**Anekant Education Society's**
**Tuljaram Chaturchand College of Arts, Science andCommerce, Baramati**
**Autonomous**
**Course Structure For S. Y. B. Sc. (Computer Science)**
**2020-21**
**Equivalence Subject/Paper and Transitory Provision**

| Sem | Old Syllabus | New Syllabus |
|---|---|---|
| Sem-III | **Paper-I : Digital System Hardware(ElC 211)** | **Paper-I: Fundamentals of Memory organization and Embedded System(CSEL2101)** |
| | **Paper-II: Analog Systems (ElC 212)** | **Paper-II: Analog Electronics(CSEL 2102)** |
| | | **Paper- III:Practical Course (CSEL 2103)** |
| **Sem-III & IV** | **Paper- III:Practical Course** (ELC 223) | |

## S.Y.B.Sc. (Computer Science) Electronics -Semester III

### Paper I:Fundamentals of Memory organization and Embedded System (CSEL2101)

**Course Objectives:**

1) Apply knowledge of computer architecture and organization appropriate to the discipline
2) Analyze given processing element, and identify and define the computing requirements.
3) Design, implement, and evaluate a microcontroller-based system, process, component, orprogram to meet desired needs.
4) Use current techniques, skills, and tools necessary for Low-Level computing.
5) Implement small programs to solve well defined problems on an embedded platform.
6) To develop familiarity with tools used to developed in an embedded environment.
7) Students have knowledge about the basic functions, structure, concept and programming at embedded system.

**Course Outcomes:**

CO1: To understand basics of computer organization in broad aspects.
CO2: To understand concept of program as sequence and operation of computers.
CO3: To understand different way of communication with I/O device and standard I/O interfaces.
CO4: To study the basics of memory organization and memory expansion.
CO5: To study the basic processing unit, embedded and other large computing systems.
CO6: To know about microprocessor and multicore processor.
CO7: To get knowledge about Arduino and embedded system.

**UNIT- 1: Memory** **[12]**

Memory Architecture, Memory Hierarchy, Introduction to USB storage device, Memory parameters (Access time, speed, capacity, cost ), Vertical & horizontal Memory expansion (increasing the capacity, increasing word size, increasing the capacity and word size), Associative Memory, Cache memory, cache mapping techniques, virtual memory.

**UNIT- 2: Computer Organization** **[12]**

Concept of Address Bus, Data Bus, Control Bus. Register based CPU organization, stack organization, I/O organization: need of interface, block diagram of general I/O interface. Working concepts like polling, interrupt initiated data transfer. Concept of DMA, DMA transfer, DMA Controller Serial communication: Synchronous, asynchronous and their data transmission formats, RS–232, General block diagram of UART, USB.

**UNIT- 3: Microprocessor** **[12]**

Evolution of Microprocessor (8086 to Pentium 4), Features like address, data, bus size, speed, cache capacity, number of parallel instructions executed. Concept of RISC & CISC, Von-Neumann & Harvard Architecture, pipeline. Architecture of basic microprocessor: 8086 & Pentium (Basic Version), pipeline. Introduction to multicore processors.

**UNIT- 4: Introduction To Embedded System** **[12]**

History & need of Embedded System, Definition of an embedded system, Basic components of Embedded System, characteristics of embedded systems, Applications of embedded systems. Classification of Embedded System, Advantage & Disadvantage, Introduction to Embedded C, Difference between C & Embedded C, Basic structure of embedded C program, Introduction of Arduino, its types and features, interfacing LED, LCD etc.

**Recommended Books:**


1. Fundamental of Digital electronics : R.P. Jain
2. Digital design : M. Morris Mano, Prentice-Hall of India
3. Computer System Architecture : Morris Mano, Prentice-Hall of India
4. Embedded C - Michael J Point
5. The Pentium Microprocessor : James Antonakos
6. Microprocessors and Interfacing Programming and Hardware: Douglas V. Hall-TATAMcGRAW-HILL EDITION
7. The Intel Microprocessors : Barry B. Brey- Pearson Education Asia
8. Embedded System, Architecture and programming,Rajkamal,TMH,2008


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

- **PO Justification:**

**PO1: Computer Knowledge:**
CO1: Student will be able to enhance understanding of fundamental computer organization concepts, providing a solid foundation in computer knowledge.
CO2: Understanding the sequence and operation of computers is crucial for designing and developing effective solutions.
CO3: Student will know about Effective communication with I/O devices is essential in the design and development of solutions.
CO4: A deep understanding of memory organization is a key aspect of computer knowledge.
CO6: Student will know that Knowledge of microprocessors and multicore processors is necessary to understanding advanced computing architectures.
CO7: Understanding Arduino and embedded systems involves learning about the hardware and software components that make up these systems, as well as their applications.

