structure Elements, Array of Structures, Opening and closing of data file, read and write data file, append data file with programming examples.

UNIT 3- Introduction to MATLAB [8 lectures]

Working in the command window, Built in functions, Array-1D, 2D and mathematical operations with array, m-Script files, 2D & 3D plots.
Functions: Inline, functional evaluation – feval, Programming: Conditional statement, Switch-case statement, loops, nested loops, break & continue statement.

UNIT 4- Mathematical Applications and Laplace Transform. [8 lectures]

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 input. To study and write MATLAB programs for Ohm's Law, RC Filter, To find Laplace Transform and Inverse LT of any given function and Transient analysis of RC / RL/RLC (series) circuit

Text/ Reference Books.

1. Let Us C. Yashavant P. Kanetkar, BPB Publications.
2. Outline of Programming with C. Byron S. Gottfried, Schaum's TMH.
3. Programming in –C. E Balaguruswamy, BPB.
4. Computer Programming in C. V. Rajaraman, Prentice hall of India Ltd.
5. MATLAB : An introduction with applications, Amos Gilat, Wiley India
6. Network Analysis, Van Valkenberg, Dorling Kindersley (India) Pvt Ltd.
7. Getting Started with MATLAB, Rudra Pratap, Oxford University Press, N Delhi.
8. MATLAB Programming For Engineers, Stephen J. Chapman, Thomas Learning.

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU5202 Major Elective Paper 1 (Practical)
Course Name: Lab course on C and MATLAB Programming.

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

Prerequisite:

- Basic knowledge of C programming language.

Course Objectives:

1. To learn basics of programming.
2. To understand decision making in C.
3. To understand loops in C
4. To learn functions in C.
5. To learn MATLAB basics and its applications
6. To use very effective tools in MATLAB

Course Outcomes:

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

1. Write a C program for functions.
2. Read and write un to data files.
3. Use pointers in C.
4. Understand the use of effective tools in MATLAB.
5. Get skill to program in MATLAB.

6. Use MATLAB for Laplace transform and inverse Laplace transform.

Course Contents:

1. Largest and smallest of given numbers.
2. Sorting of array of numbers using Bubble Sort algorithm.
3. Recursive functions - Factorial of a number, Fibonacci Series.
4. Prime numbers generation.
5. Program for code conversion - Decimal to binary (for 8-bit integer), 8-bit Binary to decimal.
6. Write C Programs for Matrix addition and multiplication.
7. Reading and writing data files.
8. Function call by value and call by reference.
9. Demonstration of structures.
10. MATLAB introduction by simple exercises.
11. MATLAB program for verification of Ohm's Law.
12. Study of Diode characteristics using MATLAB.
13. Study of RC Filter using MATLAB.
14. Laplace Transform and Inverse LT of any given function.
15. Transient analysis of RC / RL/RLC (series) circuit.

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU5203 Major Elective Paper 1I (Theory)

Course Name: Power Electronics

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

Prerequisites: Basic knowledge of electronics, circuits, and electrical engineering concepts.

Course Objective:

1. Fundamental knowledge of power electronics.
2. Electronic devices like diodes, transistors, thyristors, and their control methods.
3. Applications of power electronic circuits.
4. Understand Fundamentals of Power Electronics:
5. Analyse Power Semiconductor Devices:
6. 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 basic power electronic converter circuits.

3. Use those converters for the designing of Power Electronic systems.
4. Understand DC-DC and DC-AC Conversion Techniques:
5. Explore Applications of Power Electronics in Real-World Systems
6. Use PWM techniques for controlling inverters.

Course Structure:

Unit 1: Introduction to Power Electronics [4 Lectures]

Overview of Power Electronics: Definition and significance of power electronics in modern electrical systems, Classification of Power Electronic devices, Control Characteristics of Power devices. Understanding conduction and switching losses in power devices. Types of Power Converters, Applications of power electronics in renewable energy systems, industrial motor drives and power supplies.

