CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM III)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : III
Course Type : Major Mandatory (Theory)
Course Code : ELE-201-MJM
Course Title : Linear Integrated Circuits
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives

1. To study basic principles of amplifiers and oscillators.
2. To understand the working of various analog circuits.
3. To develop analog circuit design skills.
4. To apply the knowledge of analog circuits in different applications.
5. To understand the basic concepts of operational amplifier and its various applications.
6. To understand the basics of Op-Amp and its practical applications
7. To know about Oscillator and its Application.

Course Outcomes

After completing the course student will able to

1. Understand basics of amplifiers, op-amp and oscillators.
2. Explain the concepts of oscillators, filters.
3. Design the circuits of different filters and oscillators.
4. Design and analyze the various non-linear application of op-amp
5. Design and analyze filter circuits using op-amp
6. Design and analyze oscillators circuits using op-amp.
7. Understand and Improve the Practical Skills and knowledge about Oscillators.

Topics and Learning Points

UNIT 1: Operational Amplifier (12)

Differential Amplifier, Block diagram of an operational amplifier, Op-Amp characteristics(Ideal and practical) input offset voltage, output offset voltage,input offset current, input bias current, common mode rejection ratio, slew rate, supply voltage rejection ratio.Open loop frequency response. Gain bandwidth product. Concept of virtual Ground, offset null, Inverting and non-inverting amplifiers.Adder and subtractors,Voltage follower, Integrator, Differentiator.

UNIT 2: Applications of Op-amp (08)

Comparators, Schmitt Trigger,Voltage to current converter, Current to voltage converter, Bridge amplifier, Instrumentation amplifiers with three op-amp, Active and passive filters,

First order low pass, high pass, band pass and band reject filters.

UNIT 3: Oscillators **(10)**

Concept of negative and positive feedback and Barkhausen criterion. Types of feedback circuits: current shunt, current series, voltage shunt and voltage series, comparison and applications. Effect of negative feedback: on gain ,Bandwidth, input and output impedance, stability of an amplifier.

Positive feedback: RC oscillators- Wien bridge , Phase Shift. LC oscillators- Hartley, Colpitts,

Crystal oscillator, Design of oscillators for given feedback factor anfrequency of oscillations.

Reference Books:

1. Operational amplifiers and linear Integrated Circuits by Gaykawad R. PHP
2. Operational amplifier by Clayton G.B. ELBS
3. Electronic devices and circuits by Millman, HalkiasMcGrawHill
4. Electronic devices and circuits by Boylestead PHP
5. Principles of Electronics by Meheta V.K. S.Chand and Company
6. Basic Electronic Devices and Circuits: R.Y. Borse 1st Edition 2012 AdhayanPublishers and distributors, New Delhi.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	-	3	1	3	2	-	-	3	1	2	2	-	-
CO2	3	2	-	1	-	2	2	-	3	-	1	-	-
CO3	-	-	2	-	1	-	-	-	-	2		-	-
CO4	3	-	-	2	-	-	1	2	2	-		-	
CO5	-	1		-	3	3	2	2	3	-	-		-
CO6	-	-	-	-	-	-	-	-	-	2	-	-	-
CO7	1	3		-	3		-	-	1	-	-	-	-

Mapping Justification:-

PO1:-Comprehensive Knowledge and Understanding:

CO2:-How to analyze and design amplifier circuits. Similarly, comprehension of operational amplifiers (op-amps) includes knowledge of their ideal behavior, differentiating between inverting and non-inverting configurations, and applications in signal processing and control systems.

CO4:-Designing and analyzing non-linear op-amp circuits require knowledge of various non-linear devices and techniques such as diodes, transistors, and feedback configurations. Graduates must understand concepts like clipping, limiting, and distortion in op-amp circuits and how to mitigate or utilize them in practical applications.

CO7:-Designing op-amp characteristics also involves considering practical aspects such as power supply rejection ratio (PSRR), noise, and thermal stability to ensure reliable and robust circuit operation across different operating conditions.

PO2:-Practical, Professional, and Procedural Knowledge:

CO1:-The design process follows specific procedures, including problem definition, circuit analysis, component selection, simulation, and validation.

CO2:-Explaining the concepts of oscillators and filters requires graduates to have a deep understanding of the underlying principles, theories, and operational characteristics of these circuit elements.
CO5:-Designing and analyzing filter circuits using op-amps provides students with hands-on experience in circuit construction, testing, and validation.
CO7:- Students understanding the procedures involved in oscillator design, implementation, and optimization. This procedural knowledge encompasses aspects such as selecting appropriate components, configuring oscillator circuits, and analyzing performance characteristics.

PO3:-Entrepreneurial Mindset and Knowledge:
CO1**:-** Students we designing circuits for filters and oscillators, students gain procedural knowledge in circuit design, learning how to systematically approach design problems.
CO3:- Students will understand the basic Oscillators require knowledge of feedback theory, frequency stability, and circuit topologies to generate periodic waveforms reliably.

PO4:-Specialized Skills and Competencies:
CO1:- This practical experience enhances their understanding of filter behavior, fosters problem-solving skills, and prepares them for real-world engineering tasks where practical knowledge and skills are essential for success.
CO2**:-** Students will able to Facilitating the design and analysis of various filter and oscillator circuits.
CO4:-Students get the practical skills enhancement and knowledge improvement in oscillators.

PO5:-Capacity for Application, Problem-Solving, and Analytical Reasoning
CO1:-Students we are enables to comprehend oscillator and filter concepts.
CO3:-Students are exploring non-linear applications of op-amps.
CO5:- Students designing and analyzing filter circuits and oscillators using op-amps, students further develop their capacity for application and problem-solving.
CO7:-Students get Practical skills improvement and knowledge enhancement in oscillators and understanding and application capabilities, problem-solving.
PO6:-Communication Skills and Collaboration:
CO1**:-** understanding the basics of amplifiers, op-amps, and oscillators about students with foundational knowledge essential for effective communication.
CO5:- Analyzing various non-linear applications of op-amps as well as designing and analyzing filter circuits .

PO7:- Research-related Skills:
CO2:- students to engage in research activities related to electrical engineering. By explaining oscillator and filter concepts.
CO4:- Designing and analyzing filter circuits and oscillator using op-amps provide students with practical research experience in applying theoretical knowledge to real-world problems.
CO5:- Improving practical skills and knowledge in oscillators enhances students' ability to conduct experiments and gather data for research purposes.

PO8:- Learning How to Learn Skills:
CO1:- Students are the foundation for students to develop learning how to learn skills.
CO4:- Designing and analyzing filter circuits and oscillators using op-amps provide students with opportunities.
CO5:- students' ability to learn through hands-on experimentation and application.

PO9:-Digital and Technological Skills:-

CO1:- fundamental for developing digital and technological skills among students in the field of electrical engineering.

CO2:- We are explaining oscillator and filter concepts and designing various filter and oscillator circuits.

CO4:- students gain practical experience with analog electronic components, which are essential for understanding digital systems.

CO5:- Op-amps provide students with a strong foundation in signal processing and control, which are crucial aspects of digital and technological skills.

CO7:- Improving practical skills and knowledge in oscillators further enhances students' ability to apply analog and digital concepts.

PO10:- Multicultural Competence, Inclusive Spirit, and Empathy:

PO1:- Students the basics of amplifiers, op-amps, and oscillators and explaining the concepts of oscillators and filters provide a foundational understanding of electronic circuits.

PO2:- Designing and analyzing filter circuits using op-amps involves problem-solving and critical thinking skills, as well as hands-on experimentation.

P05:- the process of designing filter circuits, students may encounter diverse perspectives and approaches, fostering multicultural competence and empathy as they appreciate different ways of approaching and solving engineering challenges.

PO11:- Value Inculcation and Environmental Awareness

CO1:- Understanding the basics of amplifiers, op-amps, oscillators (CO1), and explaining the concepts of oscillators and filters.

