Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science andCommerce, Baramati

Autonomous

S. Y. B. Sc. (Computer Science)

Electronics (Sem. III) (2024 Pattern)

(w.e.f. June, 2025)

Semester	Paper Code	Title of Paper	No. of Credits
III	COS-211-MN(C)	Digital Logic Design	2
	COS-212-MN(C)	Electronics Practical II	2

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. (Comp. Sci.) (SEM III) (2024Pattern)

Name of the Program : B. Sc. (Comp. Sci.)

Program Code : UCSEL

Class : S. Y. B.Sc. (Comp. Sci.)

Semester : III

Course Type : Minor (Theory)

Course Code : COS-211-MN(C)

Course Title : Digital Logic Design

No. of Credits : 02

No. of Teaching Hours : 30

Course objective:

1.To provide the fundamental concept associated with the digital logic and circuit design.

2.To get familiarize combinational circuits utilized in different digital circuits and systems.

3. To get Familiarize with integrated circuits (ICs) such as IC 7483 and IC 4008 used in combinational circuitry.

4. To study some of the programmable logic devices.

5. To study the sequential logic circuit design both in synchronous and asynchronous modes for various complex logic gates.

6. To understand the concepts of Mealy and Moore sequential machine models and their applications in digital design.

7. To understand the evolution from fixed-function ICs to Programmable Logic Devices (PLDs).

Course outcomes:

CO1: Students will able to know concept of digital logic and digital circuit design.

CO2: Students having knowledge about utilization of combinational circuits in digital system design.

CO3: Students are capable to use different IC's to design various electronic circuits.

CO4: To develop students knowledge about programmable logic devices and able to make them use for digital systems.

CO5: Students having deep knowledge about designing of a sequential circuit for enabling the design and implementation of complex digital systems with memory, timing, control, and processing capabilities.

CO6: To make students able to understanding the concepts of Mealy and Moore sequential machine models and their applications in digital design enables designers to make informed decisions during the design, implementation, and analysis of sequential circuits.

CO7: This will gives the transformative impact of PLDs in enhancing flexibility, efficiency, and innovation in electronic design and manufacturing processes.

Topics and Points of Learning:

Unit 1: Combinational circuits: **(10)**

Combinational circuits: Half adder, Full adder, Half Subtractor, Parallel Adder, Universal Adder/Subtractor Study of IC 7483, IC 4008. Study of Multiplexer (4:1) and Demultiplexer (1:4), Encoders - Decimal/ BCD to binary, priority encoder, Decoder- BCD to seven segment decoder (IC 74138).

Unit 2: Sequential circuits: **(10)**

Concept of sequential circuits; State diagram, state table, excitation table and transition table Flip-flops: RS, Clocked RS, JK, Master Slave JK; Counter- synchronous, asynchronous, up-down counter, modulo-N counter, Decade Counter, (IC 7490); shift register (IC 7495), ring counter.

Unit 3: Programmable logic device: **(10)**

Introduction, fixed function IC's, ASIC's, Introduction of Programmable Logic Devices (PLD), ROM as PLD, SPLD – PLA, PAL, CPLD, FPGA with examples. Design flow for logic circuits, Mealy and Moore sequential machine models.

Reference Books:

1. Basic Electronics: Bernard Grob, McGraw Hill Publication, 8th Revised Edition,2010
2. Electronic Principles: Albert Malvino, David J Bates, McGraw Hill 7th Edition. 2012
3. Digital Electronics: Jain R.P., Tata McGraw Hill.
4. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.

CO with PO mapping:

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

CO with PO mapping justification:

PO1: Comprehensive Knowledge and Understanding:

CO1: Students will gain comprehensive knowledge and understanding of digital logic and circuit design.

CO2: Students will demonstrate comprehensive knowledge and understanding of utilizing combinational circuits in digital system design.

CO5: Students will possess deep knowledge of designing sequential circuits for complex digital systems with memory, timing, control, and processing capabilities.

CO6: Students will understand Mealy and Moore sequential machine models and their applications in digital design, facilitating informed decision-making in circuit design, implementation, and analysis.
CO7: Students will recognize the transformative impact of PLDs, enhancing flexibility, efficiency, and innovation in electronic design and manufacturing processes.

PO2: Practical, Professional, and Procedural Knowledge:

CO1: Students will acquire practical, professional, and procedural knowledge in digital logic and circuit design concepts.
CO3: Students will demonstrate practical, professional, and procedural knowledge in utilizing different ICs for designing various electronic circuits.
CO4: Students will develop practical, professional, and procedural knowledge in utilizing programmable logic devices for digital systems.
CO6: Students will gain practical, professional, and procedural knowledge in understanding and applying Mealy and Moore sequential machine models in digital design decision-making.
CO7: Students will recognize the practical, professional, and procedural impacts of PLDs, enhancing flexibility, efficiency, and innovation in electronic design and manufacturing processes.

