

Punyashlok Ahilyadevi Holkar Solapur University, Solapur.



NAAC Accredited-2022

'B++'Grade (CGPA2.96)

Name of the Faculty: Science & Technology

(As Per New Education Policy 2020)

Syllabus: Electronics

Name of the Course: B. Sc. III (Sem. V & VI)

(Syllabus to be implemented from June 2026)



Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

Faculty of Science & Technology

Nep 2020 Compliant Curriculum

B. Sc (Electronics) Program Preamble

The B.Sc. Electronics program is developed in accordance with the National Education Policy (NEP) 2020 and follows the Choice Based Credit System (CBCS) to offer a flexible, multidisciplinary, and outcome-oriented academic structure. This program aims to equip students with a sound conceptual understanding and practical knowledge of electronic systems, devices, and applications that are integral to modern science and technology. The curriculum emphasizes core competencies in analog and digital electronics, circuit design, microcontrollers and microprocessors, communication systems, embedded systems, and instrumentation. It fosters analytical reasoning, critical thinking, and innovation through a blend of theory, laboratory work, project-based learning, and skill-enhancement components.

With a focus on experiential learning, academic flexibility, and skill development, the program allows students to customize their learning pathways, supporting multiple entry-exit options and integrating vocational and research-oriented elements. Graduates are prepared to pursue advanced studies, entrepreneurial ventures, or professional roles in industry, academia, and research.

The B.Sc. Electronics program aims to nurture responsible, competent, and adaptive individuals who can contribute meaningfully to the evolving global technological landscape.

The curriculum is structured around several key components:

1. Major Courses: These core courses form the backbone of the program, providing in-depth knowledge and understanding of essential electronics concepts, theories, and methodologies.

Students will engage with topics ranging from digital and analog circuits to microcontrollers, embedded systems, digital communication, instrumentation, power electronics and linear integrated circuits, ensuring a robust and comprehensive education in the discipline.

2. Minor Courses: Students have the opportunity to choose minor courses from related or distinct disciplines, promoting an interdisciplinary approach to learning. This flexibility allows students to complement their electronics education with insights from fields such as physics, mathematics, computer science, or engineering, enhancing their versatility and broadening their career prospects.

3. Open Electives/Generic Electives: The program encourages intellectual exploration beyond the core discipline by offering a wide range of elective courses. These electives enable students to pursue their interests in diverse subjects, fostering creativity, critical thinking, and a well-rounded educational experience.

4. Vocational and Skill Enhancement Courses: Practical skills and technical proficiency are integral to the program, with vocational and skill enhancement courses providing hands-on experience in areas

such as Arduinos, Proteus simulation, VLSI etc., These courses are designed to prepare students for immediate employment and equip them with the tools necessary for career advancement in various scientific and technological fields.

5. Ability Enhancement Courses (AEC), Indian Knowledge System (IKS), and Value Education Courses (VEC): In alignment with NEP 2020, the program integrates courses that emphasize the Indian Knowledge System, ethical values, and life skills. These courses foster a deep appreciation for India's rich cultural heritage, while also developing essential communication and ethical decision-making skills that are vital for personal and professional growth.

6. Field Projects/Internships/Apprenticeships/Community Engagement Projects/On-Job Training: To bridge the gap between theoretical knowledge and real-world applications, the program includes opportunities for field projects, internships, apprenticeships, and community engagement. These experiences provide students with practical insights, problem-solving abilities, and exposure to professional environments, enhancing their readiness for careers in electronics and related fields.

7. Research Methodology and Research Projects: Research is a critical component of the BSc Electronics program, with students acquiring skills in research methodology, data collection, analysis, and scientific inquiry. By engaging in independent research projects, students are encouraged to develop innovative solutions to complex scientific problems, preparing them for advanced studies and research-oriented careers.

8. Multiple Entry and Multiple Exit Options: In accordance with the NEP 2020, the BSc Electronics program incorporates a Multiple Entry and Multiple Exit framework, offering students the flexibility to enter or exit the program at various stages. This approach ensures that students can tailor their educational journey according to their personal and professional goals, with options to earn certificates, diplomas, or degrees.

Year 1: Upon completion of the first year, students may exit with a Certificate in Electronics.

Year 2: After two years, students may choose to exit with a Diploma in Electronics.

Year 3: Completion of the third year qualifies students for a BSc Degree in Electronics.

