S.Y.B.Sc. Electronic Science Syllabus
Under Revised NEP 2020 (NEP -2024)

S.Y.B.Sc. (Electronic Science) Semester - III

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune - 5
Second Year of B.Sc.
(Under Revised NEP -2020 (NEP - 2024))
Course Code: 24ScEleU3101 Major Mandatory Major Paper 1 (Theory)
Course Name: Linear Integrated Circuits

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

Prerequisite:

1. Basic Knowledge of Electronic Circuit Elements and circuits.

Course Objectives: This course will enable the students to:

1. Impart with the ability to identify different types of amplifiers.
2. Learn the difference between discrete and integrated circuit amplifiers.
3. Understand the op-amp characteristics and applications.
4. Impart with the design of discrete and op-amp amplifiers.
5. Understand the types of Multivibrators.
6. Learn the design of various op-amp and IC 555 applications.

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

1. Recall and explain the general classification of amplifiers.
2. Analyze and perform AC and DC analysis of amplifiers.
3. Identify and compare different multistage amplifier types.
4. Explain the characteristics of Op-Amp.
5. Design and analyze basic Op-Amp circuits.
6. Design and analyze multivibrator circuits using IC-555.

Course Contents:

Unit 1: Single stage transistor amplifier (4 Lectures)

Introduction, General classification of amplifiers, ac and dc analysis of small signal amplifier, Single stage common emitter amplifier, Explanation of terms- gain, frequency response, bandwidth and gain bandwidth product.

Unit 2: Multistage transistor amplifiers (6 Lectures)

Introduction, Block diagram, Types of multistage amplifiers: Two stage R-C coupled, transformer coupled, direct coupled transistor amplifiers (Circuit diagram, Working, frequency response, advantages, disadvantages and applications of all types).

Unit 3: Op-Amp and its applications (14 Lectures)

Differential Amplifier, Block diagram, Equivalent circuit, Characteristics of an Ideal and Practical Op-Amp, Concept of feedback, negative and positive feedback, advantages of negative feedback, Open and closed loop configuration.

Inverting, non-inverting amplifier, Concept of differential amplifier, Summing and Difference Amplifier, Integrator, Differentiator, Comparator, Schmitt trigger, Active low pass and high pass filters.

Unit 4: Oscillators and Multivibrators (6 Lectures)

Oscillators: Concept, Barkhausen criterion for sustained oscillations, Phase Shift oscillator, Wien-bridge oscillator – (no derivation for each),

Multivibrators: Introduction to IC-555, Block diagram, Astable and Monostable multivibrator circuits. (Numerical Examples wherever applicable)

Reference Books:

1. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
2. Operational Amplifiers & Linear Integrated Circuits, James M. Fiore, Jaico Publishing House,
3. Electronic devices and applications, Salivahanan,Tata McGraw-Hill,1st Edition
4. Linear Integrated Circuits, D. Roy Choudhury, Jain, 4th Edition, New Age

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Second Year of B.Sc.

(Under Revised NEP -2020 (NEP - 2024))

Course Code: 24ScEleU3102 Major Mandatory Major Paper 2 (Theory)

Course Name: Digital Integrated Circuits

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

Prerequisite:

1. Basic Knowledge of Electronic Circuit Elements and circuits.

Course Objectives: This course will enable the students to:

1. Understand the K-map design of basic digital circuits.
2. Impart with asynchronous and synchronous counters.
3. Learn the understanding of digital IC interfacing to sensors and actuators.

4. Know the difference between the design of combinational circuit and sequential circuit.
5. Impart with the specialised ICs.
6. Learn the digital system design.

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

1. Design and analyze combinational circuits like code converters, adders and encoders.
2. Design synchronous counters using JK and T Flip-Flops.
3. Study and explain the features of ICs 7476 and 7490 for counters.
4. Construct DAC circuits using Binary-weighted and R-2R networks.
5. Study the features of DAC (IC-0808) and ADC (IC-0804).
6. Interface and program switches, keypads, and thumbwheel switches.

Syllabus

Unit 1: Combinational Circuits (12 lectures)

Introduction to K-map, Simplification of Boolean expression using K-map, Design of code converters: BCD to Seven segments, Binary to Gray and Gray to binary, Parallel adder, Priority encoder, Parity generator/Checker, Magnitude comparator. (Study of ICs -7447, 7483, 74148, 7485)

Unit 2: Counters (8 lectures)

Introduction to counters, types of counters, Asynchronous counter using JK Flip flops, Up / down counter, Modulo counters, Cascading of asynchronous counters, State table, State diagram, Excitation table and Transition table, Design of synchronous counter using JK Flip Flop and T Flip Flop, Design of counter for given sequence. (Study of ICs -7476, 7490)

Unit 3: Data Converters (6 lectures)

Basic concepts of digital to analog conversion (DAC) and Analog to digital conversion (ADC), specifications of ADC and DAC, Binary weighted and R - 2 R ladder networks, Analog to digital conversion: Flash, Successive approximation, Dual slope, Study of DAC (IC- 0808) & ADC (IC- 0804) (Features & functional description)

Unit 4: Peripheral Interfacing (4 lectures)

Interfacing of LED's, single and multi-digit 7 segment displays/ drivers, Switches, Keypad, Thumbwheel switches and Relays.