PO3: Entrepreneurial Mindset and Knowledge:

CO1: Students will cultivate an entrepreneurial mindset and knowledge by understanding digital logic and circuit design concepts, essential for innovation in electronics.
CO2: Students will apply entrepreneurial thinking in utilizing combinational circuits for efficient digital system design, fostering creativity and problem-solving skills.
CO3: Students will demonstrate an entrepreneurial mindset by effectively using different ICs to design diverse electronic circuits, promoting adaptability and resourcefulness.
CO5: Students will apply entrepreneurial knowledge in designing sequential circuits for complex digital systems, emphasizing creativity and strategic thinking in system development.
CO7: Students will recognize the transformative impact of PLDs from an entrepreneurial standpoint, emphasizing the importance.

PO4: Specialized Skills and Competencies:

CO2: Students will acquire specialized skills and competencies in utilizing combinational circuits for optimized digital system design, enhancing their ability to engineer efficient solutions.
CO3: Students will demonstrate specialized skills and competencies in using various ICs to design diverse electronic circuits, enriching their capability to implement complex electronic systems.
CO4: Students will cultivate specialized skills and competencies in programmable logic devices, enabling them to effectively integrate these components into digital systems for enhanced functionality and performance.

CO6: Students will gain specialized skills and competencies in understanding and applying Mealy and Moore sequential machine models, empowering them to make precise and informed decisions in the design, implementation, and analysis of sequential circuits.

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

CO1: The capacity for application, problem-solving, and analytical reasoning is demonstrated as students apply concepts of digital logic and circuit design.
CO4: Students can utilize programmable logic devices for digital systems.
CO5: Students will able to design sequential circuits for complex digital systems.
CO7: Students can recognize the transformative impact of PLDs on electronic design and manufacturing processes.

PO6: Communication Skills and Collaboration:

CO1: Students developing communication skills and collaboration is achieved as students articulate understanding of digital logic and circuit design concepts.
CO4: Students can effectively convey knowledge of programmable logic devices for digital systems.
CO7: Students can discuss the impact of PLDs on electronic design and manufacturing processes.

PO7:Research-related Skills:

CO1: Students can develop research-related skills is demonstrated as students investigate digital logic and circuit design concepts.
CO2: Students are able to conduct research on the utilization of combinational circuits in digital system design.
CO3: Students explore various ICs for electronic circuit and system design.
CO4: Students able to develop into programmable logic devices and their application in digital systems.
CO5: Students engage in depth research on designing sequential circuits for complex digital systems.
CO6: Students are able to analyze Mealy and Moore sequential machine models and their applications in digital design.
CO7: Students can explore the impact of PLDs on electronic design and manufacturing processes through research.

PO8: Learning How to Learn Skills:

CO2: Students can effectively learn about the utilization of combinational circuits in digital system design.
CO3: Students can explore various ICs for electronic circuit design to enhance their learning process.
CO4: Students having knowledge about programmable logic devices and apply them in digital systems, thereby enhancing their learning capabilities.

CO7: Students can explore the transformative impact of PLDs on electronic design and manufacturing processes to facilitate continuous learning and improvement.

PO9: Digital and Technological Skills:

CO1: This will enhance digital and technological skills is demonstrated as students acquire knowledge of digital logic and circuit design concepts.
CO2: Students can apply their understanding of combinational circuits in digital system design.
CO4: Students are able to develop proficiency in programming and utilizing programmable logic devices for digital systems.
CO5: Students gain deep understanding of sequential circuit design for complex digital systems.
CO6: Students understand the concepts of Mealy and Moore sequential machine models for informed decision-making in digital design.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy:

CO2: recognize and appreciate the diverse applications and contexts in which combinational circuits are utilized in digital system design.
CO6: foster empathy by understanding the different functionalities and applications of Mealy and Moore sequential machine models in digital design.

PO11: Value Inculcation and Environmental Awareness:

CO4: Students understand the importance of energy-efficient and eco-friendly programmable logic devices in digital systems.
CO6: Students can contemplate the environmental impact of implementing Mealy and Moore sequential machine models in digital design decisions.

PO12: Autonomy, Responsibility, and Accountability:

CO1: Instilling autonomy, responsibility, and accountability is demonstrated as students independently grasp digital logic and circuit design concepts.
CO2: Students take responsibility for effectively utilizing combinational circuits in digital system design.
CO3: Students able to autonomously select and use different ICs in designing various electronic circuits.
CO6: Students are able to understand and analyze the concepts of Mealy and Moore sequential machine models for informed decision-making.
CO7: Students recognize their responsibility in acknowledging the transformative impact of PLDs in enhancing flexibility, efficiency, and innovation in electronic design and manufacturing processes.