Year 4: The fourth year offers an advanced curriculum with a focus on research, allowing students to graduate with an **Honors Degree in Electronics**.

- **Eligibility for B.Sc. Electronics:**

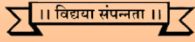
i. The candidate passing the higher secondary examination conducted by the Maharashtra State Board of Higher Secondary Education, with science stream, MCVC with science subjects, D. Pharm., Diploma Engineering, Agriculture Diploma, Dairy Diploma shall be allowed to enter upon the B.Sc. I Course.

OR

ii. An examination of any other statutory Board or an Examination Body recognized as equivalent there to. Repeater Students will be allowed to take fresh admission to the same class with same subjects or different.



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B. Sc (Electronics) Program Outcomes (PO)

Students graduating from the Bachelor of Science in Electronics program will complete

Major Courses:

1. PO1: Disciplinary Knowledge

Demonstrate comprehensive knowledge and understanding of electronic principles, devices, and systems, including analog and digital electronics, communication, embedded systems, and instrumentation.

2. PO2: Problem Solving and Analytical Skills

Identify, formulate, and analyze real-world problems using core concepts of electronics and apply appropriate tools and techniques for effective solutions.

3. PO3: Design and Development of Solutions

Design and develop electronic systems or components to meet desired specifications with appropriate consideration for public health, safety, and environmental sustainability.

4. PO4: Modern Tool Usage

Apply appropriate technologies, software, and hardware tools such as simulation platforms and programming environments to model, analyze, and design electronic circuits.

5. PO5: Communication Skills

Communicate effectively in both oral and written forms, present technical information clearly, and interact meaningfully with peers and professionals.

6. PO6: Ethics and Responsibility

Apply ethical principles and commit to professional ethics and responsibilities in the practices of electronics and scientific research.

7. PO7: Teamwork and Leadership

Work effectively as an individual, as a member, or as a leader in multidisciplinary teams to accomplish shared goals.

8. PO8: Life-long Learning

Recognize the need for lifelong learning and engage in continuous professional development in the context of evolving electronic technologies.

9. PO9: Project Management and Entrepreneurship

Demonstrate knowledge and understanding of engineering and management principles and apply them to one's own work or as a member/leader in a team to manage projects and pursue entrepreneurship.

10. PO10: Research Aptitude

Develop skills to undertake research in electronics, including literature review, experimental design, data analysis, and interpretation of results.

Minor Courses:

1. PO1: Foundational Knowledge

Acquire basic understanding of electronic components, circuits, and systems, laying the groundwork for interdisciplinary applications.

2. PO2: Analytical Thinking

Develop analytical skills to interpret, troubleshoot, and analyze simple electronic circuits and systems.

3. PO3: Application of Concepts

Apply core principles of analog and digital electronics in solving domain-specific problems related to their major discipline.

4. PO4: Technical Skills

Gain hands-on experience with basic electronic instruments, devices, and simulation tools to reinforce theoretical knowledge.

5. PO5: Interdisciplinary Relevance

Integrate electronics knowledge with their major area of study, enabling the development of practical, real-world solutions.

6. PO6: Ethical and Social Awareness

Demonstrate awareness of ethical practices and the societal impact of electronic technologies in various fields.

7. PO7: Communication and Teamwork

Communicate technical information effectively and collaborate in team environments during lab work and mini-projects.

8. PO8: Lifelong Learning Orientation

Build a foundation for continued learning in electronics or related technologies, supporting future academic or professional growth.

Open Electives/Generic Electives:

1. PO1: Conceptual Understanding

Understand basic principles and concepts of electronics including circuit components, semiconductor devices, and elementary systems.

2. PO2: Application-Oriented Learning

Apply fundamental electronic concepts to solve simple real-world problems or tasks related to their core disciplines.

3. PO3: Skill Development

Develop basic skills in using electronic measuring instruments, simulation tools, and

assembling simple circuits.

4. PO4: Interdisciplinary Relevance

Integrate electronics with their major field of study, supporting interdisciplinary innovations and applications.

5. PO5: Problem Identification and Troubleshooting

Identify common issues in electronic systems and demonstrate logical steps for troubleshooting and correction.

6. PO6: Scientific Temper and Awareness

Cultivate a scientific mindset and appreciate the role of electronics in technological advancement and societal development.

7. PO7: Communication and Collaboration

Communicate scientific ideas effectively and participate in team-based experimental or project work.