Unit 2: Power Semiconductor devices [6 Lectures]

Power Diode: Symbol, Construction, Types and switching behaviour, 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 Lectures]

AC to DC Conversion: Introduction and classification, Controlled Rectifiers: Thyristor-based phase-controlled rectifiers (single-phase), Analysis of rectifier circuits: Input and output waveforms, average and RMS values of o/p 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 Lectures)

DC-DC Converters: Introduction and classification, Types of DC-DC converters: Buck, Boost, Buck-Boost, and Cuk converters, Converter Topologies: Circuit analysis of Buck and Boost converter, Applications of DC-DC Converters, DC to AC Conversion: Introduction and classification, Voltage Source Inverter (VSI) and Current Source Inverter (CSI), Basic operation of Single-phase inverters: Half bridge and Full Bridge. PWM (Pulse Width Modulation) Techniques: Square, Quasi- square and Sinusoidal PWM (SPWM) schemes and Applications of Inverters.

Textbooks and References:

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

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU5204 Major Elective Paper 1I (Practical)

Course Name: Lab course on Power Electronics

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

Prerequisite:

- Basic 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 study various triggering methods such as RC and UJT-based circuits for SCR.
3. To explore and understand different types of rectifiers.
4. To study and evaluate single-phase AC voltage controllers.
5. To understand the use of PWM techniques for DC motor speed control.
6. 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. Demonstrate the design and operation of RC/UJT trigger circuits for SCR.
3. Evaluate the performance of single-phase half and full-controlled rectifiers with different load conditions.
4. Analyse the working of AC voltage controllers and single-phase cyclo-converters.
5. Apply PWM techniques to control the speed of DC motors efficiently.
6. Design and analyze SCR-based battery charging circuits.

Course Contents:

1. Study of V-I characteristics of SCR and measure latching, holding currents.
2. Study of V-I characteristics of Power MOSFET.
3. Study of V-I characteristics of Diac and Triac.
4. Study of RC/UJT trigger circuit for SCR.
5. Study of single-phase half wave controlled rectified with (i) resistive
    a. load (ii) inductive load with and without freewheeling diode.
6. Study of single phase (i) fully controlled (ii) half controlled bridge rectifiers with resistive and inductive loads.
7. Study of single-phase ac voltage controller with resistive and inductive loads.
8. Study of the PWM speed control of DC motor.
9. Study of MOSFET/IGBT based single-phase bridge inverter.
10. Study of the SCR based battery charging circuit.
11. Study of the AC and DC static switches.
12. Study of the operation of Solid State Relay
13. Study of SMPS.

14. Study of the switching characteristics of N Channel E- MOSFET.
15. Study of the off line UPS.

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU5301 Minor Paper section I (Theory)

Course Name: C- programming for Arduino

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

Prerequisites: Basic knowledge of programming concepts and basic electronics.

Course Objective:

1. Learn foundational programming skills
2. Understand hands-on project development on Arduino hardware.
3. Read and interpret digital input data to perform specific tasks.
4. Utilize Arduino Libraries
5. Apply built-in libraries such as LCD and Servo for interfacing and controlling devices.
6. demonstrate working projects that integrate multiple sensors and actuators.

Course outcome:

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

1. Write C programs.
2. Control hardware devices.
3. Communicate with sensors, motors, displays etc.
4. Develop projects using Arduino hardware.
5. Interface and control DC motors, servo motors, and relay drivers using Arduino
6. Control DC motors, servo motors, and relay drivers in real-time applications

Course Contents:

Unit 1: Introduction to Arduino and C Programming [8 Lectures]

Introduction to Arduino: Overview of Arduino platform and architecture, components of Arduino boards (e.g., ATmega328P), Introduction to setup() and loop() functions, Basics of C programming: Syntax, structure, variables, data types (int, float, char), and constants, Control structures: if, else, for, while, and do-while loops, Functions: Creating functions, passing parameters, and returning values, Write a C program to blink an LED on an Arduino board.

[Unit 2: Input and Output devices handling [8 Lectures]

Digital Input and Output: Working with digital pins: digitalWrite(), digitalRead(), Controlling LEDs, buttons, and switches, Analog Input and Output: Analog signals: Introduction to ADC (Analog to Digital Conversion) and PWM (Pulse Width Modulation), analogRead(),

analogWrite() functions, Interfacing sensors like potentiometers and controlling the brightness of LEDs using PWM.

Unit 3: Arduino Programming Concepts [8 Lectures]
Arduino Libraries: Introduction to Arduino libraries (e.g., Servo, LCD, and SPI libraries), Serial Communication: Introduction to serial communication protocols (UART, I2C, SPI), Using Serial.begin(), Serial.print() and Serial.read() for debugging and communicating with external devices, Sending and receiving data between Arduino and a computer or other Arduino devices, Timer Functions: Introduction to Arduino timers: delay(), millis(), and micros(), Use of interrupts with attachInterrupt() function for handling external events.

