Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
Autonomous

Course Structure & Credit Distribution for F. Y. B. Sc. (Computer Science)
Electronic Science (Sem. II)
(2022-23)

Semester	Paper Code	Title of Paper	No. of Credits
II	UCSEL121	Semiconductor Devices & Circuits	2
	UCSEL122	Digital Electronic Circuits	2
	UCSEL123	Electronic Practical's	2

SYLLABUS (CBCS) FOR F. Y. B. Sc. Computer Science(w.e.f. June, 2022)

Class : F.Y. B. Sc.(Comp. Sci.) (Semester- II)
Paper Code : UCSEL121
Title of Paper : Semiconductor Devices & Circuits
Paper : I
Credit : 2 No. of lectures: 36

- **Learning Objectives:**
  1. To study characteristic features of semiconductor devices
  2. To study elementary electronic circuits and applications
  3. To study applications of semiconductor devices
  4. To provide general understanding of semiconductor devices.
  5. To make student understand construction and working principle of the major semiconductor devices.
  6. To make student familiar with circuit symbol of various semiconductor components.
  7. To make students able to design and analyze semiconductor devices.

- **Learning Outcomes:**

  At the end of this course, students should be able to:

  CO1: Getting the fundamental knowledge of electronics components & circuits.
  CO2: Identify active and passive components and understand basic circuit theory.
  CO3: Solve & minimize complex electronic circuits.
  CO4: Demonstrate switching and amplification application of semiconductor device.
  CO5: To have knowledge about the physics of semiconductor devices.
  CO6: Analysis of circuit using semiconductor devices.
  CO7: Getting knowledge about characteristics of various devices.

Unit 1: Basic of Semiconductor (04)

Introduction to semiconductor materials, Energy level diagram, Intrinsic & Extrinsic semiconductors, n-type semiconductor, p-type semiconductor.

Unit 2: Semiconductor Diodes & Circuits (10)

Study of semiconductor active components (w.r.t. symbol, working principle, characteristics, parameters, specifications, applications): P-N junction diode, Zener diode, Varactor diode, Light Emitting Diode(LED),Photo diode, Optocoupler, Rectifiers, clipper and clamper circuits.

Unit-3:Bipolar Junction Transistor and its applications (12)

Bipolar Junction Transistor (symbol, types, construction, working principle, I-V characteristics, parameters, specifications),concept of amplifier, transistor as a amplifier,configurations of transistors (CC,CE& CB), Biasing circuit (Potential divider only), DC load line (CE), Q point, ,concept of class A, B, C and class AB amplifiers, transistor as a switch.

Unit-4: UJT and FETs **(10)**

Uni-Junction Transistor (UJT), Junction Field Effect Transitor (JFET), Metal Oxide Semiconductor Field Effect Transistor (MOSFET) (Symbol, construction, working principle, I-V characteristics), JFET as voltage variable resistor.

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. Modern Digital Electronics: R.P. Jain, Mcgraw Hill

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	2	-	-	2	1
CO2	1	2	-	-	-	-	2
CO3	2	3	1	-	-	1	3
CO4	-	2	1	-	-	1	1
CO5	-	1	-	-	-	-	1
CO6	3	2	2	-	-	2	1
CO7	3	2	-	-	-	3	2

PO Justification:

PO1: Computer knowledge:

CO1: Students having basic computer knowledge which is essential for accessing electronic simulation software, analyzing circuit data, and using computer-based tools for circuit design and analysis.

CO2: Students having computer knowledge which is essential for using simulation tools and software to analyze circuits, as well as for accessing online resources for learning and research.

CO3: Student are well known about computer skills are necessary for utilizing simulation software and optimization tools to analyze and minimize complex circuits efficiently.

CO6: Computer skills are essential for using simulation software and analytical tools to analyze circuits containing semiconductor devices.

CO7: Computer knowledge is important for accessing online resources, databases, and simulation tools that provide information on the characteristics of electronic devices.

PO2: Design/development of a solution:

CO1: Designing electronic solutions requires a deep understanding of the fundamental principles, components, and circuits. Students have the necessary knowledge to approach solution design effectively.

CO2: Identifying and understanding active and passive components is essential for designing electronic solutions. Additionally, a grasp of basic circuit theory is crucial in the design process.

CO3: Students having ability to solve and minimize complex circuits is directly applicable to the design and development of electronic solutions.

CO4: Students know how electronic solutions involve the use of semiconductor devices for switching and amplification. Students can apply these devices appropriately in their designs.

CO5: Student have solid understanding of semiconductor physics which is essential for designing solutions that leverage the unique characteristics of semiconductor devices effectively.