PO13: Community Engagement and Service:

CO1: Community engagement can involve workshops or seminars conducted by students for local schools or community centers to educate others about basic digital logic concepts and circuit design. This not only reinforces the students' understanding but also serves the community by spreading knowledge.

CO4: Students can engage with community projects or NGOs to implement digital systems using programmable logic devices (PLDs). For instance, they can work on projects related to environmental monitoring or assistive technologies, leveraging PLDs to create customized solutions that benefit the community.

CO6: Students can participate in community projects related to automation or control systems where the understanding of Mealy and Moore machine models is crucial. By applying these concepts, students can contribute to projects aimed at improving efficiency or safety in various community settings, such as transportation or infrastructure.

Name of the Program : B. Sc. (Comp. Sci.)
Program Code : UCSEL
Class : S. Y. B.Sc. (Comp. Sci.)
Semester : III
Course Type : Minor (Practical)
Course Code : COS-212-MN(C)
Course Title : Electronics Practical II
No. of Credits : 02
No. of Teaching Hours : 60

Course objective:

1. To learn how NAND gates can be used to construct flip-flops.
2. To Implement JK and T flip-flops using NAND gates.
3. To understand the concept of up/down counters and learn about decade counters and their applications.
4. To understand the concept of shift registers and their applications.
5. To verify the functionality of the multiplexer and Demultiplexer by routing different input signals to a single output.
6. To understand the basic concepts of addition in digital circuits.
7. To understand the concept of Read-Only Memory (ROM).

Course outcomes:

CO1: Students gain a thorough understanding of various types of flip-flops including RS, D, JK, and T flip-flops.

CO2: Students develop proficiency in designing and analyzing up/down counters and decade counters.

CO3:Students acquired knowledge about shift registers and its practical implications.

CO4: Students able to understand the principles of multiplexers and demultiplexers.

CO5: Students having skills in designing and testing sequence generators using digital logic circuits.

CO6:Student gain knowledge about half adders, full adders, and universal adder/subtractor circuits.

CO7: To understand the concept of ROM (Read-Only Memory) and its various implementations.

List of practicals:

Group A: Practical (Any Eleven) –

1. Study of RS,JK, T and D flip-flop using NAND gate.
2. Study of Up/Down Counter.
3. Study of Decade Counter (IC-7490).
4. Study of 4-bit Shift Register.
5. Build and Test Multiplexer.
6. Build and test Demultiplexer.
7. Build and test 4 bit sequence generator.
8. Study of Decoders.
9. Study of 4 bit ALU.
10. Diode matrix ROM.
11. Study of read and write action of RAM (using IC 2112/4 or equivalent).
12. Study of half adder / full adder.
13. Study of universal adder/ subtractor.
14. Study of ring counter.
15. Study of Johnson counter.

Group B: Activity (Any Two)-

1. Hobby projects.
2. Internet browsing.
3. Study of K-map.
4. Group Discussion / Seminar.

CO with PO mapping:

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

Mapping Justification:

PO1: Comprehensive Knowledge and Understanding:

CO1: Students gain a thorough understanding of various types of flip-flops including RS, D, JK, and T flip-flops.
CO2: Students develop proficiency in designing and analyzing counters requires a deep understanding of sequential logic circuits and their applications, indicating comprehensive knowledge in this domain.
CO6: Student gain understanding adders and subtractors is fundamental to digital arithmetic circuits, demonstrating a comprehensive grasp of arithmetic logic units (ALUs) and related components.
CO7: Students understanding ROM involves comprehending non-volatile memory and its applications in digital systems, contributing to a comprehensive understanding of memory technologies.

PO2: Practical, Professional, and Procedural Knowledge:

CO1: Students gain understanding translates into practical knowledge of how these flip-flops are implemented in digital circuits and their applications in sequential logic.
CO3: Students understanding shift registers involves knowing how to implement serial data storage and manipulation, which is important in various practical applications.
CO4: Students able to understand the principles of multiplexers and demultiplexers.
CO5: Students having skills in designing and testing sequence generators require practical knowledge of combinational and sequential logic design techniques.
CO7: Students understand the concept of ROM (Read-Only Memory) and its various implementations.

PO3: Entrepreneurial Mindset and Knowledge:

CO1: Students able to analyze problems critically and find innovative solutions, a key trait in entrepreneurship.
CO2: Students learn to optimize circuit designs for specific functions, honing their ability to innovate.
CO3: Students understanding shift registers and their practical implications equips students with tools to handle sequential data, which is necessary in various applications such as data processing and storage.
CO5: This skill involves not only technical proficiency but also creativity in designing sequences tailored to specific requirements.
CO7: Students having understanding about ROM and its implementations involves grasping the concept of non-volatile memory and its applications.