Reference Books:

1. Digital Principles and Applications, A.P. Malvino, D. P. Leach and Saha, 7th Ed., 2011, Tata McGraw Hill.
2. Modern Digital Electronics, R P Jain, McGraw Hill, 5th Edition
3. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)

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(Under Revised NEP -2020 (NEP - 2024))

Course Code: 23ScEleU3103 Major Mandatory (Practical 1)

Course Name: Lab course on 24SCEleU3101 & 3102

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

Prerequisite:

1. Fundamentals of small signal amplifiers.
2. Basics of op-amp and timer IC -555.
3. Fundamentals of digital Electronics.

Course Objectives: This course will enable the students to:

1. Learn the design different types of amplifiers.
2. Understand the experimental procedure to test the circuits.
3. Impart with the op-amp applications.
4. Learn the design combinational circuits.
5. Know the modulus of a counter and counter types.
6. Understand the interfacing of digital IC to I/O devices.

Course Outcome :

1. Design and analyze different types of amplifiers.
2. Study the operation of integrator and differentiator circuits.
3. Design Oscillators and Multivibrators.
4. Design a Butterworth low-pass filter and study its frequency response.
5. Design a 3-bit synchronous up/down counter using JK Flip-Flops.
6. Study and analyze the 4-bit R-2R ladder DAC and 3-bit flash ADC.

List of Experiments:

Experiments (Any 12 from 1 to 18) + Activity / Study tour report / Assignments / /Demonstration / Virtual lab

1. Design of an inverting and non-inverting amplifier using Op-amp (741) for given dc voltage gain.
2. Study of summing amplifier and difference amplifier.
3. Study of comparator and its application as zero-crossing detector.
4. Study of op-amp as an Integrator and Differentiator.
5. Design of a Wien bridge oscillator for a given frequency using an op-amp.
6. Design a Butterworth Low Pass active Filter (1^{st}order) & study its frequency Response
7. Design of single stage CE amplifier for a given voltage gain.
8. Design of a Monostable Multivibrator for given specification using IC 555 Timer.
10. Study of 4 bit binary parallel adder using IC 7483/ CD74HCT283.
11. Interfacing of seven segment display with IC 7447 / CD4511.
12. Design a 3 bit synchronous up/down counter using JK Flip-Flop IC 7476 / 4027.
13. Study of magnitude comparator IC 7485 / 4063.
14. Study of 4 bit R- 2R ladder DAC.

15. Study of 3 bit flash ADC.

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Second Year of B.Sc.
(Under Revised NEP -2020 (NEP - 2024))
Course Code: 24ScEleU3501 VSC (Practical)
Course Name: Lab course on Simulation of Analog and Digital circuits – I

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

Prerequisites:

1. General information of simulation software.
2. Basic knowledge of electronic components and circuits.

Course Objectives: This course will enable the students to:

1. Learn the basics of simulation software.
2. Design basic circuits.
3. Understand the simulation of Analog circuits.
4. Know the simulation technique of Digital circuits.
5. Simulate the digital IC's.
6. Learn the interfacing via simulation.

Course Outcomes: On completion of the course, student will be able to simulate:

1. Basic laws of Analog circuit design.
2. Half-wave and full-wave rectifiers.
3. Single-stage common-emitter amplifier.
4. Op-amp amplifiers, Oscillators and Multivibrators.
5. 4-bit synchronous counter using flip-flops.
6. Interfacing of various peripherals to digital IC's.

List of Experiments

Experiments (Any 12) + Activity / Study tour report / Assignments / Demonstration / Virtual lab

1. Study of Series and Parallel combination of Resistors.
2. Study of VDR and CDR rules.
3. Half wave and full wave rectifier circuit.
4. RC Low pass and RC high pass filter circuit.
5. Verification of Kirchhoff's laws.
6. Verification of Network Theorems,
7. Design and Simulate single stage CE amplifier.

8. Study of LCR series and parallel circuit.
9. Study of wave shaping circuits.
10. Design and Simulate the inverting and non-inverting amplifiers for a given voltage gain.
11. Design and Simulate an Astable Multivibrator for given specification using IC 555 Timer.
12. Simulate 4-bit synchronous counter using Flip-Flop IC 7476 / 4027.
13. Simulate seven segment display decoder for common cathode and common anode.
14. Simulate of two digit decimal counter using IC 7490/ 4518.
15. Simulate the interfacing of TWS and SSD.