CO2:- the optimization of electronic circuits, including amplifiers, op-amps, oscillators, and filters, often involves considerations such as power efficiency, minimizing energy consumption etc.

Class : S. Y. B.Sc.
Semester : III
Course Type : Major Mandatory (Theory)
Course Code : ELE-202-MJM
Course Title : Digital Circuit Design
No. of Credits : 02
No. of Teaching Hours : 30

Learning Objectives

1. To utilize k-maps in the design of combinational circuits.
2. To understand the design principles of sequential circuits.
3. To study the design and working of various data converters
4. To configure the digital circuits in system interfacing.
5. To be familiar with different logic families.
6. To Understand the basic software tools for the design and implementation of digital circuits and system.
7. To understand the Analyze the operation of counters .

Course Outcomes

Student should able to:

1. Design combinational circuits using logic gates.
2. Design various counters and determining outputs.
3. Work with different types of counters and design its applications.
4. Understand digital system interfacing and logic families.
5. Understand the fundamental concepts and techniques used in digital electronics.
6. To prepare students to perform the analysis and design of various digital electronic circuits.
7. To facilitate students in designing a logic circuit.

Topics and Learning Points

UNIT -1: Combinational Circuits: (10)

Revision of K maps, Design of code converters: BCD to Seven segments, Binary to Gray, Gray to binary, Half adder, Full adder, Half subtractor and full subtractor, One bit and Two bit Magnitude comparator.

UNIT -2: Sequential Circuits: (10)

State table, State diagram, excitation table and transition table, Design of counters using state machines: Synchronous, asynchronous, modulo-N and up-down counter.

UNIT -3: Data Converters : (10)

Digital to analog converters : Weighted resistive DAC, R-2R ladder DAC, DAC accuracy and resolution.

Analog to Digital converters: Simultaneous ADC, Counter type ADC, Tracking ADC, Successive approximation ADC, Single slope ADC, Dual slope ADC, ADC accuracy and resolution.

Reference Books:

1. Digital Fundamentals by Floyd Thomas (Pearson)
2. Digital Circuit design by Morris Mano (PHP)
3. Digital Principles and applications by Malvino Leach (TMH)
4. Modern digital Electronics by R.P.Jain (TMH)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	-	3	1	3	2	-	-	3	1	2	2	3	3
CO2	3	2	-	1	-	2	2	-	-	-	1	-	-
CO3	-	-	2	-	1	-	-	-	-	2	1	2	2
CO4	3	-	-	2	-	-	1	2	2	-	-	-	
CO5	-	1		-	-	3	2	2	-	-	-	-	2
CO6	-	-	-	-	-	-	-	-	-	2	3	1	-
CO7	1	3	-	-	-	-	-	-	-	-	-	-	-

Mapping Justification :-

PO1: Comprehensive Knowledge and Understanding:
CO2:- To provide students with comprehensive knowledge and understanding in digital electronics.
C04: focuses on designing various counters and determining their outputs.
CO7:- understanding digital system interfacing and logic families. This ensures that students acquire a holistic understanding of digital circuits, enabling them to design and analyze complex systems effectively.

PO2:- Practical, Professional, and Procedural Knowledge:
CO1:- Students we are designing combinational circuits using logic gates creating various counters and determining outputs.
CO2:- Students are understanding fundamental concepts and techniques in digital electronics.
CO5:- Students will able to facilitating students in designing logic circuits.
CO7:- This comprehensive approach equips students with hands-on skills and theoretical understanding essential for professional application in digital electronics.

PO3:- Entrepreneurial Mindset and Knowledge:
CO1:- Involves designing combinational circuits using logic gates, which encourages creative problem-solving and innovation.
CO3:- Includes designing various counters and determining outputs, which enhances students' ability to develop novel solutions and applications.

PO4:- Specialized Skills and Competencies
CO1:-Students designing combinational circuits using logic gates, which lays the groundwork for understanding digital circuitry.

CO2:- Designing various counters and determining outputs, honing students' ability to work with sequential logic.
CO4:- students' understanding of digital system interfacing and logic families, providing them with specialized knowledge essential for advanced circuit design and integration.

PO5:- Capacity for Application, Problem-Solving, and Analytical Reasoning

CO2:- Designing various counters and determining outputs, which requires problem-solving skills to ensure correct functionality and efficiency.
CO3:- students develop the capacity to apply their knowledge effectively, solve complex problems, and employ analytical reasoning in the design and application of digital circuits.

PO6:- Communication Skills and Collaboration

CO2:- To enhance communication skills and collaboration in the context of digital electronics.
CO5:- Involves designing various counters and determining outputs, which may require students to effectively communicate their design ideas.

PO7:- Research-related Skills

CO2:- Designing various counters and determining outputs, which requires students to conduct research to understand different counter designs and their applications in various Circuits.
CO4:- understanding digital system interfacing and logic families, also contributes to research-related skills by necessitating students to explore literature and resources to grasp advanced concepts and their applications.
CO5:- understanding the fundamental concepts and techniques in digital electronics, fostering the ability to critically analyze existing research and integrate new findings into digital circuit design.

PO8:- Learning How to Learn Skills:

CO1:- Students weare designing combinational circuits using logic gates, requiring students to engage in active learning processes to understand the principles behind circuit design and operation.
CO4:- Designing combinational circuits using logic gates, reinforcing the importance of iterative learning and practice in mastering this skill.
CO5:-Students to understanding the fundamental concepts and techniques used in digital electronics.

PO9:- Digital and Technological Skills

CO1:- designing combinational circuits using logic gates And practical skills in electronic circuit design and implementation
CO4:- Designing combinational circuits using logic gates, emphasizing the importance of mastering this foundational skill in digital electronics.

PO10:- Multicultural Competence, Inclusive Spirit, and Empathy

CO1:-Involves designing combinational circuits using logic gates, which can provide a platform for diverse perspectives to be expressed and integrated into circuit design projects.
CO3:- It requires working with different types of counters and designing their applications, which may involve digital circuits.
CO6:- Students will prepares students to analyze and design various digital electronic circuits, which may require understanding and empathizing with different circuits.

PO11:- Value Inculcation and Environmental Awareness

CO1:- To designing combinational circuits using logic gates, which can encourage students to consider efficiency and optimization in circuit design,

CO2:- Designing various counters and determining outputs, which can foster a mindset of resource optimization and sustainability as students work to maximize efficiency and minimize waste in circuit design.

CO3:- Students able to working with different types of counters and designing their applications, which may involve considering environmentally friendly applications or solutions in circuit design.

CO6:- students to analyze and design various digital electronic circuits, which may include design techniques for digital circuits and considering the environmental impact of electronic devices.

PO12:- Autonomy, Responsibility, and Accountability:

CO1:- students to take ownership of their design decisions and take responsibility for the functionality and performance of their circuits.and get develop skill in electronics .

CO3:-Students to perform the analysis and design of various digital electronic circuits,

CO6:- Students to understanding the various gets improve skills.

PO13: Community Engagement and Service

CO1:-Students can collaborate with local organizations to design circuits for educational purposes, such as creating interactive learning tools .

CO3:- Requires working with different types of counters and designing their applications, which can also be utilized in community service projects. For instance, students can design counting circuits for community events.

CO5:-To understanding the fundamental concepts and techniques used in digital electronics, which is essential for students to effectively contribute to community service projects.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM III)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : III

Course Type : Major Mandatory (Theory)
Course Code : ELE-203-MJM
Course Title : Introduction to C programming
No. of Credits : 02
No. of Teaching Hours : 30
Course Objectives:

1. To express algorithms and draw flowcharts in a language independent manner.
2. To teach how to write modular, efficient and readable C programs.
3. To understand different data types and operators.
4. To study decision making statements and control structures in C.
5. To design programs using if else , nested if and loops.
6. To impart knowledge in creating and using Arrays of the C data types.
7. To design C programs based on arrays while solving problems.