**PO2: Design / Development of solution:**
CO1: It contributes to building a solid understanding of computer systems.
CO2: Student will focus on the enhancing of programming, emphasizing the logical sequence of instructions and operations that computers execute to perform tasks.
CO3: Student able to know methods by which computers interact with input and output devices, including the study of standard interfaces. It is important for developing systems that effectively communicate with the external environment.
CO4: Students having deep knowledge about organization of memory within a computer system, including how data is stored and accessed.
CO5: Student getting broad aspect about the study of processing units (CPU), embedded systems, and large-scale computing systems. It provides a detailed view of different computing architectures.
CO6: Student specifically know about microprocessor and multicore processor technologies, which are essential components in modern computing systems.
CO7: Students having knowledge about hands-on applications and real-world implementations of computing concepts by using Arduino.

**PO3: Modern tool usage:**
CO1: Student able to understand computer organization involves the use of modern tools for simulation, analysis, and visualization.
CO3: Student will explore communication with I/O devices often requires the use of tools for interface analysis and testing. Students may use modern tools to understand and implement communication protocols.
CO4: Students might use memory analysis tools or memory profiling software to understand how memory is organized, and how it can be expanded or optimized.
CO6: Students will be able to use simulation tools or development environments that allow them to experiment with microprocessors and multicore processors.

**PO6: Individual and teamwork:**
CO1: Student have Understandings about computer organization basics may involve collaborative efforts in grasping complex concepts. Group discussions, peer teaching, or collaborative projects can enhance teamwork skills.
CO2: Students are able to analyzing program sequences and operations can benefit from both individual comprehension and collaborative discussions. Teamwork may be essential for solving programming challenges collectively, sharing insights, and learning from each other.
CO3: Exploring communication with I/O devices may involve individual experimentation and troubleshooting. However, discussing various interfaces and solving challenges collaboratively can enhance teamwork skills, as multiple perspectives contribute to comprehensive understandings.

CO4: Students having understandings about memory organization may require individual study and exploration. Collaborative efforts can be valuable when addressing memory expansion concepts, sharing knowledge, and discussing potential applications.
CO6: Students having Individual knowledge of microprocessors is fundamental, but teamwork is beneficial when studying multicore processors. Collaborative exploration of parallel processing and shared insights can contribute to a better understanding.
CO7: Learning about Arduino and embedded systems may involve individual experimentation, but teamwork is valuable for sharing project ideas, troubleshooting, and collectively expanding knowledge in the field.

**PO7: Innovation, Employability and Entrepreneurial skills:**
CO1: Enhance understanding of basics of computer organization which is the foundation for innovation in computing systems. Entrepreneurial skills may be fostered by the ability to identify and address challenges in computer organization.
CO2: Student will able to understand the program as a sequence and operation of computers is crucial for innovative software development. Employability is enhanced by the ability to write efficient and effective programs. Entrepreneurial skills may involve developing software solutions for new markets or solving unique problems.
CO3: Student will know different ways of communication with I/O devices is essential for innovation in device interaction. Employability is enhanced by the ability to work on diverse projects requiring various I/O interfaces.
CO4: Student will impose understandings of memory organization and expansion is vital for innovation in efficient memory usage. Entrepreneurial skills may involve developing memory-related solutions or products.
CO5: Studying various computing systems enhances innovation in system design. Employability is strengthened by the ability to work on diverse computing platforms. Entrepreneurial skills may involve developing solutions for specific computing environments.
CO6: Knowledge of microprocessors and multicore processors is very important for innovation in processors. Employability is enhanced by expertise in designing and optimizing software for these architectures. Entrepreneurial skills may involve identifying opportunities for processor-related innovations.
CO7: Knowledge of Arduino and embedded systems fosters innovation in the development of embedded solutions. Employability is increased by proficiency in working with embedded systems. Entrepreneurial skills may involve creating innovative products based on embedded technologies.