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Second Year of B.Sc.
(Under Revised NEP -2020 (NEP - 2024))
Course Code: 24ScEleU3901 IKS Major Specific Theory
Course Name: Development of Electronic Communication in India

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

Prerequisite Courses:
1. Knowledge of basic electronic components.
2. Information of Electronic communication systems

Course Objectives: This course will enable the students to:
16. Know evolution electronic communication in India.
17. Study developments in the Analog telecommunication system in India.
18. Understand developments in the Digital telecommunication system in India.
19. Impart with Television communication in India.
20. Know the progress of Mobile communication in India.
21. Understand the developments in the Internet communication.

Course Outcomes: On completion of the course, student will be able to:
1. Analyze the impact of radio communication systems (AM, FM, digital).
2. Demonstrate knowledge of telegram and telephone systems in India.
3. Understand the principles of radio and mobile communication systems.
4. Describe the history and evolution of television in India.
5. Examine modern communication tools (email, social media and Internet telephony).
6. Understand advancements in mobile communication and emerging technologies (3G, 4G, 5G, IoT, AI).

Course Contents

Unit 1 Overview of Communication Systems in India **8 L**

Growth and development of telecommunication in India: Telegram, Telephone, Pager, Mobile phone, Smart phones, Radio- AM, FM, Pocket Radio (transistor radio), Digital Radio, Internet Radio, Television- Black and White TV, Color TV, Smart TV.

Unit 2 Evolution of Telecommunication Systems in India 8 L

Telegram system in India- Block diagram and working, Telephone system in India- Block diagram of telephone set, Telephone exchange, Wireless communication - Radio Communication, Mobile communication (Block diagram and working).

Unit 3 Evolution of Television in India 8 L

Television : Block diagram and working, History of Television in India- Door-Darshan, Cable and Satellite Television, Black and White television, Color television, Smart TV, LED, LCD, Plasma, OLED.

Unit 4 Today's Communication Systems in India 6 L

Electronic mail, Social networking sites- facebook, linkedin, instagram, myspace, twitter(X), Online chat, video chatting, Internet telephony- voice , video, blogs, Internet- 3G, 4G, 5G, (Definition), IoT, Artificial Intelligence.

Text/ Reference Books:

1. Telecommunications: Indian 50 Years of Independence: 1947-97 Status, Growth and Development Hardcover – by A. V. Gokak, BR Publishing Corporation.
2. Electronic Communication systems (4th edition), George Kennedy, Bernard Davis, McGraw Hill companies (2009).
3. Electronic Communication By Dennis Roddy & John Coolean, Pearson Education.

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Second Year of B.Sc.

(Under Revised NEP -2020 (NEP - 2024))

Course Code: 24ScEleU3301 Minor (Theory)

Course Name: Instrumentation and Electronic Communication

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

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

Prerequisite Courses:

1. Knowledge of basic electronic circuits.

Course Objectives: This course will enable the students to:

1. Know types of Instrumentation systems.
2. Study lab instruments.
3. Understand sensors and actuators.
4. Impart with electronic communication systems.
5. Know the errors in the communication systems.
6. Understand the wireless communication systems.

Course Outcome :

1. Define key components and functions of instrumentation systems.
2. Explain working principles and applications of commonly used instruments.
3. Describe components and concepts of communication systems.
4. Understand modulation techniques and the impact of noise in communication systems.
5. Describe principles and applications of fiber optic communication.
6. Analyze wireless transmission systems (Bluetooth, Wi-Fi, Zigbee) and IoT.

Unit 1: Introduction to Instrumentation Systems (6 L)

Measurement systems and its types, Block diagram of an instrumentation system, Performance Characteristics, Errors, Concepts of Sensors and Transducers, Classification of sensors and actuators, Wheatstone bridge and Signal Conditioning circuits.

Unit 2: Study of Instruments (10 L)

PMMC, Ammeter, Voltmeter, Multimeter, RPS, Wattmeter, Signal Generator, Function generator, Oscilloscope (CRO), DSO (Block/ functional diagram, working principle, specifications and applications)

Unit 3: Communication Systems Overview (6 L)

Block diagram of Electronic Communication System, Types of Communication systems, Concept of Bandwidth, Channel Bandwidth, data rate and baud rate, Modulation and its types, Noise in Communication Systems and its types.

Unit 4: Advanced Communication Systems (8 L)

Introduction to fiber optics and its applications in communication, Basics of wireless transmission: Bluetooth, Wi-Fi, and Zigbee, IoT and its role in communication systems, Introduction to satellite communication systems, Applications and limitations of satellite communication.