Unit 4: Real time applications [6 Lectures]

Interfacing temperature sensors (LM35), light sensors (LDR), and distance sensors (Ultrasonic), Using PWM to control DC motor speed and servo motor position

Textbooks and References:

1. "Getting Started with Arduino" by Massimo Banzi and Michael Shiloh (O'Reilly Media)
2. "Arduino Cookbook" by Michael Margolis (O'Reilly Media)
3. "Programming Arduino: Getting Started with Sketches" by Simon Monk (McGraw-Hill)
4. Arduino Documentation: Official website and reference guide (https://www.arduino.cc/en/Reference)

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU5301 Minor Paper section II (Practical)

Course Name: Lab course on C- programming for Arduino

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

Prerequisite:

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. Gain knowledge of reading digital inputs such as buttons and switches to control external devices.
4. Develop Sensor-Based Projects
5. Interface and control DC motors, servo motors, and relay drivers using Arduino.
6. Use built-in delay and interrupt functions to control the timing and behavior of devices.

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. Design and implement projects controlling LED brightness using a potentiometer.
4. Establish bidirectional communication between Arduino and a computer.
5. Implement delay and interrupt functions for time-based applications.
6. Interface LCD displays and read data from temperature, light, and distance sensors.

Course Contents:

List of Practicals :

1. Arduino IDE: Installing, configuring, and using the Arduino IDE for writing, compiling, and uploading code.
2. Write a C program to blink an LED on an Arduino board.
3. Reading digital inputs (buttons or switches) to control an LED.
4. Use of Inbuilt libraries(LCD and Servo).
5. Build a project using a potentiometer to control the brightness of an LED.
6. Sending and receiving data between Arduino and a computer.
7. Use of Built in delay functions for the LED blinking.
8. Use of Built in interrupt functions.
9. Interfacing LCD.
10. Interfacing temperature sensors (LM35).
11. Interfacing light sensor (LDR).
12. Interfacing distance sensors (Ultrasonic).
13. Interfacing DC motor.
14. Interfacing Servo motor.
15. Interfacing relay driver.

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU5501 Major specific Practical (VSC)

Course Name: Industrial Automation with PLC and HMI

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 automations.

Course Objectives: This course will enable the students to:

1. Know about the basics of programmable logic controllers and their components.
2. Know about the basics of HMI and their programming.
3. Study of HMI Software.
4. Study different components in PLC.
5. Study of Latch & Unlatch Circuit.

Course Outcomes:

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

1. Demonstrate PLC programming using ladder programming.
2. Develop PLC based systems by programming different components in PLC
3. Develop PLC and HMI based systems.
4. Write and simulate a basic ladder logic program.
5. Implement Logic gates using ladder logic.
6. Write a Timer program with required delay.

Course Contents:

1. Study of PLC & Software – Writing and simulating a basic ladder logic program.
2. Study of Digital I/O Handling – Turning ON/OFF LEDs using push buttons via PLC.
3. Logic gates Implementation using ladder logic.
4. Study of Latch & Unlatch Circuit for a motor using a start/stop push button.
5. Timer programming to control a lamp with delay settings.
6. Two-way Traffic Light Control system using timers.
7. Study of Sequential Lamp Control using multiple timers.
8. Level Control System using a float switch sensor to control a pump based on tank level.
9. Implementation of coffee vending machine.
10. Study of HMI Software and basic programming between PLC and HMI.
11. Programming to Turn ON/OFF an bulb using an HMI button.
12. Programming a PLC to Show real-time sensor values on HMI.
13. Motor ON/OFF using HMI and PLC programming.
14. Programming a timer in HMI and PLC to control an output device.
15. Program to display count values from PLC on the HMI screen.