Course Outcomes:

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

CO1. Describe the fundamentals of C programming Language.
CO 2. Write, compile and debug programs in C language.
CO 3. Use different data types in a computer programs.
CO 4. Design programs involving decision structures, loops.
CO 5. Apply appropriate Control structures to solve problems.
CO 6. Describe the concept of Arrays.
CO 7. Use and implement data structures like arrays to obtain solutions.

Topics and Learning Points

Unit 1: Fundamentals in C [10 L]

Overview of C: History and importance of C, Art of Programming through Algorithms and Flowcharts, Basic structure of C program, executing a C program.
Constants, Variable and Data Types: Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Assigning Values to Variables, Defining Symbolic Constants. Reading a Character, Writing a Character, Formatted Input, Formatted Output.
Operators and Expressions: Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Expressions, Operator Precedence and Associativity.

Unit 2: Control Structures [10 L]

Decision Making and Branching: Introduction, Decision Making with if Statement, Simple if statement, the if-else statement, Nesting of if-else statements, else if ladder, switch statement, goto statement, Program examples.
Decision Making and Looping: Introduction, The while Statement, The do while statement, The for statement, nested for loop, Jump statements in loops. Program examples.

Unit 3: Introduction to Arrays [10 L]

Arrays: One-dimensional Arrays, Declaration of One-dimensional Arrays, Initialization of One-dimensional Arrays, Read and display 1D array. Example programs.
Two-dimensional Arrays, Declaration of Two-dimensional Arrays, Initialization of Two-dimensional Arrays, Example programs-Matrix addition, subtraction, multiplication, Transpose of a matrix.

Reference Books:

1. J. JayasriThe 'C Language Trainer with C Graphics and C++ WILEY
2. Byron. S. Gottfried Schaum's Outline of Programming with C TMH
3. E Balaguruswamy Programming in ANSI C The McGraw Hill publication
4. Stephens Cochan Programming in C Prentice hall of India Ltd
5. V. Rajaraman Computer Programming in C Prentice hall of India Ltd.
6. MadhusudanMothe C for Beginner

Course Outcome	Program Outcome												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PO13
CO1	3	3	-	1	2	1	-	-	-	-	-	-	-
CO2	3	3	1	-	2	1	-	-	-	-	-	-	-
CO3	3	3	-	2	2	-	-	-	-	-	-	2	-
CO4	3	3	-	-	2	2	2	-	1	1	-	2	-
CO5	3	3	1	2	2	2	2	1	1	1	-	2	-
CO6	3	3	-	1	2	2	-	-	-	-	-	-	-
CO7	3	3	1	2	2	-	2	1	-	-	-	2	-

Justification

PO1: Comprehensive Knowledge and Understanding
CO1:Students get a deep understanding of the key concepts and principles of the C programming language.
CO2: Students will be able to write, compile, and debug programs in the C programming language confidently.
CO3: Students will have a comprehensive understanding of various data types available in the C programming language and will be able to use them effectively in their programs.

CO4: Students will be able to design and implement programs that involve decision structures (such as if-else statements) and loops (such as for and while loops) to achieve desired outcomes.
CO5: Students will be able to apply appropriate control structures in their programs to solve complex problems efficiently.
CO6: Students will have a clear understanding of the concept of arrays in C programming and their usage in storing and manipulating multiple values of the same data type.
CO7: Students will be able to effectively use and implement data structures like arrays to solve real-world problems and obtain optimal solutions.

PO2: Practical, Professional, and Procedural Knowledge
CO1: Students will have practical and professional knowledge of the C programming language and its fundamentals.
CO2: Students will be proficient in writing, compiling, and debugging programs in the C programming language.
CO3: Students will have procedural knowledge of using different data types in the C programming language and will be able to use them effectively in their programs.
CO4: Students will be able to design programs using decision structures and loops to achieve expected outcomes and will be proficient in executing them.
CO5: Students will be able to apply appropriate control structures to solve complex problems in a professional and procedural manner.
CO6: Students will have practical knowledge of the concept of arrays in the C programming language and their application in solving real-world problems.
CO7: Students will be proficient in implementing data structures like arrays to obtain solutions to complex programming problems in a professional and procedural manner.

PO3: Entrepreneurial Mindset and Knowledge
CO2: Students will be able to effectively utilize the C programming language in developing innovative solutions and will be capable of debugging and optimizing code to create value in the marketplace.
CO5: Students will be able to apply appropriate control structures in their programs to solve complex problems effectively and innovatively.
CO7: Students will be capable of using and implementing data structures like arrays to develop innovative solutions to complex real-world problems in a competitive marketplace.

PO4: Specialized Skills and Competencies
CO1: Students will have specialized skills and competencies in the fundamentals of the C programming language, enabling them to effectively communicate and collaborate with professionals in the field.
CO3: Students will demonstrate specialized skills and competencies by effectively utilizing different data types in their computer programs, showcasing their ability to leverage the full potential of the C programming language.
CO5: Students will exhibit specialized skills and competencies by effectively applying appropriate control structures to solve various problems, highlighting their ability to optimize code and enhance program efficiency.
CO6: Students will showcase their specialized skills and competencies by demonstrating a comprehensive understanding of the concept of arrays in the C programming language, emphasizing their ability to utilize this data structure effectively.
CO7: Students will develop specialized skills and competencies in using and implementing data structures like arrays to obtain solutions for complex programming challenges, demonstrating their ability to produce efficient and effective code.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO1: Students will be able to apply their understanding of the fundamentals of C programming language to solve real-world problems, showcasing their capacity for practical application and analytical reasoning.
CO2: Students will demonstrate their capacity for practical application and problem-solving by effectively writing, compiling, and debugging programs in the C programming language, showcasing their ability to analyze and solve programming challenges.
CO3: Students will exhibit their capacity for application and problem-solving by using different data types effectively in computer programs, demonstrating their ability to select and utilize appropriate data types for specific scenarios.
CO4: Students will showcase their capacity for problem-solving and analytical reasoning by designing programs that incorporate decision structures and loops, demonstrating their ability to implement logical solutions to complex programming problems.
CO5: Students will demonstrate their capacity for problem-solving by effectively applying appropriate control structures to solve various programming problems, showcasing their ability to analyze problems and devise efficient solutions.
CO6: Students will exhibit their capacity for application and analytical reasoning by describing the concept of arrays in the C programming language, showcasing their ability to understand and explain fundamental data structures.
CO7: Students will apply their capacity for application, problem-solving, and analytical reasoning by effectively using and implementing data structures like arrays to obtain solutions for complex programming challenges, showcasing their ability to analyze problems and devise efficient solutions using appropriate data structures.

PO6: Communication Skills and Collaboration
CO1: Students will demonstrate effective communication skills by describing the fundamentals of the C programming language, facilitating collaboration and understanding with peers and professionals in the field.
CO2: Students will showcase their communication skills and ability to collaborate by effectively writing, compiling, and debugging programs in the C programming language, enabling efficient communication and teamwork in programming projects.
CO4: Students will demonstrate their ability to communicate and collaborate by designing programs that incorporate decision structures and loops, facilitating effective communication and collaboration with peers and stakeholders in the programming process.
CO5: Students will showcase their communication skills and ability to collaborate by effectively applying appropriate control structures to solve programming problems, promoting effective communication and collaboration in solving complex programming challenges.
CO6: Students will exhibit their communication skills by describing the concept of arrays in the C programming language, facilitating clear communication and collaboration with peers and stakeholders in programming projects involving arrays.

PO7: Research-related Skills
CO4: The various decision structures and loops and their usage in C programming language to design effective programs.
CO5: Various control structures and their usage in C programming language to solve problems effectively.