Reference Books:

1. Electronic Instrumentation by H. S. kalsi, Fourth Edition McGraw Hill 2019.
2. Electrical and Electronic Measurements and Instrumentation by A K Sawhney, Dhanpat Rai and Co.
3. Principles of Electronic Communication Systems by Louis E. Frenzel, McGraw Hill, 2007.
4. Electronic Communication Systems by George Kennedy, McGraw Hill, 2011.

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Second Year of B.Sc.
(Under Revised NEP -2020 (NEP - 2024))
Course Code: 24ScEleU3302 Minor (Practical)
Course Name: Lab Course on Instrumentation and Electronic Communication

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

Prerequisite Courses:

1. Theoretical information of Electronic Instrumentation and Communication systems.

Course Objectives: This course will enable the students to:

1. Know types of Instrumentation systems by experiments.
2. Study and make use of lab instruments.
3. Understand sensors and actuators via their practical usage.
4. Impart with electronic communication systems.
5. Know the errors in the communication systems.
6. Understand the wireless communication systems.

Course Outcomes: On completion of the course, student will be able to:

1. Demonstrate use and working of a multirange voltmeter.
2. Investigate the operation and characteristics of signal/function generators.
3. Examine and evaluate different types of power supplies.
4. Perform measurements using ammeters, voltmeters, and wattmeters.
5. Utilize an LCR meter to measure L, C, and R.
6. Use a load cell to measure force or weight.

List of Experiments

Experiments (Any 12) + Activity / Study tour report / Assignments / Demonstration / Virtual lab

1. Study of Multirange voltmeter
2. Study of signal/ Function generator
3. Study of CRO/ DSO
4. Study of different types of power supply
5. Use of Ammeter, Voltmeter and Wattmeter
6. Use of LCR meter
7. Amplitude Modulator
8. FM modulator
9. Study of voice recorder module and its application
10. Measurement of load using load cell
11. Study of simplex communication system(FM receiver)
12. Study of 433MHz communication link
13. Study of Optical Fibre Communication system
14. Bluetooth communication via HC 05 module

15. Study of IoT communication system

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Second Year of B.Sc.
(Under Revised NEP -2020 (NEP - 2024))
Course Code: 24ScEleU3401 GE/OE (Practical)
Course Name: Lab Course on Electronic Fundamentals

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

Prerequisite Courses:

1. General information of electronic components.
2. Characteristics and identification of electronic components.

Course Objectives: This course will enable the students to:

1. Learn identification of electronic circuit components.
2. Impart with diode and transistor testing.
3. Understand the circuit construction on tag and bread board.
4. Learn various switches and devices.
5. Understand the operation of transformer.
6. Know one way/two way light bulb wiring connections.

Course Outcomes: On completion of the course, student will be able to:

1. Identify and specify fuses, MCBs, relays, batteries, cables, connectors, speakers, and microphones, resistors, capacitors, diodes, transistors, photodiodes, thermistors, heat sinks, and PCBs.
2. Use a multimeter to measure voltages, resistance, test diodes, and transistors.
3. Use breadboards and tag-boards for assembling circuits.
4. Implement a light-sensitive switching circuit using an LDR.
5. Identify and understand different types of motors and their applications.
6. Analyze and test the performance of batteries in electronic circuits.

List of Experiments

Experiments (Any 12) + Activity / Study tour report / Assignments / Demonstration / Virtual lab

1. Identification, Specification of Electronic components-
   Fuse, MCB, Relays, Batteries, Cables, Connectors, Speaker, Mic
2. Identification, Specification of Electronic components-
   Resistors, Capacitors, Inductors, Diode, Transistor, Relay,
   Photodiode, Thermistor, Heat sinks, PCBs
3. Measurement of resistor using color code and Multimeter
4. Use of Multimeter- Measurement of DC and AC voltage, Diode and
   Transistor testing

5. Study of step down transformer
6. Study of sine and square wave signals
7. Study of Breadboard and Tag-board
8. LED Circuit: Intensity Variation
9. Light sensitive switching: Application of LDR
10. Study of Switches
11. Touch Sensor circuit
12. One-way light bulb
13. Wiring of light circuit using Two-way switches(Staircase wiring)
14. Study of different types of Motors
15. Study and testing of Batteries

S.Y.B.Sc. (Electronic Science) Semester - IV

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Second Year of B.Sc.
(Under Revised NEP -2020 (NEP - 2024))
Course Code: 24ScEleU4101 Major Mandatory Major Paper 1 (Theory)
Course Name: Fundamentals of Microcontroller

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

Prerequisites:
1. Basic knowledge of digital electronics.
2. General information of logic gates, flip flop, registers and counters.