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(Course under NEP 2020)

Course Code: 23ScEleU5002 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:

- Basic ideas of electronic components and circuits
- Use of test and measuring instruments
- Skills for design , built , simulate and test electronic circuits
- Proper reference work for the topic of the project work selected
- 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 favorite 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

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

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU6101 Major core Paper 1 (Theory)

Course Name: Electronics Communication and Fundamentals of Nano-electronics

Teaching Scheme: TH: 4 Hours/Week	**Credit: 04**
Examination Scheme: CIA: 40 Marks	**End-Sem : 60 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 study the basics of communication systems
2. To understand Amplitude and Frequency Modulation and demodulation.
3. To understand the basics of AM and FM Receivers
4. To study the basics of nanoscience and nanotechnology
5. To study synthesis techniques of nonmaterial
6. To study electronic instrumentation used for characterization of solid state materials

Course Outcomes:

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

1. Understand fundamentals of electronic communication
2. Know various techniques for sending and receiving messages in electronic communication
3. Understand functioning of electronic communication transmitter and receiver
4. Understood concept of nanotechnology
5. Understood synthesis techniques of nonmaterial
6. Understood advanced tools available for material characterization.

Course Contents:

Section 1- Electronics Communication

UNIT 1- Basics of Communication Systems [8 lectures]

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- Modulation and De-modulation [14 lectures]

Need of modulation, concept of modulation, AM waveform, mathematical expression of AM, concept of sideband, modulation index, power distribution,
AM modulators: Balanced Modulator- using diodes & FETs, SSBSC modulator- Filter Method & Phase shift method,
AM demodulator: Diode demodulator, Synchronous demodulator, Product demodulator.
FM modulation: definition, mathematical representation, modulation index, frequency deviation and average power, FM modulator using Varactor diode, Indirect method of FM generation,
FM Detector: Slope detector, Foster-Seeley discriminator.

UNIT 3- Transmitter and Receiver. [8 lectures]

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.

Section I1- Fundamentals of Nano-electronics

UNIT 4- Nanoscience and Nanotechnology. [8 lectures]

Introduction to Nanoscience and Nanotechnology.
Significance of nanoscale: Surface area, Quantum confinement effect.
Different types of nonmaterial‟s: Metals, Semiconductors, Composites, Ceramics and Polymers.

Classifications of nanomaterial‟s, Properties, Importance and Applications of Nanomaterial‟s.

UNIT 5- Synthesis techniques of Nonmaterial's . [10 lectures]
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 6- Characterization techniques . [12 lectures]
X-ray Diffraction technique, Fourier Transform Infrared Spectroscopy (FTIR), UV-Visible Spectroscopy, Scanning Electron Microscopy, Atomic Force Microscopy. Energy Dispersive X-ray Analysis, X-ray Photoelectron Spectroscopy. Photoluminescence. Fluorescence. Phosphorescence. Electroluminescence. Photoconductivity,
Electrical measurement techniques: Resistivity, Polarization, Dielectric properties, Electrochemical techniques (Cyclic voltammetry).

Text/ Reference Books:

1. Communication Systems by R. P. Singh, S. D. Sapre, McGraw Hill.
2. Electronic Communication by Dennis Roddy & John Coolean, Pearson Education
3. Principles of Communication Systems by Taub Schilling, McGraw Hill.
4. Electronic Communication systems by Kennedy & Davis, Tata McGraw Hill
5. Fundamentals of nanoelectronics , George W. Hanson, LPE, Pearson Education V. Mitin ,Viatcheslav A. Kochelap , Michael A. Stroscio Vladimir
6. "Introduction to Nanoelectronics Science ,nanotechnology , Engineering and Applications" Cambridge University Press 2008
7. Solid State Electronic Devices, Ben G. Streetman , Sanjaykumar Banerjee

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU6102 Major Paper 1 (Theory)

Course Name: Advanced microcontroller –PIC

Teaching Scheme: TH: 4 Hours/Week **Credit: 4**
Examination Scheme: CIA: 40 Marks **End-Sem : 60 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 the architecture 8-bit microcontroller
2. To understand registers and modules of PIC controller.
3. To understand basics of interfacing concepts.
4. To learn software techniques to embed codes into the systems.
5. To interface different peripherals to PIC controller.
6. To learn communication standards and protocols

Course Outcomes:

At the end of the course the student should be able to:
1. Understood the architecture and features of PIC microcontrollers.
2. Understood various modules of PIC microcontroller.
3. Write and debug programs for PIC microcontrollers using C.
4. Interface external devices with PIC microcontrollers (e.g., sensors, motors, displays).
5. Design embedded systems using PIC microcontrollers.
6. Use simulation tools and hardware to test and debug PIC programs.