CO7: Various data structures and their usage in C programming language to efficiently implement them in programs to obtain solutions.

PO8: Learning How to Learn Skills
CO5: Learner will acquire the skills to learn and apply various control structures in the C programming language to effectively solve problems, enhancing their ability to learn and adapt to new programming challenges.
CO7: Learner will gain the knowledge and skills required to learn and implement data structures such as arrays through self-directed learning, enabling them to leverage these structures efficiently to obtain solutions.

PO9: Digital and Technological Skills
CO4: Learners to design programs with decision structures (like if-else statements) and loops (like for and while loops). It helps them create more robust and efficient software solutions.
CO5: Learners to apply suitable control structures (like loops and conditional statements) to tackle problems in computer programming. It enhances their problem-solving capabilities in real-world

PO10: Community Engagement and Service
CO4: Enables developers to create more efficient and effective software solutions that can have a positive impact on communities.
CO5: Allows developers to create software solutions that can help solve real-world problems faced by communities.

PO12: Autonomy, Responsibility, and Accountability
CO3: Demonstrates an understanding of the importance of selecting appropriate data representation and taking responsibility for accurate and efficient data management.
CO4: Designing efficient and logical program flow and being accountable for the outcomes produced.
CO5: Reflects autonomy in problem-solving, taking responsibility for developing efficient and effective solutions, and being accountable for the results.
CO7: Obtain solutions demonstrates autonomy in leveraging appropriate data structures, taking responsibility for efficient algorithm design, and being accountable for delivering effective solutions.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM III)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.

Semester : III
Course Type : Major Mandatory (Practical)
Course Code : ELE-204-MJM
Course Title : Electronics Practical III
No. of Credits : 02
No. of Teaching Hours : 60

Course Objectives:

1. To make use different basic concepts for building different applications
2. To understand design procedures of different electronic circuit as per requirement
3. To build experimental setup and test the circuits.
4. To develop skills of analyzing test results of given experiments.
5. To Design and test combinational circuits.
6. This course gives students deep knowledge in digital communication systems
7. To Understand Basic knowledge of Digital electronics.

Course Outcomes

After achieving the above objectives, students should be able to

1. Design any operational amp. Based application circuit and test it.
2. Design any instrumentation based application circuit and test it.
3. To Understand basic parameters in electronics.
4. Students we Know operation of different instruments used in the laboratory.
5. Students we Connect circuit and do required performance analysis.
6. The course will help in design and analysis of the digital circuit and system.
7. At the end of the course, the students will be able to.

List of Practicals

❖ The practical course consists of **15** experiments.

List of Practicals (Analog Electronics): Any Four

1. Wein bridge oscillator/Phase shift oscillator
2. Design and build two stage amplifier using transistor
3. Design and build V to I converter using Opamp
4. Design of Low Pass Filter and High Pass Filter using OPAMP IC-741
5. Push pull amplifier
6. Effect of negative feedback on amplifier parameters.

List of Practicals (Digital Electronics): Any Four

1. Code conversion using logic gates – binary to gray , gray to binary
2. DAC using R-2R ladder network
3. ADC using IC 0808/IC 7109/IC 741/IC 324
4. Sequence generator for stepper motor
5. 3 bit synchronous counter using flip flops
6. Decimal to BCD encoder using logic gates

List of Practicals (C programming): Any Three

1. Basic programs using different operators.

2. To swap value of two variables.
3. To find the maximum number out of the three numbers.
4. To check given number is Armstrong number or not.
5. To reverse digits of the given number.
6. To calculate average of all elements of an array.
7. To add two square matrices.

Activity: Any Two (Any one Activity equivalent to two experiments)

1. PCB Making
2. Internet browsing
3. Industrial /field Visit
4. Hands on training workshop
5. Do it Yourself Open ended Project

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	-	3	1	3	2	-	-	3	1	2	2	-	3
CO2	3	2	-	1	-	2	2	-	-	-	1	-	-
CO3	-	-	2	-	1	-	-	-	-	2	1	-	2
CO4	3	-	-	2	-	-	1	2	2	-		-	
CO5	-	1		-	3	3	2	2	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	2	3	-	
CO7	1	3	-	-	3	-	-	-	-	-	-	-	1

Mapping Justification:-

PO1:- **Comprehensive Knowledge and Understanding**:

CO2:- Students acquire practical skills in designing and testing instrumentation-based circuits. Through this, students get understanding of the theoretical concepts and practical applications of instrumentation, thereby enhancing their overall knowledge and understanding.

CO4:- Understanding the operation of various instruments in a laboratory setting is fundamental to gaining comprehensive knowledge in the field of instrumentation.

CO7: It enables students to demonstrate their ability to apply theoretical knowledge to practical scenarios by designing and testing instrumentation-based circuits.

PO2:- **Practical, Professional, and Procedural Knowledge**:

CO1:- Students practical knowledge and skills in designing operational amplifier-based circuits.

CO2:- Design and testing process, students acquire professional-level competence in applying instrumentation principles to real-world applications.

CO5:- Connecting circuits and performing performance analysis are essential procedural skills. And students develop the ability to effectively connect circuits and analyze their performance, which is crucial for professional practice in the field of instrumentation.

CO7:- Students to demonstrate their ability to apply practical knowledge and skills in designing and testing operational amplifier-based circuits

PO3:- **Entrepreneurial Mindset and Knowledge**:

CO1:- Designing and testing operational amplifier-based circuits, students not only gain technical skills but also learn to innovate and create solutions to real-world problems.

CO3:- Understanding basic parameters in electronics is essential for developing an as it provides students with foundational knowledge about electronic components and systems.

PO4:-Specialized Skills and Competencies:

CO1:- To design and testing process, students acquire specific competencies relevant to their field of study.

CO2:- Design and testing of such circuits equips students with specialized competencies required for working with instrumentation systems.

CO4:- Understanding the operation of various instruments used in laboratory settings is a fundamental specialized skill.

PO5:-Capacity for Application, Problem-Solving, and Analytical Reasoning:

CO1:- Students to apply their theoretical knowledge of operational amplifiers and circuit design principles to real-world applications. By designing and testing circuits.

CO3:- Understanding basic parameters in electronics is crucial for applying theoretical knowledge to practical Skill.

CO5:-Students get performing performance analysis requires students to apply their knowledge of circuit theory and measurement techniques.

CO7:- Developing students' capacity for application, problem-solving, and analytical reasoning throughout the course.

PO6:-Communication Skills and Collaboration:

CO2:-Students will get the communication skills through group projects or lab work. In many cases, students may need to work in teams to design and test instrumentation-based circuits.

CO5:-In the process of designing circuits, students encounter various challenges that require them to analyze problems and develop the own skill in electronics projects.

PO7:-Research-related Skills:

CO2:- When designing and testing instrumentation-based circuits, students may need to conduct research to explore new techniques, components.

CO4:- students develop their capacity for application, problem-solving, and analytical reasoning in the field of electronics.

CO5:- To Understanding the operation of various instruments used in the various circuits.

PO8:-Learning How to Learn Skills:

CO1:- students are encouraged to engage in research, seek out resources, and apply critical thinking to solve problems.

CO4:- Understanding the operation of various instruments in the laboratory requires students to engage in active learning processes

CO5:- The design and testing process, students encounter challenges that require them to analyze problems, develop solutions, and evaluate the performance of their designs.

PO9:-Digital and Technological Skills:

CO1:- Electronic circuit design, digital components and technologies are often integrated with analog circuits.

CO4:- Understanding the operation of various instruments in the laboratory, including digital instruments.

PO10:-Multicultural Competence, Inclusive Spirit, and Empathy:

CO2:- Collaborating on projects such as designing and testing instrumentation-based circuits encourages interaction and mutual respect among students, fostering an inclusive atmosphere where different viewpoints are valued.