8. PO8: Foundation for Future Learning

Build a foundational platform to pursue higher-level electronics courses or incorporate electronics into their main discipline.

Vocational and Skill Enhancement Courses:

• **PO1: Practical Competence**

Acquire hands-on skills in handling, testing, assembling, and troubleshooting electronic devices, circuits, and systems.

• **PO2: Industry Readiness**

Develop job-oriented competencies aligned with current industry needs in areas such as PCB design, embedded systems, IoT, and consumer electronics.

• **PO3: Tool and Software Proficiency**

Gain proficiency in using industry-relevant tools such as simulation software, microcontroller development environments, and diagnostic instruments.

• **PO4: Entrepreneurship and Innovation**

Apply vocational knowledge to identify local needs, propose solutions, and potentially establish small-scale or startup ventures.

• **PO5: Project-Based Learning**

Design and execute practical projects that reflect real-world problems and promote creativity, teamwork, and time management.

• **PO6: Technical Communication**

Prepare technical documentation, user manuals, and project reports and communicate effectively in professional environments.

- **PO7: Lifelong Learning and Upskilling**

Cultivate a mindset of continuous learning and skill enhancement to adapt to evolving technologies and career opportunities.

- **PO8: Social and Ethical Responsibility**

Demonstrate responsible use of electronic technologies and awareness of their ethical, environmental, and societal implications.

Ability Enhancement Courses (AEC), Indian Knowledge System (IKS), and Value Education Courses (VEC):

- PO1: Understand and appreciate the rich heritage of the Indian Knowledge System, integrating traditional wisdom with modern education.

- PO2: Develop ability enhancement skills like communication and life skills along with ethical values, social responsibility, and a strong sense of citizenship, contributing positively to society.

Field Projects/Internship/Apprenticeship/Community Engagement Projects/ On Job Training/ Internship/Apprenticeship:

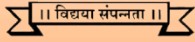
- PO1: Apply theoretical knowledge to real-world situations through field projects, internships, community engagement and On job Training for gaining practical experience and problem-solving skills.

Research Methodology and Research Project:

- PO1: Acquire research skills, including data collection, analysis, and interpretation, fostering a scientific approach to problem-solving to develop independent research projects handling capabilities.



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B. Sc (Electronics) Program Specific Outcomes (PSO)

Students graduating from B. Sc (Electronics) will able to:

PSO1: Foundational and Multidisciplinary Knowledge: Gain a comprehensive understanding of core concepts in electronics along with interdisciplinary knowledge from physics, mathematics, and computer science as per NEP's holistic approach.

PSO2: Competence in Electronic Systems and Instrumentation: Develop proficiency in designing, building, and analyzing analog and digital electronic systems, instrumentation, and control systems.

PSO3: Embedded Systems and Programming Skills: Acquire hands-on experience in microprocessors, microcontrollers, IoT, and embedded programming with an emphasis on real-world applications.

PSO4: Research and Innovation Orientation: Cultivate research aptitude through projects, internships, and innovation activities, fostering analytical thinking, creativity, and entrepreneurship.

PSO5: Employability and Skill Enhancement: Build essential skills such as circuit simulation, PCB design, soldering, testing, and use of modern electronic tools to enhance job readiness and employability.

PSO6: Communication, Ethics, and Lifelong Learning: Develop effective communication, teamwork, and ethical decision-making skills, encouraging continuous learning and responsible citizenship in a technological society.

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Faculty of Science and Technology

Three Majors in First Year structure as per NEP-2020 Approved in For AC Meeting on 18/04/2024

4- Year Multidisciplinary UG Program with DSC as a Major (4 -Year Bachelor of Science (Honors)/(Honors with Research)