## Paper-II : Analog Electronics (CSEL 2102)

**Course Objectives:**

1) To understand basics of analog electronics
2) To study different types of sensors
3) To understand different types of signal conditioning circuits
4) To learn data conversion techniques
5) To apply knowledge of analog systems in different applications
6) To develop an understanding of operational amplifier.
7) To enhance the skill of designing of various electronic circuits.

**Course Outcomes:**

CO1: Ability to design various analog electronic circuits.
CO2: To make students able to use different types of sensors.
CO3: To get knowledge about signal conditioning systems in broad aspects.

CO4: Give knowledge about different types of data conversions.
CO5: Develop skills of circuit design using sensors in different application areas.
CO6: To be able to design and use different types filters.
CO7: Ability to introduce various applications based on operational amplifiers.

**UNIT 1: Analog Systems [12]**

Introduction of Analog electronic systems. Definition of sensors and transducers. Classification of sensors: Active and passive sensors. Specifications of sensors: Accuracy, range, linearity, sensitivity, resolution, reproducibility. Temperature sensors (LM-35), optical sensor (LDR), displacement sensor (LVDT), Passive Infrared sensor (PIR). Introduction to Op-amp, specifications of op-amp, types of Op-amp: Inverting and non-inverting with expression, Applications of Op-amp.

**UNIT- 2: Signal Conditioning [12]**

Introduction to signal conditioning, Signal conditioning of passive sensors using bridgecircuit: Wheatstone's bridge, Level Shifter, Amplifier, Three OP-amp instrumentation amplifier, Filters; active and passive filters, Concept of Order of filters. Working principle of Single order Op-Amp based Low Pass Filter, High Pass Filter, Band Pass Filter, Notch Filter, Band reject filter; Working of Voltage to frequency Converter using Op-amp.

**UNIT- 3: Data Converters [12]**

Digital to Analog Converter (DAC): Resistive divider, R-2R ladder, Parameters: Linearity, resolution, accuracy, Analog to Digital Converter (ADC): Types of ADC- Flash, Successive approximation, single slope, dual slope. Parameters of ADC: Linearity, resolution,conversion time, accuracy. Applications of DAC and ADC.

**UNIT- 4: Case studies [12]**

Temperature monitoring system using LM35, Intruder detector system using PIR sensor, Electrocardiography (ECG), Schmitt trigger.

**Recommended Books:**


1. Sensors & Transducers : Dr. A. D. Shaligram: CTC publications
2. Op-Amps and Linear Integrated Circuits: Ramakant Gaikwad: PHI: 4th Ed.
3. Electronic Instrumentation: H. S. Kalsi: TMH: 2nd Ed.
4. Modern Electronic Instrumentation and Measurement Techniques: Albert D. Helfrick, William D. Cooper: PHI publications
5. Electronic measurements : K.A. Bakshi, A. V. Bakshi and U. A. Bakshi, Technicalpublications.
6. A Course in Electrical and Electronic measurements and Instrumentation: A.K. Sawhney:Dhanpat Rai & Sons Educational & technical publishers
7. Handbook of Biomedical instrumentation: R. Khandpur, Tata McGraw Hill Publications2003.


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

## PO Justification:

## PO1: Computer Knowledge:

CO5: Designing circuits using sensors for various applications often requires simulation and modeling using computer software. Computer knowledge is necessary for effectively utilizing simulation tools and ensuring the practicality of the designed circuits.

## PO2: Design/ Development of a solution:

CO1: Students having deep knowledge about practical application of designing electronic circuits, which is a fundamental aspect of engineering design and development.

CO2: Students will impose knowledge about how sensors used to design projects this is practical skill that directly contributes to the design and development of solutions.

CO3: Students will be able to understand signal conditioning is important in the design process, as it ensures that signals are suitable for processing and analysis in a systems.

CO4: Student enhance knowledge about Data conversions. Which is an integral part of designing electronic systems. Different types of data conversions are essential for designing effective solutions.

CO5: This gives sensor-based circuit design skills to different application areas, contributing to the overall engineering design and development process.

CO6: Designing and using filters is an application-oriented skill that contributes to the design of electronic systems.

CO7: Students having deep idea about applications based on operational amplifiers demonstrates practical knowledge that contributes to the design and development of solutions.

### PO3: Modern tool usage:

CO1: Students are able to design analog electronic circuits which involves the use of modern simulation tools for analysis and verification.