Course Objectives: This course will enable the students to:
1. Understand basic concept of microprocessor.
2. Differentiate microprocessor and microcontroller.
3. Study architecture of microcontroller.
4. Know an assembly language instruction set.
5. Impart with the ALP programming.
6. Learn bit and byte level I/O programming.

Course Outcomes: On completion of the course, student will be able to:
1. Identify and describe microprocessor evolution, architecture, memory organization, and I/O interfacing.
2. Understand the fundamentals of microcontrollers and describe the features, architecture, and programming model of the 8051 microcontroller.
3. Explain microcontroller systems and the working of the 8051 family, including memory maps and I/O interfaces.
4. Classify and describe the 8051 instruction set, including data transfer, arithmetic, logical, Boolean, and branching instructions.
5. Design and implement algorithms and flowcharts for assembly language programs on the 8051 microcontroller.
6. Write and debug assembly programs for applications like code conversion and I/O port programming.

Detailed Syllabus:

Unit 1: Overview of Microprocessors (4 Lectures)

Microprocessors: Introduction and Evolution, Microprocessor based systems: Block diagram(Microcomputer), Input/Output Devices, Data storage (RAM and ROM), Memory organization & addressing, Memory Map and Memory Interfacing.

Unit 2: Fundamentals of Microcontrollers: (8 Lectures)

Introduction to Microcontrollers, 8051 microcontroller: features, overview of 8051 family, block diagram , architecture, programming model, RAM and ROM memory map, I/O ports, Timers, Stack pointer and stack memory, Interrupts and serial communication.

Unit 3: Instruction set of 8051 **(** 6 Lectures**)**

Addressing Modes: immediate addressing, register addressing, direct addressing, register indirect addressing and indexed addressing, Different Groups of Instructions, Data Transfer Instructions, Arithmetic Instructions, Logical Instructions, Boolean Instructions, Program branching instructions.

Unit 4: Assembly Language Programming: **(**12 Lectures**)**

Algorithms, Flow Charts, Assembly Language instruction Format, Assembler Directives (ORG, EQU, DB, DW, DS, END) Arithmetic Programs: 8-bit addition, subtraction, multiplication and division, One's and two's complement of 16-bit numbers, Code Conversion Programs**:** Hex to ASCII and BCD to binary conversion, Delay generation,I/O port program: LED blinking, one digit counter.

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Second Year of B.Sc.

(Under Revised NEP -2020 (NEP - 2024))

Course Code: 24ScEleU4102 Major Mandatory Major Paper 2 (Theory)

Course Name: Interfacing to 8051

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

Prerequisites:

1. Basic knowledge of digital electronic circuit design.

Course Objectives: This course will enable the students to:

1. Understand basic concept of microprocessor.
2. Differentiate microprocessor and microcontroller.
3. Study architecture of microcontroller.
4. Know an assembly language instruction set.

5. Impart with the ALP programming.
6. Learn bit and byte level I/O programming.

Course Outcomes: On completion of the course, student will be able to:

1. Demonstrate the process of delay calculation and use timers in different modes for port programming.
2. Implement simple serial communication programs using USART to transmit and receive messages.
3. Interface switches, thumbwheel switches, LEDs, and seven-segment displays with the 8051 microcontroller.
4. Interface IR, PIR sensors,16x2 LCD, stepper motors, servo motors, and DC motors with the 8051 microcontroller.
5. Interface DACs and ADCs with the 8051 microcontroller for signal conversion.
6. Implement PWM control for DC motor speed using the 8051 microcontroller.

Detailed Syllabus:

Unit 1: 8051 Timer programming: **(**8 Lectures**)**
Basic structure, Control registers, Modes of timers, Delay calculation steps, programming of timers in different modes, use of timer delay for the port programming.

Unit 2: Serial Communication protocols: **(**6 Lectures**)**
USART: Basics of Serial Data Communication, RS-232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly. Use of serial port to transmit and to receive a message, Introduction to I^2C, SPI and CAN.

Unit 3: 8051 Microcontroller interfacing I: **(**8 Lectures)
Interfacing of Switch, Thumb wheel switch, Transistor, LED, Seven Segment Display, IR sensor and PIR sensor.

Unit4:8051 Microcontroller interfacing II: **(** 8 Lectures)
Interfacing of 16x2 LCD display, Stepper motor, Servo motor, DAC, ADC, DC motor speed control using PWM.

Reference Books:

1. Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.
2. The 8051 Microcontroller and Embedded Systems using Assembly and C, M.A.Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd edition, 2007, Pearson Education India.
3. 8051 Microcontroller: Architecture, Programming and Applications, Kenneth J. Ayala, 2nd edition, Delmar Cengage Learning.
4. 8051 Microcontroller Architecture, Programming and Application, M. Mahalakshmi, 1st Edition, University Science Press.
5. 8051 Microcontroller: Internals, Instructions, Programming and Interfacing, Subrata Ghoshal, 2nd Edition, Pearson.