Level/ Difficulty	Sem.	Faculty			Generic/ Open Elective GE/ OE	Vocational and Skill Enhancement Courses (SEC/VSC)	Ability Enhancement Course (AEC), IKS, VEC	Field Project/ RP/CC/Internship/Appre nticeship/ Community Engagement & Services	Credits	Cumulati ve Credits
		Major		Minor						
		DSC	DSE							
4.5 100-200	I	DSC1-1 (2+2)#	--		GE1/ OE1(2)	SEC1 (2)	L1-1(2) IKS (2) VEC1(2) <small>(Indian Constitution And Democracy)</small>	--	22	44 UG Certificate (44)
		DSC2-1 (2+2)#	--							
		DSC3-1 (2+2)#	--							
	II	DSC1-2 (2+2)#	--		GE2/ OE2(2)	SEC 2 (2)	L1-2(2) VEC2(2) <small>(Environmental Studies)</small>	CC1 (2)	22	
		DSC2-2 (2+2)#	--							
		DSC3-2 (2+2)#	--							
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor										
5.0/20 0	III	DSC1-3 (2+1)	---	DSC2-3 (2+1)	GE3 / OE3(2)	VSC1 (2) (DSC1) VSC2(2) (DSC2)	L2-1 (2)	CC2 (2)	22	44 UG Diploma (88)
		DSC1-4 (2+1)	---	DSC-2-4 (2+1)						
	IV	DSC1-5 (2+1)	---	DSC2-5 (2+1)	GE4/ OE4 (2)	VSC3 (2) (DSC1) VSC4(2) (DSC2)	L2 -2(2)	FP1/CEP1(2)	22	
		DSC1-6 (2+1)	--	DSC2-6 (2+1)						
Exit option: Award of UG Diploma in Major with 88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major										

5.5/300	V	DSC1-7 (3+2)	DSE1-1 (2+1) or	---	---	VSC3 (2) (Hands on Training related to DSE)	IKS 2 (2) (related to major subject)	--	22	44 UG degree (132)
		DSC1-8 (3+2)								
		DSC1-9 (3+2)	DSE1-2 (2+1)							
	VI	DSC1-10 (3+2)	DSE1-3 (2+1) or DSE1-4 (2+1)	---	---	VSC4 (2) (Hands on Training related to DSE)		FP2/CEP2/OJT1 (2)	22	
		DSC1-11 (3+2)								
		DSC1-12 (3+2)								
Total Credi ts 3 Yrs	66-8#	6	12 +8# 20	08	16	16	16	08	132	
Exit option: Award of UG degree in Major with 132 Credits OR Continue with Major										
6.0/40 0	VII	DSC1-13 (4+2)	DSE1-5 (4+2)	Research Methodology (4)	-----	---	---	---	22	44 UG Honours Degree in Main faculty (176)
		DSC1-14 (4+2)								
	VIII	DSC1-15 (4+2)	DSE1-6 (4+2)	---	-----	---	OJT/In-house Project/ Internship/ Apprenticeship (4)	22		
		DSC1-16 (4+2)								
Total 4 Yrs	90-8#	18	16+8#	08	16	16	16	12	176	
Award of Bachelor of Science Honors., (B.Sc. Honors.) degree with Major and Minor (176 credits)										

OR

6.0/40 0	VII	DSC1-13 (4)	DSE1-5 (4)	Research Methodology (4)	-----	----	----	Research Project (6)	22	44 UG Honours with research Degree in Main faculty (176)
		DSC1-14 (4)								
	VIII	DSC1-15 (4+2)	DSE1-6 (4)	----	-----	----	Research Project (6)	22		
		DSC1-16 (4+2)								
Total 4 Yrs		86-8#	14	16+8#	08	16	16	20	176	

#Out of the three major courses in the first year, one major (comprising 4 credits for the 1st semester and 4 credits for the 2nd semester) will transition into a minor starting from the second year. Consequently, 8 credits will be reallocated from the major course credit count and added to the minor credit count, thereby meeting the requisite credit criteria for the minor as stipulated in the guidelines.

Scheme of Marking and Credit as per NEP Structure

Semester	Verticals	Course Name	Scheme of Marking			Period/Week		Credits
			UA	CA	Total	Theory	Practical	
V	DSC 1-7	Linear Integrated Circuits and Applications	45	30	75	3	0	3
	DSC 1-8	Fundamentals and Programming of 8051 Microcontroller	45	30	75	3	0	3
	DSC 1-9	Fundamentals of Sensors and Transducers	45	30	75	3	0	3
	DSE 1-1 or DSE 1-2	Electronics Communication OR Fundamentals of VHDL	30	20	50	2	0	2
	IKS	Evolution of Electronics	30	20	50	2	0	2
	Practical on DSC 1-7	Electronics Practical LAB 7 (based on DSC 1-7)	30	20	50	0	4	2
	Practical on DSC 1-8	Electronics Practical LAB 8 (based on DSC 1-8)	30	20	50	0	4	2
	Practical on DSC 1-9	Electronics Practical LAB 9 (based on DSC 1-9)	30	20	50	0	4	2
	Practical on DSE 1-1 or DES 1-2	Electronics Practical LAB 5 on DSE 1-1 or DSE 1-2	15	10	25	0	2	1
	VSC -3	VHDL LAB (Hands on Training related to DSE)	30	20	50	0	4	2
	Total		330	220	550	13	18	22