CO3: Signal conditioning may involve the use of modern tools for signal processing and analysis and understanding.

CO4: Students will use Tools for data conversion analysis and simulation are essential in different types of data conversions.

### PO6: Individual and teamwork:

CO1: Student having ability to design electronic circuits which involves collaboration in a team setting, sharing ideas, and contributing individual expertise. Teamwork is essential in simplifying complex projects.

CO2: Working with sensors may require collaboration, especially in integrating them into larger electronic systems or applications. There is need to work individually and as a team.

CO4: Exploring and applying knowledge about data conversions can benefit from both individual research and collaborative efforts, especially when tackling real-world problems.

CO5: Student actively work individually to designing of circuits using sensors in specific areas (e.g., sensor selection) and collaborative efforts when integrating these circuits into larger systems.

CO6: Designing and using filters can benefit from individual expertise in theoretical aspects and collaborative efforts in practical implementations.

CO7: Introducing various applications based on operational amplifiers may involve individual research and creativity, as well as collaborative efforts in exploring diverse applications.

## PO7: Innovation, employability and Entrepreneurial skills:

CO1: Students have ability to design analog electronic circuits demonstrates innovation in problem-solving. The skill is directly related to employability in roles that require circuit design expertise, and it can be entrepreneurial when applied to create new electronic products or solutions.

CO2: Students have deep knowledge about utilizing different types of sensors involves innovation in choosing and adapting sensor technologies. Proficiency in sensor use enhances employability, especially in fields like IoT or automation, and can lead to entrepreneurial opportunities by creating novel applications for sensor technologies.

CO3: Student have ability to know about how signal conditioning is essential for innovation in optimizing and processing signals effectively. This knowledge enhances employability in roles involving signal processing, and it can be entrepreneurial when applied to create new solutions in various industries.

CO4: Students have knowledge about data conversions is important for innovation in data processing and analysis. It enhances employability in fields requiring data engineering skills, and it can be entrepreneurial when applied to develop new approaches for efficient data conversions.

CO5: Students develop skills in circuit design with sensors showcases innovation in applying sensor technologies to diverse applications. It enhances employability in roles involving circuit design and sensor integration, and it can be entrepreneurial when applied to create new products or solutions.

CO6: Student know about Designing using filters involves innovation in signal processing. These skills are employable in roles requiring expertise in electronic filter design, and they can be entrepreneurial when applied to address specific challenges in signal conditioning.

CO7: Introducing various applications based on operational amplifiers demonstrates innovation in applying amplifier technologies. This knowledge enhances employability in roles involving amplifier applications, and it can be entrepreneurial when applied to develop novel solutions in electronics.

## Paper- III: Practical Course [ CSEL 2103]

**Objectives:**

1. To use basic concepts for building various applications in electronics.
2. To understand design procedures of different electronic circuits 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 make able to develop programming skills.
6. To give knowledge interfacing hardware.
7. To enhance designing skill of the students.

**Course Outcomes:**

CO1: Understand and identify use of various components of analog systems.
CO2: Design and implement hardware circuit to test performance and application in analog electronics.
CO3: To make student familiar with Arduino and its applications.
CO4: To develop signal conditioning circuits using amplifiers.
CO5: To get knowledge about wireless connectivity.
CO6: To design different types of data convertors using op-amp.
CO7: To design electronic circuits using different sensors.

Total Practical to be conducted 10.
8 experiments compulsory.
Activities ( 2 ) :

**<u>Section I : Fundamentals of Memory organization and Embedded System</u>**

1. Study of read and write action of RAM (using IC 2112/4 or equivalent).
2. Knowledge of hardware that goes in the making of a computer: Assembling of PC. Installation of OS, setting up of dual boot, installation of hardware and software.
3. Arduino with LCD

Display counter using Arduino

4. Interfacing of Seven Segment Display to arduino
5. Analog to Digital Conversion using arduino
6. Pulse Width Modulation using arduino
7. Wireless Connectivity to Arduino
8. Serial communication using RS 232

**Section II : Analog Electronics**

1. LM-35 based temperature sensing system.
2. IC-741 Op Amp. As Inverting and Non-inverting amplifier.
3. Build and test DAC using R-2R Ladder network.
4. Flash ADC using discrete components.
5. Build and test LDR based light control system.
6. Study of Linear Variable Differential Transformer.
7. Build and test Instrumentation Amplifier.