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Second Year of B.Sc.

(Under Revised NEP -2020 (NEP - 2024))

Course Code: 23ScEleU4103 Major Mandatory (Practical 1)

Course Name: Lab Course on 24ScEleU4101 & 24ScEleU4102

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

Prerequisites:

1. Knowledge of assembly language instructions.
2. Information of architecture of microcontroller.

Course Objectives: This course will enable the students to:

1. Develop the ability to write the assembly language codes.
2. Know the importance of CPU registers.
3. Understand the use of specific instructions for a particular task.
4. Learn Motor interfacing.
5. Impart with ADC and DAC interfacing.
6. Learn LCD interfacing.

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

1. Make use of data transfer, Arithmetic, Logical, Bit and branching instructions.
2. Read any one ports data and write it to another one.
3. Write the delay subroutines using timers.
4. Interface LED banks and generate different patterns on them.
5. Interface ADC and DAC.
6. Make use of motors.

List of Experiments:

Experiments (Any 12 from 1 to 15) + Activity / Study tour report / Assignments / Demonstration / Virtual lab(Equivalent to 3 practicals)

1. Addition and subtraction of 8-bit unsigned numbers stored in RAM.
2. Multiplication and division of two 8 bit unsigned numbers.
3. Packed BCD to unpacked BCD and vice versa.
4. 2- digit Hex to decimal conversion.
5. Single digit hex to ASCII and ASCII to hex code conversion.
6. Block data transfer.
7. Program to find the largest/smallest number.

8. Program to flash LEDs connected to a port.
9. Program to implement 8- bit binary counter on LED's connected to a port.
10. Program to read data from TWS connected to anyone I/O port and display it on the seven segment LED display.
11. Interfacing of four digit multiplex display.
12. Interface stepper motor with 8051 and write a program to rotate in clockwise or counter clockwise direction.
13. Program to rotate the DC motor, change the speed of the DC motor.
14. DAC0808 interfacing.
15. 16x2 LCD interfacing.

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Second Year of B.Sc.

(Under Revised NEP -2020 (NEP - 2024))

Course Code: 24ScEleU4501 VSC (Practical)

Course Name: Lab course on Simulation of Analog and Digital circuits – II

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

Prerequisites:

1. General information of simulation software.
2. Basic knowledge of electronic components and circuits.

Course Objectives: This course will enable the students to:

1. Learn simulation software.
2. Design basic op-amp and IC- 555 circuits.
3. Simulate op-amp and IC- 555 circuits.
4. Design basic combinational and sequential circuits.
5. Learn the Interfacing to 8051.
6. Simulate external peripheral interfacing to 8051.

Course Outcomes: On completion of the course, student will be able to:

1. Design and simulate op-amp amplifiers.
2. Simulate op-amp oscillators and IC- 555 multivibrators.
3. Test magnitude comparator IC (7485/4063).
4. Read data from the sensors and write data to the actuators.
5. Control a DC motor and change speed with PWM.
6. Interface a 16x2 LCD and display data.

List of Experiments

Experiments (Any 12) + Activity / Study tour report / Assignments / Demonstration / Virtual lab(Equivalent to 3 practicals)

1. Study of summing amplifier and difference amplifier.
2. Study of inverting Schmitt trigger circuit.
3. Study of wave shaping circuits.
4. Design of a Wien bridge oscillator for a given frequency using an op-amp.
5. Design a Butterworth Low Pass and high pass active Filter (1^{st}order) & study its frequency Response
6. Design of Astable and Monostable Multivibrator for given specification using IC 555 Timer.
7. Study of magnitude comparator IC 7485 / 4063.
8. Study of 4 bit R- 2R ladder DAC
9. Study of 3 bit flash ADC

Interfacing to 8051

10. Program to flash LEDs connected to a port and implementation of 8- bit binary counter.
11. Program to read data from TWS connected to anyone I/O port and display it on the seven segment LED display.
12. Interfacing of four digit multiplex display.
13. Interface stepper motor with 8051 and write a program to rotate in clockwise or counter clockwise direction.
14. Program to rotate the DC motor, change the speed of the DC motor.
15. 16x2 LCD interfacing

Progressive Education Society's

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

Shivajinagar, Pune - 5

Second Year of B.Sc.