Semester	Verticals	Course Name	Scheme of Marking			Period/Week		Credits
			UA	CA	Total	Theory	Practical	
VI	DSC 1-10	Power Electronics devices and Applications	45	30	75	3	0	3
	DSC 1-11	Embedded System Design	45	30	75	3	0	3
	DSC 1-12	Electronics Instrumentation	45	30	75	3	0	3
	DSE 1-3 or DSE 1-4	Modern Communication OR Fundamentals of LabVIEW.	30	20	50	2	0	2
	FP	Field Project	30	20	50	0	4	2
	Practical on DSC 1-10	Electronics Practical LAB 10 (based on DSC 1-7)	30	20	50	0	4	2
	Practical on DSC 1-11	Electronics Practical LAB 11 (based on DSC 1-8)	30	20	50	0	4	2
	Practical on DSC 1-12	Electronics Practical LAB 12 (based on DSC 1-9)	30	20	50	0	4	2
	Practical on DSE 1-3 or DES 1-4	Electronics Practical LAB 6 on DSE 1-3 or DSE 1-4	15	10	25	0	2	1
	VSC -4	LabVIEW Programming. (Hands on Training related to DSE)	30	20	50	0	4	2
	Total		330	220	550	11	22	22

Total Marks of TY B.Sc. 1100 Total Credit: 44



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B.Sc. III: Semester V

Vertical: DSC 1-7

Course Code:

Course Name: Linear Integrated Circuits and Applications

Teaching Scheme			Examination Scheme		
Credit: 03	Theory Periods: 30	Lectures: 03 hours / per week	Total Marks 75	UA: 45 marks	CA: 30 marks

Course Preamble

This course is designed as a major paper focusing on the fundamentals and applications of operational amplifiers and analog electronic systems. It consists of two comprehensive units aimed at developing a strong understanding of op-amp characteristics, signal processing circuits, waveform generation, active filters, and Phase-Locked Loop (PLL) systems.

In Unit 1, students explore the internal structure and characteristics of operational amplifiers, including ideal and practical parameters and configurations. The unit emphasizes linear and non-linear applications such as amplifiers, integrators, differentiators, comparators, waveform shaping circuits, and precision rectifiers using standard ICs like 741.

Unit 2 introduces students to waveform generation techniques and active filtering methods. It covers oscillators, Multivibrator, and triangular wave generators, along with the design and classification of active filters such as low-pass, high-pass, band-pass, and band-stop filters. The unit also provides insight into PLL systems, their working principles, and applications in frequency synthesis, modulation, and signal conversion using ICs like 565 and LM331.

This course provides a strong foundation for advanced studies in analog circuit design, communication systems, instrumentation, and electronic signal processing applications.

Course Objectives

- To introduce the fundamental concepts of operational amplifiers, including their block diagram, equivalent circuit, ideal characteristics, and parameters such as input offset voltage, bias current, CMRR, and slew rate.
- To develop the ability to analyze and design linear op-amp circuits such as inverting, non-inverting amplifiers, voltage followers, summing amplifiers, differential amplifiers, integrators, and differentiators.
- To explain the working and applications of non-linear op-amp circuits including comparators, zero crossing detectors, Schmitt triggers, precision rectifiers, clippers, clampers, and sample-and-hold circuits.

- To enable students to understand and design waveform generators such as phase shift oscillators, Wien bridge oscillators, astable and monostable Multivibrator, and triangular wave generators.
- To provide knowledge of active filters, including their advantages, classification (LPF, HPF, BPF, BSF), and the design of second-order Butterworth filters.
- To introduce the principles and applications of Phase-Locked Loop (PLL), Voltage Controlled Oscillators (VCO), and converters such as voltage-to-frequency and frequency-to-voltage converters.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to define and explain the structure, characteristics, and specifications of operational amplifiers and their parameters.
- CO2 (Understanding – L2): Students will be able to describe the working principles of linear and non-linear op-amp circuits and interpret their behavior in different configurations.
- CO3 (Applying – L3): Students will be able to design and implement linear op-amp circuits such as amplifiers, integrators, and differentiators for practical applications.
- CO4 (Applying – L3): Students will be able to design and analyze non-linear op-amp circuits including comparators, rectifiers, and waveform shaping circuits.
- CO5 (Analyzing – L4): Students will be able to analyze waveform generators, Multivibrator, and active filters for desired frequency and signal responses.
- CO6 (Evaluating – L5): Students will be able to evaluate the performance of PLL systems, VCOs, and converters and apply them in communication and signal processing applications.