CO6: Designers need to analyze circuits to ensure they meet the required specifications. Students have the skills to perform this analysis using semiconductor devices.

CO7: Students have the necessary knowledge to make appropriate choices for designing solutions.

PO3: Modern tool usage:

CO1: Students utilizing modern tools which enhances the learning experience by allowing students to simulate and visualize electronic circuits, making the understanding of fundamental concepts more practical and applicable.

CO3: By using modern tools, students can explore different approaches to solving and optimizing circuits, providing them with a hands-on experience in dealing with complexity.

CO4: Virtual demonstrations using modern tools help students observe and analyze the behavior of semiconductor devices in switching and amplification applications, enhancing their comprehension and practical skills.

CO6: Integrating modern tools into circuit analysis allows students to explore the behavior of semiconductor devices in various circuit configurations, facilitating a deeper understanding of their applications.

PO6: Individual and teamwork:

CO1: Students will have groundwork for individual learning, as students need to grasp foundational concepts independently before engaging in collaborative activities.

CO3: Students be able in both individual capability in problem-solving and teamwork when dealing with more complex challenges.

CO4: Students have individual knowledge with collaborative skills, as they may work together to design and demonstrate applications of semiconductor devices.

CO6: Students individual learning with teamwork, as students may independently research device characteristics and collaboratively apply this knowledge in group projects.

CO7: Students may independently research device characteristics and collaboratively apply this knowledge in group projects.

PO7: Innovation, Employability and Entrepreneurial skill:

CO1: Students acquire the foundational knowledge necessary for innovation, making them more employable and equipping them with the skills needed for entrepreneurial endeavors.

CO2: Students with practical skills that are directly applicable to innovation and employability in the electronics field. Entrepreneurs often need to identify and work with various components to create new products.

CO3: Students have problem-solving skills, a key attribute for entrepreneurs and professionals seeking innovative solutions in the electronics industry.

CO4: Students have hands-on skills and practical applications, which are valuable for individuals seeking employment in electronics-related industries and for entrepreneurs developing new electronic products.

CO5: Students contributes to deepening the understanding of the underlying principles of semiconductor devices, enabling individuals to innovate and create new technologies or products.

CO6: Students have the skills needed to analyze and optimize circuits, enhancing their ability to contribute to innovative projects and making them more employable in the electronics industry.

CO7: Students have a broad knowledge of electronic devices, which is valuable for entrepreneurial ventures and employment opportunities in diverse electronic applications.

ANEKANT EDUCATION SOCIETY'S

TULAJARAM CHATURCHAND COLLEGE of ARTS, SCIENCE AND COMMERCE, BARAMATI

(AUTONOMOUS)

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

SEMESTER : II (2022 Pattern)

Paper II: UCSEL 122: Digital Electronic Circuits

(2022-23)

(2 Credits, 36 lectures)

Objectives:

1. To know about different Combinational Circuits.
2. Study and construction of sequential logic circuits, understanding design of flip flops.
3. To understand Binary different Counters and Shift Registers.
4. To get knowledge about the computer memories.
5. Be able to analyze sequential logic circuits.
6. To get idea about memory expansion.
7. Be able to design digital circuits using various digital components.

Learning Outcomes:-

CO1: Design number of combinational circuits using logic gates.
CO2: Design various flip flops, counters and determining outputs.
CO3: Design different types of shift registers.
CO4: Design different types of memory elements for particular operation.
CO5: To design synchronous and asynchronous counter.
CO6: To understand memory organization and expansion.
CO7: To know about types of memory and role in digital systems.

Unit I: Combinational Circuits (10L)

Introduction , Multiplexer (4:1), Demultiplexer (1:4), Encoders , Decimal to BCD , Octal to Binary, Priority Encoder, Decoders – BCD to 7 Segment Decoder, 7 segment display, Types of 7 segment display - Common Anode, Common Cathode, Digital comparator.

Unit II: Flip Flops (6L)

Introduction to Sequential Circuits, Flip Flops – RS Flip Flop using NAND Gate, Clocked RSFF, DFF, JKFF, TFF, MSJKFF and Excitation Table of Flip flops.

Unit III: Counters and Shift Registers **(10L)**

Counters –Asynchronous Type – 3 bit Up and Down and Up-Down counter, Synchronous Type - 3 bit and 4 bit Up and Down Counter, Concept of Modulus Counters, IC 7490. (Time Diagrams of all counters are expected). Shift Registers – SISO, SIPO, PISO, PIPO shift registers, Ring Counter using DFF, Johnson Counter.