Course Contents:

Section 1- Architecture and programming

Unit 1- PIC18FXX Architecture and Overview [10 lectures]

PIC microcontroller overview, PIC18FXX: 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 - On chip resources of PIC [10 lectures]

Timer module, CCP module, ADC module, Comparator module, EUSART module, Capture/ Compare/ PWM (CCP) Modules,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: PIC Programming in C [10 lectures]

- Introduction to Embedded C for PIC
- Structure of C Program for PIC
- Data Types, I/O Ports, and Bit Manipulation
- Conditional Statements and Loops
- Functions and Macros
- Debugging and Simulation

Section 2- Interfacing with PIC Microcontroller

Unit 4: Timer, Counter, and Interrupts **[10 lectures]**

- Timers and Counters in PIC18
- Programming Timers for Delay Generation
- Interrupt Concepts and Handling
- External and Internal Interrupts
  Timer and Interrupt Applications

Unit 5: I/O Interfacing and Peripherals **[10 lectures]**

- Interfacing LEDs, Switches, and Relays
- Keypad and LCD Interfacing\
- ADC (Analog-to-Digital Converter) Basics
- UART (Serial Communication) Basics
- SPI and I2C Protocols

Unit 6 : Advanced Topics and Real-Time Applications **[10 lectures]**

- Pulse Width Modulation (PWM) and Motor Control
- Servo and Stepper Motor Interfacing
- Real-Time Clock (RTC) Interfacing
- Introduction to Wireless Communication using PIC

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.
2. Programming and Customizing the PIC Microcontroller, by Myke Predko, McGraw Hill.
3. PIC Microcontroller and Embedded Systems, Mazidi, Mckinlay and Causey, Pearson Education.
4. Design with PIC Microcontrollers, John B. Peatman, Prentice Hall

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU6103 Major Paper 1I (Practical)

Course Name: Lab course on Electronic communication and Interfacing with PIC microcontroller

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

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

Prerequisite:

- Use of computer and understanding of software
- Basic idea of computer programming
- Basic ideas in digital electronic circuits

Course Objectives: This course will enable the students to:

1. Understand the Principles of Modulation and Demodulation:
2. Analyze FM Modulation Using VCO ICs:
3. To learn Antenna Characteristics:
4. To understand the working and programming of microcontroller 8051
5. To get practice in C programming for microcontroller
6. To use microcontroller for various interfacing applications

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. Get various skills for interfacing peripherals with microcontroller.
5. Use of microcontroller with C language programming for developing various applications
6. Use of different motor interfacing with PIC microcontroller.

List of practical-

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. Arithmetic operations using MPLAB X software.
7. Delay Generation using register/timer.
8. Switch Interfacing: Single key interface result on LED
9. LED bank interfacing to PIC microcontroller
10. SSD Interfacing to PIC microcontroller
11. Alphanumeric LCD panel interfacing to PIC microcontroller
12. Interfacing of stepper motor with PIC microcontroller
13. Interfacing of DC motor.
14. Interfacing I2C based RTC (DS1307) to PIC Microcontroller
15. Temperature Sensor Interfacing.
16. Serial Communication with PIC
17. External interrupt input switch press, output at relay.

(Course under NEP 2020)
Course Code: 23ScEleU6201 Major Elective Paper 1 (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:

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

Course Objectives:

1. Understand Antenna and Wave Propagation.
2. To study basics of communication systems and telephone systems.
3. To study the digital communication system.
4. To study the telecommunication system.
5. To study basics of Internet of Things..
6. 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 advanced wireless communication systems
4. Understand concept of IoT , its characteristics and its application
5. Identify and address key challenges in IoT systems such as power consumption, security, scalability, and data storage.
6. Apply IoT concepts to real-world applications by evaluating relevant case studie

Course content-

UNIT 1- Antenna & Propagation [8 lectures]

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 lectures]

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,
Evolution of cellular telephone system- 2G, 3G, 4G, VoLTE&5G,Cellular systems - characteristics and applications

UNIT 3- Mobile Communication [5 lectures]

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 lectures]

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, McGraw Hill.
2. Principles of Electronic Communication System, Louis Frenzel, McGraw Hill Education.
3. Electronic Communication systems, George Kennedy, Bernard Davis, McGraw Hill companies.
4. Internet of Things : Principles and Paradigms, Rajkumar Buyya and Dastjerdi, MK publishers.
5. Internet of Things, Mayur Ramgir, Pearson publication.
6. Antenna Theory: Design & Analysis By Balanis, Wiley Eastern.