Syllabus

Unit 1: Operational Amplifier fundamentals and Applications

1.1 Block diagram and Parameters: Block diagram and equivalent circuit of op-amp, Ideal characteristics, Open-loop and closed-loop configuration and need Op-amp parameters: Input offset voltage, Input bias current, Input impedance, Output impedance, CMRR, Slew rate, Specifications of IC 741.

1.2 Linear applications: Concept of virtual ground, Inverting amplifier, Non-inverting amplifier, Voltage follower, summing amplifier, differential amplifier, Integrator and differentiator.

1.3 Non-linear applications: Comparator and zero crossing detector, Schmitt trigger, Precision rectifier (half and full wave), Clippers and clampers, Sample and hold circuit.

Unit 2: Waveform Generators, Active Filters and PLL Applications

2.1 Waveform generators: Phase shift oscillator, Wien bridge oscillator, Astable and Monostable multi-vibrator, Triangular wave generator.

2.2 Active filters: Advantages of active filters, Classification- LPF, HPF, BPF, BSF. Second order Butterworth low pass and high pass filters.

2.3 PLL and converters: VCO, Block diagram and working principle of PLL,

Features of IC 565, Applications of PLL, Frequency multiplier, FM demodulator, Voltage to Frequency (V-F) and Frequency to Voltage (F-V) converters (LM331).

Reference Book

1. Integrated Circuit (New Edition) – K. R. Botkar 10th Edition Khanna Publication.
2. Integrated Electronics – Millman and Halkies (MGH)
3. Linear Integrated Circuit – D Roy Choudhari, Shail Jain (Wiley Eastern Ltd)
4. Op-Amps and Linear Integrated Circuits – Ramakant Gaikwad (PHI)



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B.Sc. III: Semester V

Vertical: DSC 1-8

Course Code:

Course Name: Fundamentals and Programming of 8051

Microcontroller

Teaching Scheme			Examination Scheme		
Credit: 03	Theory Periods: 30	Lectures: 03 hours / per week	Total Marks 75	UA: 45 marks	CA: 30 marks

Course Preamble

This course is designed as a major paper focusing on the fundamentals and programming of the 8051 microcontrollers. It consists of two comprehensive units aimed at developing a strong understanding of microcontroller architecture, instruction set, and assembly language programming for embedded system applications.

In Unit 1, students explore the architecture and features of the 8051 microcontrollers, including memory organization, general purpose registers, special function registers, I/O ports, timers, interrupts, and serial communication. The unit also covers the instruction set of 8051, addressing modes, and classification of instructions, along with the concept of stack and subroutines for efficient program execution.

Unit 2 introduces students to assembly language programming of the 8051 microcontrollers. It focuses on developing programs for data transfer, arithmetic and logical operations, branching, and I/O interfacing. The unit also emphasizes programming of timers, counters, interrupts, and serial communication, including baud rate generation and interfacing with external devices using standards such as RS-232.

This course provides a strong foundation for advanced studies in embedded systems, microcontroller-based system design, and real-time applications.

Course Objectives

- To introduce the fundamental concepts of microcontrollers and explain the architecture and features of the 8051 microcontrollers, including memory organization, registers, I/O ports, timers, interrupts, and serial communication.
- To develop the understanding of the instruction set of 8051, including addressing modes and classification of instructions such as data transfer, arithmetic, logical, branch control, and Boolean instructions.
- To enable students to write and analyze assembly language programs for data transfer, arithmetic operations, logical operations, branching, looping, and I/O port interfacing.

- To provide knowledge of timer and counter programming in 8051, including different modes of operation, time delay generation, and waveform generation.
- To introduce the concepts of interrupt programming, including handling of internal and external interrupts using assembly language programs.
- To develop an understanding of serial communication in 8051, including RS-232 standard, baud rate generation, and programming for serial data transmission and reception.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to define and explain the architecture, features, and components of the 8051 microcontrollers, including memory organization, registers, and I/O ports.
- CO2 (Understanding – L2): Students will be able to describe the instruction set, addressing modes, and execution of instructions in the 8051 microcontrollers.
- CO3 (Applying – L3): Students will be able to develop assembly language programs for data transfer, arithmetic, logical operations, branching, looping, and I/O port interfacing.
- CO4 (Applying – L3): Students will be able to design and implement programs using timers and counters for delay generation and waveform generation.
- CO5 (Analyzing – L4): Students will be able to analyze and implement interrupt handling mechanisms for both internal and external interrupts in 8051 systems.
- CO6 (Evaluating – L5): Students will be able to evaluate and implement serial communication using the 8051 microcontrollers, including baud rate configuration and data transmission/reception.