PO4: Specialized Skills and Competencies:

CO1: Students having specialized knowledge of sequential logic elements, which are essential building blocks in digital circuit design.

CO3: Students acquiring knowledge about shift registers and their practical implications equips students with specialized skills in handling sequential data storage and manipulation.

CO4: Students having understanding the principles of multiplexers and demultiplexers develops students' specialized skills in data routing and selection.

CO6: Students gaining knowledge about half adders, full adders, and universal adder/subtractor circuits enhances students' specialized skills in arithmetic circuit design.

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

CO3: Students must analyze the requirements of various applications, design shift register circuits to meet those requirements, and troubleshoot issues that arise during implementation.
CO4: Students having understanding the principles of multiplexers and demultiplexers involves applying logical reasoning to data routing and selection problems.
CO5: Developing skills in designing and testing sequence generators using digital logic circuits requires students to apply their understanding of sequential logic to create custom sequence generation algorithms.
CO6: Students must solve arithmetic problems, translate them into circuit requirements, and analyze the performance of adder/subtractor circuits under different input conditions.

PO6: Communication Skills and Collaboration:

CO1: Students effectively understand various types of flip-flops, students often engage in collaborative activities such as group discussions, peer teaching, or presentations.
CO2: Designing and analyzing counters often involves collaborative projects where students work in teams to conceptualize, design, and implement counter circuits.

CO4: Students having understanding multiplexers and demultiplexers often requires collaborative learning activities such as group discussions or peer teaching sessions.
CO7: Understanding ROM and its implementations may involve collaborative research projects or presentations where students share their findings with peers.

PO7:Research-related Skills:

CO1: Students able to develop into academic literature, technical documentation, and research papers to deepen their understanding of flip-flops and stay updated with the latest developments.
CO2: Developing proficiency in designing counters requires students to conduct research on counter architectures, design methodologies, and optimization techniques.
CO4: Students understanding the principles of multiplexers and demultiplexers requires researching their theoretical foundations, logical operations, and implementation techniques.
CO5: Students able to design and test sequence generators involves researching sequential logic design methodologies, sequence generation algorithms, and testing methodologies.
CO7: Understanding ROM and its implementations requires researching memory technologies, ROM architectures, and applications in digital systems.

PO8: Learning How to Learn Skills:

CO3: Students acquiring knowledge about shift registers and its practical implications requires students to engage in self-directed learning processes such as literature review, experimentation, and problem-solving.
CO4: Students having understanding the principles of multiplexers and demultiplexers involves self-directed learning activities where students research theoretical concepts, study logical operations, and analyze circuit implementations.
CO5: Students will learn how to learn by independently exploring design methodologies, testing strategies, and optimization techniques.
CO7: Students understanding the concept of ROM and its various implementations entails self-directed learning activities where students research memory technologies, study ROM architectures, and analyze practical applications.

PO9: Digital and Technological Skills:

CO1: Students understanding flip-flops is fundamental to digital circuit design, which aligns with the development of digital and technological skills.
CO2: Students designing and analyzing counters require a deep understanding of digital logic and sequential circuits, which are essential digital skills.
CO3: Students understanding shift registers involves mastering serial data manipulation, which is crucial in digital communication systems and data storage technologies.
CO5: Students having skills to design and test sequence generators require proficiency in digital logic design and testing techniques, aligning with the development of digital skills.
CO6: Students having understanding adder circuits is foundational in arithmetic and logical operations in digital systems, contributing to the development of digital skills.

CO7: Students having understanding ROM and its implementations is crucial for designing memory systems in digital devices, which is a fundamental aspect of digital and technological skills.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy:

CO3: Students having understanding shift registers and their practical implications involves recognizing diverse applications across different cultural and societal contexts.
CO7: Students having understanding ROM and its implementations involves acknowledging diverse memory storage needs and applications.

PO11: Value Inculcation and Environmental Awareness:
CO2: Students Proficiency in designing counters involves considering the environmental impact of digital systems.
CO6: Students having understanding adder circuits involves considering the energy efficiency and environmental impact of arithmetic operations in digital systems.

PO12: Autonomy, Responsibility, and Accountability:

CO2: Proficiency in designing and analyzing counters necessitates students to take ownership of their design processes and outcomes.

CO3: Acquiring knowledge about shift registers requires students to take initiative in understanding the practical implications of these circuits.
CO6: Gaining knowledge about adder circuits requires students to independently understand the principles and applications of these essential arithmetic components.

PO13: Community Engagement and Service:

CO2: Students can collaborate with local organizations or schools to design and implement simple counting systems for events or projects.
CO4: Students can volunteer to assist in organizing community events where multiplexing techniques are used, such as music or art festivals.
CO5: Students can collaborate with local artists or performers to create interactive installations or performances that incorporate sequence generators.
CO6: Students can engage in community service by participating in STEM outreach programs for local schools.