(Under Revised NEP -2020 (NEP - 2024))

Course Code: 24ScEleU4301 Minor Mandatory (Theory)

Course Name: Sensors, Actuators and Data converters

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

Prerequisites:

1. Basic knowledge of Electronic Circuit Elements and Circuits.

Course Objectives: This course will enable the students to:

1. Learn the performance parameters of sensors.
2. Understand operating principles, constructions and specifications of sensors.
3. Classify different types of sensors and actuators.
4. Learn commonly used sensors and actuators.
5. Study analog to digital data converters.
6. Learn DAC's.

Course Outcomes: On completion of the course, the students will be able to:

1. Explain sensor performance parameters.
2. Describe commonly used sensors and their applications.
3. Define actuators and explain their types and working principles.
4. Describe the concepts of DAC and ADC, and different techniques.
5. Analyze Binary-weighted and R-2R DAC techniques.
6. Study the DAC (0808) and ADC (0804) ICs.

Course Contents:

Unit 1: Fundamentals of Sensors: (6 Lectures)

Need of sensors, Definition, Types of sensors, Operating Principle, Specification and performance parameters: Accuracy, Resolution, Threshold, impedance, Sensitivity, Hysteresis, Linearity, Range, Reliability, Selectivity.

Unit 2: Commonly used Sensors (8 Lectures)

Principle, Construction, Working, specifications of sensors and applications: temperature, displacement, Force, Pressure, position/ Motion, level, flow, Humidity, pH sensors, load cells, smoke sensor, sound, and light.

Unit 3: Actuators (8 Lectures)

Actuators: principle, construction and specifications, Pressure controller, flow control actuators (Valves), Solid State Relay, Electromagnetic devices: Relay, Solenoid,
Electromechanical: Servo motor, DC motor, AC motor and Stepper motor.

Unit 4: Data Converters (8 Lectures)

Basic concepts of digital to analog conversion (DAC) and Analog to digital conversion (ADC), specifications of ADC and DAC, Binary weighted and R - 2 R ladder networks, Analog to digital conversion: Comparative (Flash), Successive approximation, dual slope ADC techniques, Study of DAC (IC 0808) & ADC (IC 0804) (Features & functional description)

Reference books:

1. Modern Digital Electronics, R P Jain, McGraw Hill, 5th Edition
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. Electronic Instrumentation, H. S. Kalsi., McGraw Hill, 2nd Edition
4. Instrumentation Devices and systems, Rangan, Mani and Sharma, McGraw Hill, 2nd Edition.

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous),
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Second Year of B.Sc.
(Under Revised NEP -2020 (NEP - 2024))
Course Code: 23ScEleU4301 Minor Mandatory (Practical)
Course Name: Sensors, Actuators and Data converters Lab

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

Prerequisites:

1. Basic knowledge of Sensors, Actuators and Data converters.

Course Objectives: This course will enable the students to:

1. Learn the performance parameters of sensors.
2. Understand operating principles, constructions and specifications of sensors.
3. Classify different types of sensors and actuators.
4. Learn commonly used sensors and actuators.
5. Study Analog to Digital data converters.
6. Learn DAC's.

Course Outcomes: On completion of the course, the students will be able to:

1. Analyze the characteristic curve of Thermistor.
2. Demonstrate and analyze the use of proximity sensors in detection systems.
3. Study and apply LVDT for displacement measurement.
4. Analyze speed control methods for a DC motor.
5. Demonstrate stepper motor control using a driver circuit.
6. Use ADC IC 0804 and DAC IC 0808.

Experiments: Sensors, Actuators and Data Converter:

Experiments (Any 12 from 1 to 15) + Activity / Study tour report / Assignments / Demonstration / Virtual lab

1. Study of Thermistor characteristics.
2. Study of IR Sensors.
3. Study of an application of LDR.
4. Study of Humidity sensor.
5. Study of Proximity sensor.
6. Displacement Measurement using LVDT.
7. Study of DC motor speed control.
8. Study of stepper motor driver circuit.
9. Study of solenoid flow control circuit.
10. Study of temperature sensor LM 35.

11. Study of R-2R ladder DAC.
12. Study of Binary weighted DAC.
13. Study of Parallel/Flash ADC.
14. Study of ADC IC 0804.
15. Study of DAC IC 0808.

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Second Year of B.Sc.

(Under Revised NEP -2020 (NEP - 2024))

Course Code: 24ScEleU4401 GE/OE (Practical)

Course Name: Lab Course on Electronic Instruments

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

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

Prerequisite Courses:

1. Basic information regarding semiconductor physics.
2. General information of electronic components.

Course Objectives: This course will enable the students to:

1. Learn identification of electronic circuit components, specifications and Characteristics.
2. Study various lab meters.
3. Understand the use of Continuity, TDS testers.
4. Impart with the use of lab tools.
5. Study speed of motors shaft using Tachometer.
6. Learn about the LUX meter.