CO3:- Understanding basic parameters in electronics is essential for effective communication and collaboration, specially in multicultural settings.

CO6:- When working on digital circuit and system design, students may encounter diverse requirements and constraints that require them to consider the needs this circuits .

PO11:-Value Inculcation and Environmental Awareness:

CO1:- The importance of designing operational amplifier-based circuits with optimal performance and minimal waste, students learn to value efficiency and environmental consciousness in their practical.

CO2:- students to design instrumentation-based circuits that are energy-efficient and environmentally sustainable.

CO3:- Understanding basic parameters in electronics, such as power consumption, voltage levels, and signal etc.

CO6:- Students develop a deeper understanding of the importance of environmental awareness in electronic Project practices.

PO13: Community Engagement and Service:

CO1:- Students to independently design operational amplifier-based circuits and test them. By taking ownership of their design projects, students learn to make decisions, solve problems, and manage tasks autonomously.

CO3:- Understanding basic parameters in electronics is essential for students to take responsibility for their designs and ensure their effectiveness

CO7:- Students develop autonomy in problem-solving and decision-making, take responsibility for their design choices, and are held accountable for the performance of their digital circuits and systems.

CBCS Syllabus as per NEP 2020 for F. Y. B.Sc. Electronics

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.

Semester : III
Course Type : Minor (Theory)
Course Code : ELE -211-MN
Course Title : Linear and Digital Integrated Circuits
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives

1. To study Operational Amplifier working, characteristics and its applications

2. To design simple linear and non-linear circuits using Op-Amp.

3.To Study filter.

4.To study Oscillator circuit.

5. To study Boolean laws

6. To Study combinational circuit.

7.To study digital IC

Course Outcomes

After completing the course student will able to

CO1. Design and analyze Op-Amp based circuits.

CO2:Concept of filter.

CO3:Uses of oscillator

CO4: Design of combinational circuit.

CO5: Use of Boolean laws

CO6:Concept of Digital IC

CO7: Practical application of digital IC

Topics and Learning Points

Unit-1: Linear Integrated Circuit and Its Application. **[15L]**

Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Open and closed loop configuration, Frequency Response. CMRR. Slew Rate and concept of Virtual Ground. Inverting and non inverting amplifiers, Summing and Difference Amplifier, Differentiator, Integrator, Wein bridge oscillator, Comparator and Zero- crossing detector, and Active low pass and high pass Butterworth filter (1st and second order only).

Unit 2:-Boolean Algebra & Combinational Circuit **[15L]**

Rules and laws of Boolean algebra, De Morgan's theorem, simplification of Logic equations using Boolean algebra rules. Half adder and full adder, 4-Bit Universal adder/ Subtractor, applications of Ex-OR gates as parity checker and generator, study of Multiplexer (4:1) and Demultiplexer (1:4), Encoders - Decimal/BCD to binary, 3X4 matrix keyboard encoder,

priority encoder, Decoder- BCD to seven segment decoder, IC 74138 and IC 7447, Digital comparator.

Reference Books:

1.OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
2. Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011, Oxford University Press.
3. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011, Tata McGraw
4. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.

Course Outcome	Program Outcome												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	-	-	-	-	3	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	1	-	-	3	-
CO3	-	-	-	1	-	-	2	-	-	-	-	-	1
CO4	-	-	2	-	-	-	-	2	-	-	3	-	-
CO5	-	-	-	-	2	-	1	-	-	-	-	-	-
CO6	-	-	-	-	-	1	-	-	-	-	-	-	-
CO7	1	-	-	-	-	-	-	-	-	2	-	3	

PO1: Comprehensive Knowledge and Understanding
CO1: Understanding how to design and analyze Op-Amp based circuits requires a comprehensive understanding of electronic circuits, including their principles, components, and applications.

PO2: Practical, Professional, and Procedural Knowledge
CO2: Understanding the concept of filters involves practical knowledge of filter design techniques, hands-on experience with filter implementation, and familiarity with professional standards for filter specification and performance evaluation. This outcome contributes to practical, professional, and procedural knowledge by enabling students to apply filter concepts in real-world engineering scenarios

PO3: **Entrepreneurial Mindset and Knowledge**:

CO4; Designing combinational circuits requires identifying market demands for digital logic functions, creatively designing circuits to implement those functions efficiently, and innovatively optimizing circuit designs for cost-effectiveness and performance. This outcome fosters an entrepreneurial mindset by encouraging students to apply their combinational circuit design skills in innovative ways to create value in the marketplace

PO4: **Specialized Skills and Competencies**:

CO3: Proficiency in oscillator applications offers specialized skills in timing and signal generation, essential for fields like communications, control systems, and embedded systems design.

PO5: **Capacity for Application, Problem-Solving, and Analytical Reasoning**:

CO5: Identifying and applying oscillator uses require problem-solving skills in selecting appropriate oscillators for specific applications, analytical reasoning in oscillator performance evaluation, and the capacity to apply theoretical knowledge to practical oscillator design challenges.

PO6: **Communication Skills and Collaboration**:.

CO1: Effective communication is crucial when explaining the design rationale, analysis results, and circuit performance to team members, clients, or stakeholders. Collaboration may involve working with others to brainstorm design ideas, gather requirements, or present findings.
CO6: Communicating the use of Boolean laws involves explaining logic simplification techniques, truth table manipulations, and circuit optimization strategies to team members or stakeholders. Collaboration may occur when discussing Boolean expressions, sharing optimization ideas, or coordinating with others during logic design.

PO7: **Research-related Skills**:

CO3: Exploring the uses of oscillators requires investigating diverse oscillator applications, circuit configurations, and frequency stability considerations through literature review and technical research. This research informs the selection, design, and optimization of oscillators for specific applications.
CO5: Exploring the use of Boolean laws entails investigating different Boolean algebra theorems, laws, and manipulation techniques through literature review and scholarly research. This research deepens understanding and proficiency in applying Boolean logic to digital circuit design and optimization
PO8: **Learning How to Learn Skills**:

CO4: Designing combinational circuits involves exploring various logic functions, circuit architectures, and optimization techniques. To excel in this area, students must engage in continuous learning, seeking out new design methodologies, and staying updated on emerging technologies. This process enhances their ability to learn independently and adapt to evolving design requirements.

PO9: **Digital and Technological Skills**

CO2: Filters are commonly used in digital signal processing applications. Understanding filter concepts requires knowledge of digital filtering techniques, including finite impulse

response (FIR) and infinite impulse response (IIR) filters, enhancing students' digital and technological skills.

PO10: **Multicultural Competence, Inclusive Spirit, and Empathy**:

CO7: Practical applications of digital ICs may involve addressing diverse user needs and preferences across different cultural contexts. By considering the cultural implications of digital IC usage and design decisions, students can cultivate a more inclusive spirit and empathetic approach to engineering practice.

PO11: **Value Inculcation and Environmental Awareness**:.

CO4: Promoting value inculcation and environmental awareness in combinational circuit design involves considering factors such as power consumption, material usage, and end-of-life disposal. By integrating sustainability principles into circuit design methodologies, students can contribute to environmentally responsible engineering solutions.

PO12: **Autonomy, Responsibility, and Accountability**:

CO2: Understanding the concept of filters involves students taking responsibility for selecting appropriate filter types, designing filter circuits, and ensuring their effectiveness in meeting design specifications. This requires autonomy in decision-making and accountability for the performance of the filter designs.
CO7: Practically applying digital ICs requires students to independently plan, execute, and evaluate their integration into electronic systems. They must take responsibility for ensuring proper interfacing, troubleshooting any issues that arise, and ensuring the overall functionality and reliability of the IC-based solutions.
PO13: **Community Engagement and Service**:

CO3: Understanding the uses of oscillators can extend beyond traditional engineering applications and into community engagement and service. For instance, students could explore how oscillators are utilized in medical devices for community healthcare initiatives.