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU6202 Major Elective Paper 1 (Practical)

Course Name: Lab course on Advanced Communication & IoT

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

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

Prerequisite:

- Basic knowledge of electronic communication.
- Basic knowledge of computer networks and IoT.

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 study the working of RF communication systems and receivers.
4. To explore signal multiplexing and transmission techniques. (FDM and TDM)
5. To gain knowledge of antenna design and characterization.
6. To introduce wireless transceivers and IoT communication protocols.

7. To implement and interface IoT modules such as Raspberry Pi/ESP8266/NodeMCU.

Course Outcomes:

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

1. Analyze and demonstrate amplitude and frequency modulation techniques.
2. Implement and evaluate pulse modulation techniques.
3. Design and analyze signal multiplexing systems.
4. Study and evaluate characteristics of different antennas.
5. Explain the working and applications of superheterodyne receivers.
6. Demonstrate the use of wireless transceivers for communication.
7. Set up and program IoT devices using Raspberry Pi/ESP8266/NodeMCU.
8. Apply IoT concepts in real-world scenarios through case studies.

List of practical:-

1. DSB-SC generation using AD633
2. Study of Super heterodyne AM/ FM receiver
3. Study of FM Modulator
4. To study FSK modulator
5. To study BPSK modulator
6. To study pn sequence generator
7. Pulse modulation – PAM/PWM/PPM
8. Pulse code modulation
9. Study of TDM/ FDM 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/NodeMCU
13. Reading Data from a DHT11 Sensor (Temperature and Humidity)
14. Interfacing PIR Sensor for Motion Detection
15. Home Automation using Pi/ESP32/NodeMCU

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU6203 Major Elective Paper 1I (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:

- Basic knowledge of C Programming.
- 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.
5. Interfacing raspberry with python programming.
6. To study the interfacing techniques of Raspberry Pi using Python software

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. Understood Raspberry architecture.
4. Understand Raspberry Pi and interfacing.
5. Use Python for Electronic System development
6. Communicate raspberry with protocols

Course Contents:

Unit 1- Python Programming [6 Lectures[

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 Lectures[

Introduction: Raspberry Pi, Features of Raspberry Pi, History of Raspberry Pi, Full Architecture Overview, CPU 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 Lectures[

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 Lectures[

Interfacing: LED, SSD, Switches, Alphanumeric LCD, ADC, Servo Motor, Stepper Motor with Raspberry Pi, Built In Functions: PWM generation, I2C, SPI, Raspberry Pi Camera. Peripheral controls through Python Interfacing different sensors to Raspberry Pi – temperature, pressure, camera, microphone, etc. Real time signal processing on Raspberry Pi.

Text / Reference Books:

1. Programming the Raspberry Pi Getting Started with Python, Simon Monk, The McGrawHill Companies.
2. Python for Everybody, Dr. Charles R. Severance.
3. Learn RPI Programming with Python, Wolfram Donat.
4. Raspberry Pi User Guide by Eben Upton, Greath Halfacree John Wiley Publication
5. Raspberry Pi CookBook: Software & Hardware problems and Solutions by Simon Monk
6. Python Crash Course: A Hands-On, Project-Based Introduction to Programming Raspberry Pi Robotic Projects - Third Edition Machine Learning For Absolute Beginner

7. Learning Python with Raspberry Pi by Alex Bradbury, Ben Everard
8. Raspberry Pi for Python programmers Cookbook, Tim Cox, Packi Publishing limited

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU6204 Major Elective Paper 1I (Practical)

Course Lab course on Python programming for Raspberry Pi

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.
1. Utilize Python's built-in data structures such as lists, tuples, sets, and dictionaries effectively.
3. Setting up the development environment
4. Variables and data types
5. Operators and expressions

List of practical-

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 connected to the GPIO pins
9. Program the Raspberry Pi to detect room light from a photocell sensor connected to the GPIO pins.
10. Program the Raspberry Pi for Motion detection using Raspberry pi.
11. Program the Raspberry Pi for interfacing the Camera to grab the image.
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.

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU6301 Minor Paper section I (Theory)

Course Name: Electronics Technology in Agriculture

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

- Bacic knowledge of electronics
- Bacic knowledge of agriculture

Course Objectives: This course will enable the students to:

1. To introduce the fundamentals of sensors and actuators used in agriculture.
2. To develop knowledge of agricultural electronic systems and automation techniques.
3. To apply IoT concepts and communication technologies in agriculture.
4. To provide an understanding of precision agriculture technologies.
5. To analyze data for decision-making using analytics and machine learning techniques.
6. To implement practical applications of electronics in agricultural processes.