Syllabus

Unit 1: Architecture and Instruction Set of 8051 Microcontroller

1.1 Architecture of Microcontroller: Comparison between Microprocessor and Microcontroller, requirement of microcontrollers, overview and features of MCS-51 family, block diagram and pin description of 8051, memory organization, general purpose registers (GPRs) and special function registers (SFRs), flags, I/O ports, study of timer/counter, interrupts, serial communication port, clock and reset circuits.

1.2 Instruction Set of 8051: Addressing modes, instruction set and execution of instructions, classification of instruction set including data transfer group, arithmetic group, logical group, branch control group, Boolean (single-bit) instructions, concept of stack and subroutine.

Unit 2: Assembly Language Programming of 8051 using Timer, Interrupt, and Serial Port.

2.1 Assembly Language Programming with 8051: Assembly language programming for data transfer, arithmetic and logical operations, branching and looping, I/O port programming and bit manipulation, time delay subroutines.

2.2 Timer and Interrupt Programming in 8051: Configuration of timers in various modes, use of timers as counters, time delay generation, square wave generation, programming of interrupts including assembly language programs for internal and external interrupt handling.

2.3 Serial Port Programming in 8051: Basics of serial communication, serial port of 8051, RS-232 standard and IC MAX232, baud rate in 8051, baud rate doubling using crystal frequency and PCON register, SBUF and SCON registers, significance of TI and RI flags, assembly language programming for serial data transmission and reception.

Reference Book

1. The 8051 microcontroller Architecture, programming and application by Kenneth J. Ayala
2. The 8051 Microcontroller and Embedded Systems, M. A. Mazadi, J. G. Mazadi, Pearson Education,
3. Microcontroller by Ajay Deshmukh



Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester V

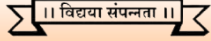
Vertical: DSC 1-9

Course Code:

Course Name: Fundamentals of Sensors and Transducers

पुण्यश्लोक अहिल्यादेवी होळकर

सोलापूर विद्यापीठ



NAAC Accredited-2022
'B++' Grade (CGPA-2.96)

Teaching Scheme			Examination Scheme		
Credit: 03	Theory Periods: 30	Lectures: 03 hours / per week	Total Marks 75	UA: 45 marks	CA: 30 marks

Course Preamble

This course is designed as a major paper focusing on the principles, classification, and applications of sensors and transducers used in modern measurement and control systems. It consists of two comprehensive units aimed at developing a strong understanding of measurement systems, various types of transducers, electronic sensors, smart sensors, and actuators.

In Unit 1, students explore the fundamentals of measurement systems, including measurands, system characteristics, and calibration techniques. The unit also introduces the concepts of sensors and transducers, their classification, and selection criteria. It further covers resistive, inductive, and capacitive transducers, along with their principles of operation and practical applications such as strain gauges, LVDT, and capacitive sensors.

Unit 2 introduces students to electronic and smart sensors used in real-world applications. It covers various transducers such as thermocouples, piezoelectric, Hall effect, and photoelectric sensors. The unit also focuses on modern smart sensors including gas sensors, temperature sensors, motion sensors, and environmental sensors. Additionally, it provides an overview of actuators such as motors, relays, and electromechanical devices used for control and automation.

This course provides a strong foundation for advanced studies in instrumentation systems, automation, robotics, IoT, and embedded system applications.

Course Objectives

- To introduce the fundamental concepts of measurement systems, including measurands, system characteristics, dynamic response, and the need for calibration.
- To develop an understanding of sensors and transducers, including their principles, classification, types, and selection criteria for various applications.
- To explain the working principles and applications of resistive, inductive, and capacitive transducers used for measuring physical parameters such as displacement, pressure, temperature, and humidity.
- To provide knowledge of electronic transducers such as thermocouples, piezoelectric, Hall effect, and photoelectric sensors used in modern instrumentation systems.