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

1. Identify and describe different types of ammeters.
2. Demonstrate the working principle of a Dimmerstat, Rheostats and Resistance boxes.
3. Make use of continuity tester, LCR meter, Tachometer, TDS meter and air quality measurement meters.
4. Measure capacitance using a digital multimeter.
5. Describe the operation of a wattmeter and measure power.
6. Test lab circuit elements.

List of Experiments

Experiments (Any 12) + Activity / Study tour report / Assignments / Demonstration / Virtual lab

1. Study of different types of Ammeters
2. Study of different types of Voltmeters
3. Study of Dimmerstat
4. Study of Rheostat/Resistance box
5. Study of continuity tester

6. Study of lab tools
7. Study of LCR meter
8. Study of different types of potentiometers
9. Measurement of Capacitance using Multimeter
10. Study of Tachometer
11. Study of LUX meter
12. Sound level Measurement meter
13. Study of signal strength analyser
14. Study of Wattmeter
15. Study of CO/ CO_2 concentration meter
16. Study of TDS meter

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Second Year of B.Sc.
(Under Revised NEP -2020 (NEP - 2024))
Course Code: 23ScEleU4601 SEC (Practical)
Course Name: Lab course on Electronic systems

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

Prerequisites:
1. Basic knowledge of Analog and Digital circuits.
2. Information of circuit design.

Course Objectives: This course will enable the students to:
1. Learn need of electronic System Design.
2. Understand the Electronic system design.
3. Learn construction of circuit as per the design.
4. Impart with the testing of Electronic circuits.
5. Know the use of lab instruments for testing.

Course Outcomes: At the end of the course the student should be able to:
1. Build and test the automatic LED emergency light system.
2. Develop and analyze an infrared motion detection system.
3. Construct and demonstrate a four-digit object counter system.
4. Design and explain the working of a public address system.
5. Implement DC motor speed control using PWM and analyze the effects.
6. Build and test of a water level indicator system, ON-OFF controller, bank token generator system and program a line-following robot.

List of Experiments: (Based on Discrete circuits / Arduino)

Experiments (Any 12 from 1 to 15) + Activity / Study tour report / Assignments / Demonstration / Virtual lab

1. Automatic LED emergency light
2. Infrared motion detection
3. Four digit object counter
4. Public Address system
5. DC motor speed variation using PWM
6. Water level indicator
7. ON- OFF controller
8. Digital thermometer
9. Electronic weighing machine
10. Waveform generator
11. Fire alarm
12. Bank token generator
13. Line following robot
14. Street light control
15. Traffic Signal control

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Second Year of B.Sc.

(Under Revised NEP-2020(NEP -2024))

Course Code: 24ScEleU4701 Minor (Practical)

Course Name: Lab Course on C Programming

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

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

Prerequisites:

1. Basic knowledge of computers.

Course Objectives: This course will enable the students to:

1. Learn variables declaration and Initialization.
2. Understand the conditional statements.
3. Learn Problems with Mathematical Concepts.
4. Impart with program writing.
5. Know the use of logical operators.
6. Understand C- programing for various tasks.

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

1. Understand Basic Arithmetic Operations.
2. Master of Control Structures and Loops.
3. Solve Problems with Mathematical Concepts.
4. Learn Data Structures and Algorithms.
5. Know Logical and Bitwise Operations.
6. Deal with Functions and Input/Output.

List of Experiments:

Experiments (Any 12 from 1 to 15) + Activity / Study tour report / Assignments / Demonstration / Virtual lab

1. Write a program that takes two integers as input and outputs their sum, difference, product, quotient, and remainder.
2. Write a program to input two numbers, then swap their values and display the swapped numbers.
3. Write a program that takes the radius of a circle as input and calculates its area and perimeter.
4. Write a program that takes a number as input and checks if it is a prime.
5. Write a program that takes an integer as input and calculates its factorial (n!) using a loop or recursion.
6. Write a program that takes an integer (n) as input and prints the Fibonacci sequence up to the nth term.
7. Write a program to check if a number is an Armstrong number (i.e., the sum of its digits raised to the power of the number of digits is equal to the number itself).
8. Write a program that takes an integer and computes the sum of its digits.
9. Write a program that takes an integer as input and checks whether it is even or odd using modulo operator (%).
10. Write a program to check if a given year is a leap year or not.
11. Write a program that takes a character as input and displays its ASCII value.
12. Write a program that takes an integer N as input and calculates the sum of natural numbers from 1 to N.
13. Write a program to input three numbers and determine the largest/smallest number among them.
14. Write a program to demonstrate the use of logical operators. Check conditions like if both x > 5 and y < 10, or if x == 2 or y == 5.
15. Write a program to demonstrate the use of bitwise operators like AND (&), OR (|), XOR(^), NOT (~), left shift (<<), and right shift (>>).

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