CBCS Syllabus as per NEP 2020 for F. Y. B.Sc. Electronics

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : III
Course Type : Minor (Practical)

Course Code : ELE -212-MN
Course Title : Lab Course -1
No. of Credits : 02
No. of Teaching Hours : 60

Course Objectives

1.To Study basics of multimeter, DSO, Signal generator.
2.To Study Opamp Applications.
3.To Design Various Opamp Circuit.
4.To Study Boolean laws.
5.To Design and Study various combinational circuit.
6.To study software simulation
7.To study concept of Filter.

Course Outcomes

After completing the course student will able to

CO1. Basics of Multimeter and DSO.
CO2. Practical Application of Opamp.
CO3: Concept of filter.
CO4: Designing of combinational circuit.
C05: Concept of Demorgans theorem.
CO6: Designing of Opamp Circuit.
CO7:Decoder circuit.

Topics and Learning Points

(Any 15 Practicals)

Preparatory Experiments (Compulsory)

1. Study of components
2. Study of Multimeter.
3.Study of CRO/DSO
4.Study of Signal Generator.
5. Study of Breadboard

Analog Based Practical (Any Four)

1. Inverting Amplifier using Opamp
2. Non inverting Amplifier using Opamp.
3. To investigate the use of an op-amp as an Integrator.
4. To investigate the use of an op-amp as an differentiator.
5. Wien bridge oscillator for given frequency using an op-amp.
6. Study of Low Pass Filter.
7. Study of High Pass Filter.

Digital Based Practical (Any Four)

1. Study of Demorgan's Theorem.
2. Study of Half Adder.
3. Study of Full Adder.
4. Study Half Subtractor
5. Study of 4:1 Mux.

6. Study of Demux 1:4.
7. BCD to Seven Segment.
8. Study of Comparator.

Any One Activity (Equivalent to two Practical)

1.Software simulation.

2. Internet Browsing

Course Outcome	Program Outcome												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	2	-	-	-	-	3	-	-	-	-	-	2	-
CO2	-	2	-	-	-	-	-	-	1	-	-	-	-
CO3	-	-	3	2	-	-	2	2	-	-	-	-	2
CO4	-	-	1	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	2	-	1	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-
CO7	2	-	-	-	-	-	-	-	-	2	-	3	

Justification

PO1:Comprehensive Knowledge and Understanding:

CO1: introduces students to the fundamental tools used in electronics testing and measurement, essential for acquiring comprehensive knowledge.

CO7: involves designing decoder circuits, which are fundamental in digital systems and contribute to a deeper understanding of logic and circuit design principles.

PO2:Practical, Professional, and Procedural Knowledge.

CO2: involve the practical application and design of operational amplifier circuits, which are commonly used in various professional settings, enhancing students' practical knowledge and skills in this area.

PO3:Entrepreneurial Mindset and Knowledge:

CO3: covers the concept of filters, which is crucial in entrepreneurial endeavors involving signal processing, communications, and innovative product development.

CO4: involves designing combinational circuits, essential for understanding the logic behind various electronic systems, fostering an entrepreneurial mindset by encouraging creative problem-solving.

PO4: Specialized Skills and Competencies:

CO3: involves understanding filters, which are specialized components used extensively in signal processing and communication systems, developing competencies in this area.

PO5:Capacity for Application, Problem-Solving, and Analytical Reasoning:

CO5: DeMorgan's theorem, enhances students' analytical reasoning skills by providing a method to simplify and analyze complex digital circuits.

PO6:Communication Skills and Collaboration:.

CO1: provides a foundation in communication skills as students learn to interpret and communicate measurement results obtained using Multimeters and Digital Storage Oscilloscopes (DSOs).

PO7:Research-related Skills:

CO3: introduces the concept of filters, which involves researching different types of filters, their characteristics, and applications in various fields such as signal processing, communications, and instrumentation.

CO5: DeMorgan's theorem, enhances research skills by encouraging students to explore its applications in circuit simplification and optimization through literature review and experimentation.

PO8:Learning How to Learn Skills:

CO3: introduces the concept of filters, prompting students to learn about different types of filters, their properties, and applications, thereby enhancing their ability to learn and apply new concepts in signal processing and communications.

PO9:Digital and Technological Skills

CO2: involve the practical application and design of operational amplifier circuits, which are crucial components in various digital systems and technologies, enhancing students' digital and technological skills.

PO10:Multicultural Competence, Inclusive Spirit, and Empathy:

CO7: involves designing decoder circuits, which are essential components in communication systems used globally, promoting multicultural competence by understanding and appreciating diverse communication standards and protocols.

PO11:Value Inculcation and Environmental Awareness:

CO4: involves designing combinational circuits, where students may explore low-power design techniques and optimization strategies, aligning with values of sustainability and environmental consciousness.

PO12:Autonomy, Responsibility, and Accountability:

CO1: provides students with foundational knowledge and skills in using measurement tools like Multimeter and Digital Storage Oscilloscope (DSO), fostering autonomy in acquiring data and analyzing signals independently. provides students with foundational knowledge and skills in using measurement tools like Multimeter and Digital Storage Oscilloscope (DSO), fostering autonomy in acquiring data and analyzing signals independently.

CO7: involves designing decoder circuits, where students are accountable for decoding encoded signals accurately, ensuring compatibility with communication systems, and troubleshooting potential issues, fostering autonomy and accountability in system integration and troubleshooting.

PO13:Community Engagement and Service:

CO3: introduces the concept of filters, which can be applied in community projects related to signal processing, audio enhancement, or environmental monitoring.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics

Name of the Programme : B.Sc. Electronics

Programme Code : USEL

Class : S. Y. B.Sc.

Semester : III

Course Type : Open Elective (OE) (Theory)

Course Code : ELE -216-OE

Course Title : Electronic Consumer Products

No. of Credits : 02

No. of Teaching Hours : 30

Learning Objectives:

1. To demonstrate the working principle of various Audio Devices.
2. To understand the characteristics and features of Audio systems.
3. To explain the concept of various video systems.
4. To describe working principles of different video systems.
5. To study the working principle of various home Appliances.
6. To study the various technical specifications and facilities of the consumer products.
7. To identify the blocks in the consumer products and operations.

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

CO1: Understand Audio Fundamentals.
CO2: Explain various types of microphones.
CO3: Identify and explain various types of head phones, headsets and loud speakers.
CO4: Understand Television Fundamentals and classify different types of TV.
CO5: Explain the concept of CCTV.
CO6: Understand the working principle of various domestic appliances.
CO7: Explain the working principle of Electronic Gadgets.

Topics and Learning Points

Unit 1: Audio and Video Systems 15L

Wave motion, types of waves, wave properties, sound wave, sound level, properties of sound waves, reflection and refraction of waves.
Microphones- Operation principle, characteristics, types of microphones.
Headphones- difference between headphone and headset, Types of headphones.
Loudspeakers- Ideal and basic loud speaker, types.
Telivisions- Persistance of vision, resolution, pixels, hue, brightness, luminescence, saturation, chrominance, types-comparative study of LCD,TV, LED TV, Plasma TV.
CCTV Camera- block diagram and working, Bullet camera, Dome camera, day-night camera, night/ infrared vision camera.