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

**PO Justification:**

**PO1: Computer Knowledge:**

CO3: Introducing students to Arduino enhances their engineering knowledge and allows them to apply this knowledge to practical problem-solving through the design and development of solutions.

CO5: Students having understandings of wireless connectivity provides comprehensive engineering knowledge, especially in the context of modern communication systems.

**PO2: Design/ Development of a solution:**

CO1: Students able to understand and identify the use of various components in analog systems is a fundamental step in the process of designing solutions. This lays the groundwork for the more advanced designing.

CO2: Student will design and implement hardware circuits which involves creating solutions to real-world problems in analog electronics. Students are expected to apply their knowledge to develop practical and effective solutions.

CO3: Introducing students to Arduino and its applications is a step towards enabling them to develop solutions using this platform. The familiarity gained in this CO contributes to the broader skill set required for designing solutions in electronics.

CO4: Designing signal conditioning circuits requires a problem-solving approach students need to develop effective solutions for conditioning signals, considering factors such as noise, amplification, and filtering.

CO5: Students gaining knowledge about wireless connectivity lays the foundation for future solutions. Understanding wireless technologies is much needed for designing communication solutions and integrating wireless connectivity into electronic systems.

CO6: Students will able to design data converters using op-amps is a clear application of design and development skills. Students are expected to create effective solutions for converting data between analog and digital domains using operational amplifiers.

CO7: Student design electronic circuits with sensors which leads to creative and problem-solving mindset. Students are required to develop solutions that effectively incorporate various sensors into electronic circuits.

### PO3: Modern tool usage:

CO3: Student will be able to design and implement hardware circuits often involves the use of modern tools for simulation, testing and validation. Students may use simulation software or other tools to model and analyze their circuit designs before physical implementation.

CO5: Students know about wireless connectivity

### PO6: Individual and teamwork:

CO1: Students focuses on knowledge and comprehension of analog system components. Students are expected to be able to recognize and use of various components in analog systems.

CO2: Student know about application of theoretical knowledge to practical scenarios. Students are expected to design and implement hardware circuits to test the performance of analog electronics.

CO3: To enhance students for a specific platform, Arduino, and its applications. It emphasizes hands-on experience with a widely used electronics platform.

CO4: Develop skill about practical application of signal conditioning using amplifiers. Students are able to design circuits which modify signals for better processing or transmission.

CO5: This outcome focuses on expanding students' knowledge about wireless connectivity, which is an essential aspect of modern electronics.

CO6: This outcome emphasizes the design aspect of data converters using operational amplifiers (op-amp). Students are expected to apply their knowledge to create functional circuits.

CO7: This outcome involves the application of knowledge in designing electronic circuits that incorporate various sensors. Students should be able to integrate sensor technology into electronic systems.

### PO7: Innovation, Employability and Entrepreneurial skills:

CO1: Fosters innovation by providing foundational knowledge essential for creative problem-solving in analog electronics, enhancing employability through a deep understanding of system components, and supporting entrepreneurial skills for innovative solutions in the electronics industry.

CO2: Promotes innovation through practical circuit design, boosts employability by imparting hands-on skills crucial in electronics industries, and cultivates entrepreneurial skills by encouraging students to apply their knowledge to real-world applications.

CO3: Drives innovation by exposing students to a versatile platform for creative projects, enhances employability through practical skills with a widely used electronics tool, and nurtures entrepreneurial skills by facilitating rapid prototyping and development.

CO4: Encourages innovation by teaching advanced circuit techniques, enhances employability with specialized knowledge in signal processing, and cultivates entrepreneurial skills through the ability to design circuits for specific applications.

CO5: Fosters innovation by providing insights into evolving wireless technologies, enhances employability in industries reliant on wireless communication, and supports entrepreneurial skills through understanding and application of wireless connectivity in diverse sectors.

CO6: Promotes innovation by developing skills in designing data converters, enhances employability with specialized knowledge in analog electronics, and cultivates entrepreneurial skills through the ability to design and optimize data conversion circuits.

CO7: Drives innovation by integrating sensor technologies into electronic circuits, enhances employability through skills in sensor-based system design, and nurtures entrepreneurial skills by enabling the development of novel applications and solutions in sensor-based electronics.