Unit IV: Basics of Computer Organization and Memory

(10L)

Basic Computer Organization, Concept of Address Bus, Data Bus, Control Bus. CPU Block Diagram and Explanation of each block, Register based CPU organization, Concept of Stack & its organization, Memory Architecture, Memory hierarchy, Types of Memories (Role of Cache memory, Virtual Memory), Vertical and Horizontal Memory Expansion.

Recommended Books:

1. **Digital Electronics : Principles, Devices and Applications - Anil K. Maini (Wiley)**
2. **Digital Fundamentals - Floyd T.N. and Jain R.P. (Pearson Educations)**
3. **Digital system Design – M. Morris Mano (Pearson Education)**
4. **Digital Principles and Applications –Leach, Malvino, Saha (TMH)**
5. **Computer System Architecture - Morris Mano, Prentice Hall of**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	2	-	-	2	1
CO2	1	2	-	-	-	-	1
CO3	1	2	1	-	-	1	1
CO4	3	2	2	-	-	1	1
CO5	1	1	1	-	-	-	1
CO6	3	3	2	-	-	2	1
CO7	1	3	1	-	-	2	2

PO Justification:

PO1: Computer knowledge:

CO1: Students developing the skills needed for designing basic building blocks of digital systems. Understanding and designing combinational circuits using logic gates are essential aspects of computer knowledge.

CO2: Students understanding the working of flip-flops and counters, which are key components in digital systems. Determining outputs further strengthens the understanding of system behavior.

CO3: Shift registers play a crucial role in digital systems for tasks such as data storage and transfer. Designing different types of shift registers enhances the understanding of sequential circuits and expands the knowledge of digital systems.

CO4: Memory elements are fundamental in computer systems. Students focusing on the design of memory elements, contributing directly to the understanding of how data is stored and processed in digital systems.

CO5: Understanding and designing counters, both synchronous and asynchronous, are important aspects of digital logic design.

CO6: Memory organization is a crucial aspect of computer systems. Understanding how memory is organized and expanded contributes directly to the knowledge of computer architecture.

CO7: Knowing the types of memory and their roles in digital systems is essential for computer engineers.

PO2: Design/ development of a solution:

CO1: Students have knowledge about practical design of combinational circuits, providing them with hands-on experience in implementing solutions using logic gates.

CO2: The design of flip-flops and counters requires a solution-oriented approach. Determining outputs involves troubleshooting and refining the design to achieve the desired results, contributing to solution development skills.

CO3: Designing shift registers requires a problem-solving mindset. Students need to understand the application requirements and design shift registers accordingly, aligning with the idea of developing solutions.

CO4: Designing memory elements involves creating solutions tailored to specific operational needs.

CO5: The design of synchronous and asynchronous counters involves crafting solutions that meet timing and synchronization constraints.

CO6: Understanding memory organization is a crucial aspect of designing efficient and effective solutions.

CO7: Student have knowledge about different types of memory and their roles in digital systems is foundational for designing solutions that involve memory.

PO3: Modern tool usage:

CO1: Students uses modern tools, such as digital design software and simulators, to design and simulate combinational circuits.

CO3: Modern tools are commonly used for simulating and validating the design of shift registers. Students would likely use these tools for efficient design and verification.

CO4: The design of memory elements often involves the use of advanced tools for simulation and analysis.

CO5: Tools for simulation and synthesis are integral to designing and validating synchronous and asynchronous counters.

CO6: Students focused on conceptual understanding, students may use modern tools for visualizing and simulating memory organization concepts. Tools can aid in comprehending complex memory structures.

CO7: Understanding different types of memory and their roles in digital systems may involve the use of tools for analysis and simulation.

PO6: Individual and teamwork:

CO1: Students have individual design skills, it can also be part of team projects where multiple individuals contribute to a larger digital system design. Effective communication and collaboration may be required for successful completion.

CO3: Designing shift registers can be both an individual and team activity. Collaborative efforts may be needed when integrating shift registers into larger systems or applications.

CO4: Memory design, being a complex task, may involve teamwork for comprehensive system design. Collaborative efforts are essential to integrate memory elements into the broader context of digital systems.

CO6: Students having understanding, collaborative discussions and knowledge sharing within a team can enhance the overall understanding of memory organization and expansion.

CO7: Students are more focused on knowledge acquisition, may involve individual study but can also benefit from team discussions and knowledge sharing to gain a comprehensive understanding of the topic.

PO7: Innovation, Employability and Entrepreneurial skill:

CO1: Enhancing innovation by fostering creative thinking in the design of combinational circuits. Students have ability to think innovatively is a valuable employability skill in the field of digital systems.