Unit 2: Electronic Appliances 15L

Inductor cooker, Washing Machine, Refrigerator, ATM – Block diagram, Working Principle, features
Air conditioner- air conditioning, components of conditioning system, types.
Mobile Phone- Mobile network, electronic components of mobile phone, maintenance, pre cautions,

Reference Books:

1. Consumer Electronics - Bali S P - Pearson Education India, latest edition
2. Modern Television practices - Gulati R R - New Age International Publication (P) Ltd. New Delhi
3. Audio video systems - Gupta R G - Tata Mc graw Hill, New Delhi, India
4. The Digital Consumer Technology Handbook - Amit Dhir - Xilinx, Inc., San Jose, CA, USA
5. Television engineering and video systems - Gupta R G - Tata Mc graw Hill, New Delhi, India

Course Outcome	Program Outcome												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
CO1	3	3	-	1	2	1	-	-	-	-	-	-	-
CO2	3	3	-	-	2	1	-	2	1	-	-	-	-
CO3	3	3	-	2	2	-	-	2	1	-	-	2	-
CO4	3	3	-	-	2	2	2	-	-	1	-	2	-
CO5	3	3	-	2	2	2	2	-	1	1	-	2	-
CO6	3	3	2	1	2	2	-	2	-	-	-	-	-
CO7	3	3	2	2	2	-	2	2	1	-	-	2	-

Justification

PO1: Comprehensive Knowledge and Understanding
CO1: Technical audio concepts, applications, and technologies.
CO2: Understanding of microphone technology, characteristics, and applications.
CO3: Broad and comprehensive knowledge of audio hardware and its applications.
CO4: Knowledge of television technologies, standards, and applications.
CO5: Understanding of surveillance and security technologies, applications, and regulations.
CO6: Knowledge of electrical and electronic technologies, circuitry, and components.
CO7: Understanding of electronic technologies, hardware and software components, and applications.

PO2: Practical, Professional, and Procedural Knowledge
CO1: Practical knowledge of audio equipment, signal flow, and professional procedures for capturing and reproducing sound.
CO2: Practical knowledge of microphone applications, techniques, and professional procedures for selecting and using the right microphone for specific tasks.
CO3: Involves practical knowledge of audio equipment, specifications, and professional procedures for choosing and using audio playback devices.
CO4: Practical knowledge of television technologies, display technologies, and professional procedures for setting up and calibrating television systems.
CO5: Practical knowledge of surveillance systems, camera technologies, and professional procedures for designing and implementing effective CCTV setups.
CO6: Practical knowledge of electrical circuits, components, and professional procedures for troubleshooting and repairing appliances.
CO7: Demands practical knowledge of electronic components, circuitry, and professional procedures for designing and manufacturing electronic devices.

PO3: Entrepreneurial Mindset and Knowledge
CO6: to explore innovative approaches, energy-efficient solutions, and potential business opportunities in the home appliance market.

CO7: to evaluate market trends, consumer needs, and potential business opportunities in the electronic gadget industry.

PO4: Specialized Skills and Competencies

CO1: Involves specialized skills and competencies in areas such as sound engineering, acoustics, and audio production techniques.

CO3: Involves specialized skills and competencies in audio equipment specifications, audio playback technologies, and sound reproduction principles.

CO5: Develop specialized skills and competencies in surveillance systems, camera technologies, and video surveillance principles.

CO6: Involves specialized skills and competencies in electrical engineering, appliance circuitry, and appliance repair techniques.

CO7: Involves specialized skills and competencies in electronic engineering, circuit design, and knowledge of electronic components and systems.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

CO1: Applying knowledge of audio fundamentals to solve problems related to audio systems and equipment.

CO2: It requires applying knowledge of different types of microphones to select the most appropriate one for specific applications or scenarios.

CO3: It involves applying knowledge of different types of audio output devices to choose the most suitable one for specific purposes or environments.

CO4: It requires applying knowledge of television fundamentals to categorize and differentiate between various types of televisions based on their features and technologies.

CO5: Applying knowledge of closed-circuit television systems to understand their functioning and usage in surveillance and security applications.

CO6: Applying knowledge of the working principles of household appliances to troubleshoot issues, make informed decisions about their usage, and perform basic repairs.

CO7: Applying knowledge of the working principles of electronic devices to comprehend their functionality, troubleshoot problems, and make informed choices when using or purchasing such gadgets.

PO6: Communication Skills and Collaboration

CO1: Effective communication and collaboration with others when discussing and explaining audio principles and concepts.

CO2: Effectively communicating and collaborating with others to explain the different types of microphones and their specific uses.

CO4: It involves effective communication and collaboration with others to understand television fundamentals and categorize different types of TVs based on their features.

CO5: It requires clear communication to explain the concept of closed-circuit television (CCTV) and its applications in surveillance and security.

CO6: It involves effective communication and collaboration with others to understand and explain the working principles of domestic appliances.

PO7: Research-related Skills

CO4: It involves conducting research on television technologies and classifications to gain a deeper understanding of television fundamentals.

CO5: Researching the concept of closed-circuit television (CCTV), including its history, evolution, and current applications.

CO7: Conducting research on the working principles and components of electronic gadgets, including their design, features, and performance capabilities.

PO8: Learning How to Learn Skills

CO2: It involves researching and learning about various types of microphones, including their features, applications, and technical specifications, which requires the ability to effectively gather and synthesize information.

CO3: It requires acquiring knowledge about different types of audio output devices, including headphones, headsets, and loudspeakers, and being able to explain their characteristics, functions, and differences.
CO6: It requires developing the ability to comprehend and learn about the working principles of different domestic appliances, including their components, mechanisms, and interactions, through various learning methods and resources.
CO7: It involves acquiring knowledge about the working principles of electronic gadgets, understanding their internal components, circuitry, and functionality, and being able to explain them through effective learning strategies and techniques.

PO9: Digital and Technological Skills

CO2: It involves understanding the technological aspects of different microphone types, including their construction, pickup patterns, and connectivity options.
CO3: It requires knowledge of the different technologies and features used in headphones, headsets, and loudspeakers, such as driver types, impedance, and wireless connectivity options.
CO5: It requires knowledge of digital surveillance systems, including CCTV cameras, DVR/NVR systems, network protocols, and video compression technologies.
CO7: It requires understanding the digital circuitry, programming, and components behind electronic gadgets, such as microprocessors, memory, and input/output interfaces.

PO10: Community Engagement and Service

CO4: It equips individuals with the knowledge to educate and guide community members in understanding TV technologies and features, assisting with TV purchases, and conducting TV-related workshops or seminars for the community.
CO5: It enables individuals to educate and create awareness within the community regarding the importance and usage of CCTV systems for enhancing safety and security, providing guidance on CCTV installation and setup in community spaces or events.

PO12: Autonomy, Responsibility, and Accountability

CO3: Identifying and explaining different audio devices requires autonomous exploration, taking responsibility for learning about their features and functions, and being accountable for providing accurate explanations.
CO4: Understanding TV fundamentals and classifying types of TVs requires self-directed learning, taking responsibility for acquiring knowledge about TV technologies, and being accountable for correctly categorizing them.
CO5: Explaining the concept of CCTV involves taking autonomous initiative to understand its workings, being responsible for researching its principles, and being accountable for providing a clear explanation to others.
CO7: Explaining the working principle of electronic gadgets requires autonomous exploration and understanding of their inner workings, taking responsibility for acquiring the necessary knowledge, and being accountable for providing accurate explanations.

CBCS Syllabus as per NEP 2020 for F. Y. B.Sc. Electronics

Name of the Programme : B.Sc. Electronics

Programme Code : USEL

Class : S. Y. B.Sc.

Semester : III

Course Type : Vocational Skill Course (VSC) (Theory)

Course Code : ELE -221-VSC

Course Title : 8 bit Embedded Microcontroller and Applications

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To study the basics of 8x51 microcontroller.
2. To study Architecture of Embedded Systems.
3. To get knowledge about Embedded Systems.
4. To learn Embedded C programming language.
5. To study the Programming of 8x51 microcontroller in Embedded C.
6. To study the interfacing techniques of 8051 microcontroller.
7. To apply knowledge of 8x51 to design different application circuits.

Course Outcomes:

CO1: Get familiar with general microcontroller and their working.

CO2: Acquire a basic knowledge about fundamentals of microcontrollers

CO3: Acquire a basic knowledge about programming and system control to perform a specific task.