Course Outcomes:

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

1. Identify and explain the role of sensors and actuators in agricultural automation.
2. Design and implement agricultural electronic systems for automated control.
3. Apply IoT architecture to agricultural automation systems.
4. Analyze the use of GPS, GIS, and drones in precision agriculture.
5. Interpret and apply data analytics for better decision-making in agriculture.
6. Develop and evaluate electronic systems for practical agricultural applications.

Course Contents:

Unit 1: Introduction to Sensors and Actuators **[6 Lectures[**

Types of sensors used in agriculture, working principle of soil moisture sensors and temperature sensors, role of actuators in agricultural automation (valves, motors, etc.), working principle of solenoid valves and motors.

Unit 2: Agricultural Electronics Systems **[10 Lectures[**

Measurement Systems: Interfacing sensors and actuators with microcontrollers , Data acquisition techniques. Automation and Control in Agriculture: Automated irrigation systems: Components and design, Use of electronics in greenhouse automation (lighting,

temperature, humidity control), Internet of Things (IoT) in Agriculture: IoT architecture: Sensors, communication, and cloud computing in agriculture.

Unit 3: Electronics in Precision Agriculture [10 Lectures[

Precision Agriculture Systems: Overview of precision farming technologies, GPS, GIS, and drones in precision agriculture for crop monitoring and field mapping. Data Collection and Analysis: Collecting data from agricultural sensors, Use of data analytics and machine learning in decision-making for crop management.

Unit 4: Applications of Electronics in Agriculture [4 Lectures[Crop irrigation systems, Precision fertilization systems, Crop surveillance, Pesticide spraying.

Reference Books:

1. Precision Agriculture for Sustainability: Use of Smart Sensors, Actuators, and Decision Support by Narendra Khatri, Ajay Kumar Vyas , Celestine wendi , Prasenjit Chatterjee, CRC press, Feb 24.
2. **"Internet of Things and Analytics for Agriculture, Volume 1"** Editors: Prasant Kumar Pattnaik, Rajib Mall, and Souvik Pal

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU6301 Minor Paper section II (Practical)

Course Name: Lab course on Electronics Technology in agriculture

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 Agriculture

Course Objectives: This course will enable the students :

1. To introduce basic electronic components and circuits used in agricultural systems.
2. To design and implement sensor-based systems for agricultural applications.
3. To integrate sensors with microcontrollers for data acquisition and control.
4. To apply GPS and drone technologies in precision agriculture.
5. To implement data logging and real-time monitoring for precision agriculture.
6. To introduce sensor-based systems for livestock health monitoring.

Course Outcomes:

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

1. Identify and assemble basic electronic circuits used in agricultural systems.
2. Design and calibrate soil moisture and temperature sensor circuits.
3. Interface sensors with microcontrollers and display data effectively.
4. Develop and implement automated irrigation systems. n soil moisture levels.
5. Utilize GPS technology for farm mapping and crop monitoring.
6. Log and analyse data from agricultural sensors for decision-making. cs.

List of Practical:

1. Understanding and assembling basic electronic circuits using resistors, capacitors, diodes, and transistors.
2. Soil Moisture Measurement.
3. Study of Temperature sensor (PT100).
4. Design and testing of Instrumentation Amplifier for the Sensors (Temperature/ Humidity/Soil Moisture/Light sensor)
5. Motor speed Control for Agricultural Applications
6. Solar Power Management for Agriculture
7. Study of temperature and humidity sensor (DHT11).
8. Study of Light Sensors with respect to their characteristics (range, Sensitivity etc)
9. Design and testing of Automatic Control of Water Pump.
10. Study of actuators used in irrigation.
11. Automated Irrigation System.
12. Study of crop protection systems.
13. Study of rain detection system.
14. Design and Testing of a Data Logging systems (DAS) for specific Sensor application.
15. Study of leaf wetness detection system.

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Third Year of B.Sc.

(Course under NEP 2020)

Course Code: 23ScEleU6004 (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. Provide practical exposure to industry operations and technologies.
2. Develop technical and problem-solving skills in relevant domains.
3. Enhance communication, teamwork, and professional skills.
4. Familiarize students with industrial standards, safety protocols, and work ethics.
5. 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.