CO2: Allow students to determine outputs, which involves problem-solving skills, a crucial aspect of innovation. Students can design and understand sequential circuits enhances employability in digital design roles.

CO3: Designing different types of shift registers encourages creativity and innovative thinking. Understanding various shift register designs enhances employability by providing students with a broader skill set.

CO4: Memory design involves addressing specific operational needs, fostering problem-solving and innovative thinking. This skill is valuable for employability in roles that require designing memory elements tailored to specific applications.

CO5: Designing synchronous and asynchronous counters requires an understanding of timing and synchronization, contributing to employability skills in the field of digital systems. Innovation may come into play when optimizing counter designs for specific applications.

CO6: Understanding memory organization and expansion is crucial for developing innovative solutions in digital systems. This knowledge enhances employability by providing a solid foundation for tackling complex design challenges.

CO7: Knowing about different types of memory and their roles contributes to both employability and entrepreneurial skills.

SYLLABUS (CBCS) FOR F. Y. B. Sc. (Computer Science)
(w.e.f. June, 2022)

Class : F.Y. B. Sc. (Computer Science)
Semester II
Paper Code : UCSEL 123
Paper III
Title of Paper : Electronic Practical's
Credit 2

- **Learning Objectives:**
    1. To teach students how to draw different symbols, logic diagrams and circuit diagrams.
    2. To develop skill of circuit connections.
    3. To train them to design and analyze circuits for specific purpose.
    4. To motivate them to work on different mini projects.
    5. To analyze the network theorems and laws.
    6. To design the logic circuits and different class of digital circuit like unipolar and bipolar logic families.
    7. To study about RAM and ROM operation.

- **Learning Outcomes:**

  At the end of this course, students should be able to:

CO1: Identify different components, devices, IC's, as well as their types.
CO2: Understand basic parameters.
CO3: Know operation of different instruments used in the laboratory.
CO4: Connect circuit and do required performance analysis.
CO5: To implement the knowledge of K-map to solve Boolean equations.
CO6: To study and analyze characteristics of various semiconductor devices.
CO7: To design digital systems using sequential circuits.

Group A: Activity (Any One)

Perform any one of the following activities with proper documentation.

1. Hobby Projects
2. Internet Browsing
3. Industrial Visit / Live Work Experience
4. Market Survey of Electronic Systems
5. Study Tour and Its Report Writing.
6. IC testing

Group B : Analog Electronics (Any Four)

1. Study of forward and Reverse biased characteristics of PN Junction Diode
2. Study of breakdown characteristics and voltage regulation action of Zener diode.
3. Study of output characteristics of Bipolar Junction Transistor in CE mode.
4. Study of output and transfer characteristics of JFET/MOSFET

5. Study of I-V characteristics of UJT and Demonstration of UJT based relaxation oscillator.

6. Study of low voltage Half-wave, Full-wave and Bridge rectifier circuits.
7. Study of amplification action of BJT.
8. Study of clipping circuit (Bias).
9. Study of opto-coupler.
10. Study of angular response of LED.
11. Study of transistor as switch.

Group C: Digital Electronics (Any Four)

1. Study of RS, JK D and T 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 and Demultiplexer using gates.
6. Build and Test Keyboard Encoder.
7. Build and Test Diode Matrix ROM.
8. Study of Decoders.
9. Study of Four bit ALU.
10. Study of Read/Write Action of RAM Using IC 7489.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	2	-	-	2	1
CO2	1	2	-	-	-	-	1
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CO4	3	2	2	-	-	1	1
CO5	1	1	3	-	-	-	1
CO6	3	3	2	-	-	2	1
CO7	3	3	3	-	-	2	2

PO Justification:

PO1: Computer Knowledge:

CO1: In a computer system, understanding different components, devices, and integrated circuits is crucial. Students with knowledge of these components can better appreciate the intricacies of computer architecture and design.

CO2: Basic parameters such as speed, power consumption, and reliability are essential considerations in computer systems. Students gaining an understanding of these parameters will be better equipped to analyze and optimize computer systems.

CO3: Knowing the operation of laboratory instruments is essential in computer science, especially when working with hardware. This skill ensures that students can effectively use tools for testing and analysis in computer systems.

CO4: Connecting circuits and analyzing performance is crucial in computer hardware design. This skill enables students to design and optimize circuits for various computer applications.
CO5: Knowledge of Karnaugh maps (K-map) is essential in digital logic design, a key aspect of computer systems. Students with this knowledge can design efficient and optimized logical circuits.
CO6: Semiconductors form the backbone of modern computer systems. Understanding their characteristics is crucial for designing efficient and reliable electronic circuits.
CO7: Designing digital systems with sequential circuits is a fundamental skill in computer engineering. This knowledge is essential for creating complex systems with memory and logic components.