CO4: Acquire knowledge about devices and buses used in embedded networking

CO5: Acquire a basic knowledge about fundamentals of microcontrollers

CO6: Interfacing of input output peripherals to the 8051 microcontrollers

CO7: Designing microcontroller based hobby projects.

Topics and Learning Points

Unit 1: Microcontroller architecture **[10]**

Introduction to microcontroller, 8x51 microcontroller Architecture block diagram, 8x51 Oscillator and clock, Program counter, Data Pointer, A and B CPU registers, Flags and PSW, Internal RAM and ROM, Stack and stack pointer, SFRs, I/O ports, Clock and reset circuitry, External memory , Timers and Counters , Serial Data I/O, Interrupts.

Unit 2: 8x51 C Programming **[10]**

C data types, C Programs for Time Delays & I/O Operation, I/O Bit Manipulation, Arithmetic and Logical Operations, Timer programming - Timers and counters, delay generation using timer, waveform generation using timer. Serial Port Programming in C.

Unit 3: Interfacing 8x51 C Programming **[10]**

LED, LCD, Seven segment display, DC motor , Stepper motor, DAC, ADC, Thumb wheel Switch, RTC interfacing using embedded C. Introduction of Editors, Assemblers, Compilers, Cross compiler, Linkers, Simulator, Emulator and Debugger.

Reference Books:

1. Microcontroller and Embedded Systems – Mazidi M.A. / Mazidi J.G. , Pearson Education Publication.
2. Microcontroller : Architecture, programming and Applications – Ayala, Kenneth J., Penram Publication- second edition.
3. Microcontroller and Embedded Systems using Assembly and C- Muhammad Ali MAzidi, Rolin Mckinlay, Janice Gillispie Mazidi, Pearson Publication.
4. Embedded Systems - Raj Kamal, TMH.
5. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
6. Embedded Systems – Lyla, Pearson, 2013.
7. An Embedded Software Primer - David E. Simon, Pearson Education.

Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	-	3	3	2	2	-	-	2	-	2	-	-
CO2	-	-	-	2	-	-	-	-	-	3	-	3	2
CO3	-	-	-	-	3	-	-	2	-	-	3	-	-
CO4	-	-	-	-	-	3	-	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	3	-
CO6	-	3	3	-	-	-	2	-	-	-	1	-	3
CO7	2	3	-	2	-	-	3	-	3	-	-	-	3

PO1: Comprehensive Knowledge and Understanding:

CO1: Graduates demonstrate a profound understanding of specific technologies within their field, as evidenced by their ability to comprehend the workings of various microcontrollers, enhancing their multidisciplinary knowledge base.

CO7: Graduates exhibit a strong capability to design microcontroller-based hobby projects, indicating their practical proficiency and creative application of acquired knowledge.

PO2: Practical, Professional, and Procedural Knowledge

CO6: Graduates demonstrate strong procedural knowledge in interfacing peripherals with 8051 microcontrollers, showcasing their practical proficiency.

CO7: Graduates exhibit strong practical skills in designing hobby projects based on microcontrollers, indicating their professional competence and creativity.

PO3: Entrepreneurial Mindset and Knowledge

CO1: A deep understanding of general microcontrollers fosters an entrepreneurial mindset by enabling graduates to identify innovative opportunities and develop novel solutions in related fields.

CO6: Proficiency in interfacing peripherals with microcontrollers enhances an entrepreneurial mindset by enabling graduates to develop innovative solutions and products with practical applications.

PO4: Specialized Skills and Competencies

CO1: Demonstrating familiarity with general microcontrollers indicates proficiency in technical skills and problem-solving, essential for adapting and innovating in response to changing circumstances.

CO2: Acquiring basic knowledge of microcontroller fundamentals contributes to technical skills and analytical abilities, but further depth may be needed for stronger problem-solving and innovation.

CO7: Designing hobby projects based on microcontrollers demonstrates proficiency in technical skills, analytical abilities, problem-solving, effective communication, and leadership, relevant to the field, while also showcasing adaptability and innovation.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

CO1: Familiarity with general microcontrollers facilitates practical application, problem-solving, and analytical reasoning, indicating readiness to learn and apply concepts in real-world scenarios.

CO3: Acquiring basic knowledge in programming and system control enhances capacity for application and problem-solving, but further development is necessary for more robust analytical reasoning.

PO6: Communication Skills and Collaboration

CO1: While familiarity with microcontrollers contributes to communication skills and collaboration by providing a common technical understanding, further development is necessary to effectively communicate complex information and collaborate in diverse teams.

CO4: Acquiring knowledge about devices and buses in embedded networking enhances communication skills and collaboration by providing additional technical context, but further development is necessary to effectively communicate complex information and collaborate in diverse teams.

PO7: Research-related Skills

CO6: Proficiency in interfacing peripherals with microcontrollers enhances research-related skills by demonstrating observational and inquiry skills, and the ability to utilize appropriate methodologies for data collection and analysis, thereby adhering to research ethics and effectively reporting findings.

CO7: Designing hobby projects based on microcontrollers requires observational and inquiry skills to formulate research questions, and the utilization of appropriate methodologies for data collection and analysis, demonstrating adherence to research ethics and effective reporting of findings, thereby enhancing research-related skills.

PO8: Learning How to Learn Skills

CO3: Acquiring basic knowledge in programming and system control contributes to learning how to learn skills by enabling graduates to apply technical concepts, yet further development is required to demonstrate adaptability and independent goal-setting and achievement.

CO5: Acquiring basic knowledge in microcontroller fundamentals contributes to learning how to learn skills by establishing a technical foundation, yet additional development is necessary to demonstrate adaptability and independent goal-setting and achievement.

PO9: Digital and Technological Skills

CO1: Familiarity with general microcontrollers provides a foundation for digital and technological skills, but additional development is needed to demonstrate proficiency in using ICT, accessing information sources, and analyzing data using appropriate software.

CO7: Designing hobby projects based on microcontrollers requires proficiency in using ICT for research and analysis, showcasing strong digital and technological skills.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

CO2: Acquiring basic knowledge of microcontroller fundamentals contributes to multicultural competence by providing technical understanding, yet additional growth is necessary to effectively engage in multicultural settings and lead diverse teams.

CO4: Acquiring knowledge about devices and buses in embedded networking enhances multicultural competence by providing technical context, yet additional refinement is needed to effectively engage in multicultural settings and lead diverse teams.

PO11: Value Inculcation and Environmental Awareness

CO1: While familiarity with microcontrollers lays the foundation for ethical awareness, further development is needed to actively address ethical issues and promote sustainability and environmental conservation.

CO3: Acquiring basic knowledge in programming and system control enables graduates to recognize ethical issues, but further development is required to take appropriate actions for sustainability and environmental conservation.

CO6: Proficiency in interfacing peripherals with microcontrollers demonstrates a strong foundation for recognizing ethical issues and promoting sustainability and environmental conservation through appropriate actions.

PO12: Autonomy, Responsibility, and Accountability

CO2: Acquiring basic knowledge of microcontroller fundamentals supports autonomy in applying skills, yet additional growth is necessary to manage projects effectively and demonstrate responsibility and accountability.

CO5: Acquiring basic knowledge in microcontroller fundamentals contributes to autonomy in applying skills, but further development is necessary to effectively manage projects and demonstrate responsibility and accountability.

PO13: Community Engagement and Service

CO2: Acquiring basic knowledge of microcontroller fundamentals supports community engagement, but additional growth is necessary to actively participate in community-engaged services and activities.

CO6: Proficiency in interfacing peripherals with microcontrollers enables graduates to actively participate in community-engaged services and activities, promoting societal well-being through practical applications.

CO7: Designing microcontroller-based hobby projects fosters community engagement by allowing graduates to apply their skills and knowledge for the betterment of society, thereby promoting societal well-being through innovative solutions.