PO2: Design/ Development of a solution:
CO1: Students have understanding of the components and devices that will be used for designing. This knowledge is essential in the initial stages of solution development.
CO2: A solution's design needs to consider various parameters such as performance, power consumption, and reliability. Understanding these parameters is critical for developing effective solutions.
CO3: In the process of designing solutions, especially in a laboratory setting, knowledge of instrument operation is essential for creating accurate and reliable experimental setups.
CO4: Connecting circuits and analyzing their performance is an integral part of designing electronic solutions. This skill is essential for ensuring that the designed solution meets the required specifications.
CO5: Logical design is fundamental in solution development, and the ability to implement K-maps for Boolean equations is crucial in designing efficient and optimized logical circuits.
CO6: Semiconductor devices play a vital role in electronic solutions. Understanding their characteristics is fundamental for choosing and incorporating the right components in the design process.
CO7: Designing digital systems using sequential circuits is a specific skill that directly contributes to the development of solutions in digital electronics and computer systems.

PO3: Modern tool usage:
CO1: Students should use software tools for component identification and analysis. Tools like simulation software, databases, and electronic design automation (EDA) tools can aid in this process.
CO3: Integrate virtual labs or software simulations to familiarize students with modern instruments, ensuring they understand their operation and can interpret results.
CO4: Use circuit simulation software for connecting circuits virtually and conducting performance analysis. This allows students to visualize and analyze circuit behavior without physical setups.
CO5: Employ digital design tools that support Karnaugh Map (K-map) analysis and Boolean equation simplification. Software tools can assist in visualizing and optimizing logic circuits.
CO6: Use semiconductor simulation tools or device modeling software to study and analyze the characteristics of semiconductor devices in a virtual environment.
CO7: Utilize digital design software or hardware description languages (HDLs) for designing and simulating digital systems with sequential circuits. This allows students to implement and test their designs in a virtual space.

PO6: Innovation and teamwork:
CO1: In team projects, individuals may specialize in identifying specific components or devices based on their expertise. Collaboration is crucial to ensure a comprehensive understanding of various components and devices.
CO3: Individuals may specialize in the operation of specific instruments, and teamwork is essential to ensure that everyone is familiar with the various instruments used in the laboratory. Sharing knowledge and coordinating efforts contribute to efficient lab work.

CO4: Connecting circuits and analyzing performance can be a collaborative effort where individuals contribute their skills and work together to achieve the desired outcomes. Teamwork ensures that tasks are efficiently completed.
CO6: Studying semiconductor devices may involve individual research or collaborative efforts to analyze characteristics comprehensively. Teamwork allows for a more thorough exploration of diverse semiconductor devices.
CO7: Designing digital systems with sequential circuits often requires teamwork to ensure that different aspects of the system are considered. Individuals may specialize in specific components or stages of the design process.

PO7: Innovation, Employability and Entrepreneurial skill:
CO1: Understanding a wide range of components and devices fosters innovation by enabling students to explore creative solutions to engineering challenges. This knowledge enhances employability as individuals become versatile in their ability to work with diverse technologies.
CO2: A solid understanding of basic parameters is crucial for innovation in designing efficient systems. Employability is enhanced as individuals with a strong grasp of fundamental parameters are well-equipped for a variety of roles.
CO3: Knowing the operation of laboratory instruments promotes innovation by enabling the development of novel experimental setups. Employability is enhanced as individuals can contribute to various roles that involve laboratory work.
CO4: The ability to connect circuits and perform analysis is essential for innovation in circuit design. Employability is strengthened as individuals can contribute to roles involving circuit design and analysis.
CO5: Applying knowledge of K-maps to solve Boolean equations supports innovation by optimizing digital logic design. Employability is enhanced as individuals can contribute to roles involving digital circuit design. Entrepreneurs can leverage this skill to develop efficient and customized digital systems.
CO6: Studying and analyzing semiconductor device characteristics is foundational for innovation in electronic device design. Employability is strengthened as individuals can contribute to roles involving semiconductor device analysis. Entrepreneurs can use this knowledge to identify opportunities for developing new electronic devices.
CO7: Designing digital systems with sequential circuits requires innovation to optimize system performance. Employability is enhanced as individuals can contribute to roles involving digital system design. Entrepreneurial skills are developed by applying this knowledge to create innovative digital solutions for various applications.