- To introduce smart sensors and their applications in real-time systems, including environmental, motion, and industrial sensing applications.
- To develop an understanding of actuators, including electromechanical and electronic devices such as motors, relays, and other control elements used in automation systems.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to define and explain the fundamental concepts of measurement systems, sensors, and transducers, including their characteristics and classifications.
- CO2 (Understanding – L2): Students will be able to describe the principles of operation and working of resistive, inductive, and capacitive transducers.
- CO3 (Applying – L3): Students will be able to apply the concepts of transducers to measure physical parameters such as temperature, pressure, displacement, and humidity.
- CO4 (Analyzing – L4): Students will be able to analyze the performance and suitability of different electronic sensors for specific applications.
- CO5 (Analyzing – L4): Students will be able to analyze and compare smart sensors and their role in modern instrumentation and IoT-based systems.
- CO6 (Evaluating – L5): Students will be able to evaluate the selection and application of actuators in control and automation systems.

Syllabus

Unit I: Fundamentals and Resistive, Inductive & Capacitive Transducers

1.1 Fundamentals of Measurement Systems: Measurand and basic needs of measurement, Block diagram of measurement system, Characteristics of measurement systems, static characteristics, dynamic characteristics and response, Need of system calibration.

1.2 Sensors and Transducers: Definition of sensor and transducer, Principle of transduction, Difference between sensor and transducer, Types of sensors, Classification of transducers, Active and passive sensors, Basic requirements and selection criteria of transducers.

1.2.1 Resistive Transducers: Principle of operation, Potentiometer (linear and rotary), Strain gauge and load cell, Resistive pressure sensor, Resistive position sensor, RTD and Thermistor, Force Sensitive Resistor (FSR), Soil moisture sensor (resistive type).

1.2.2 Inductive Transducers: Principle of operation, Variable reluctance transducer, differential transducers: LVDT, RVDT, Inductive proximity sensor, Eddy current displacement sensor.

1.2.4 Capacitive Transducers: Principle of operation, Types of capacitive transducers, Capacitor microphone, Capacitive humidity sensor, Capacitive touch sensor, Capacitive pressure sensor.

Unit II: Electronic Sensors, Smart Sensors and Actuators

2.1 Electronic Transducers: Thermocouple, Piezoelectric transducer, Hall effect transducer, Photoelectric transducers: LDR, Photovoltaic cell, Photodiode, Phototransistor, Pyrometers, Ultrasonic sensor, Infrared sensor,

2.2 Smart Sensor: Gas sensor: MQ-2, N26, Air Quality (VOC) Sensor: (CCS811), Hall effect Sensor: A3144, Temperature sensors: LM35, DHT11 / DHT22, , PIR motion sensor: HC-SR501, Pressure sensor: BMP180 Light intensity sensor: BH1750/BME280, Accelerometer and Gyroscope sensor: MPU6050, color sensor: TCS3200, Capacitive soil moisture sensor, CCS811

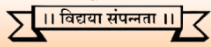
2.3 Actuators: Electromagnetic relay, Solenoid, Opto-couplers, DC motor, Servo motor, Stepper motor, Brushless DC motor, Linear actuator, Solid State Relay, Piezoelectric actuator, Shape Memory Alloy actuator

Reference Book

1. A Course in Electrical and Electronics Measurements and Instrumentation by A K Sawhney, Dhanpat Rai Publication.
2. Electronic Instrumentation by K.S. Kalsi, TMH Publication.
3. Sensors and Transducers by KV Gitapathi, Center: Technical Coordination.
4. Instrumentation devices and systems, CS Rangan, JR Sharma and VSV Mani, MGH.
5. Smart sensors from datasheet (LM35, N26, PIR)
6. Basic Electronics – B L Thereja S Chand.



पुण्यश्लोक अहिल्यादेवी होळकर
सोलापूर विद्यापीठ



NAAC Accredited-2022
'B++' Grade (CGPA-2.96)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester V

Vertical: DSE 1-1 (Discipline Specific Elective-1)

Course Code:

Course Name: Electronics Communication

Teaching Scheme			Examination Scheme		
Credit: 02	Theory Periods: 30	Lectures: 02 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This course is designed as a discipline-specific elective focusing on the principles and applications of electronic communication systems. It consists of two comprehensive units aimed at developing a strong understanding of communication fundamentals, modulation techniques, antennas, propagation mechanisms, and receiver systems.

In Unit 1, students explore the basics of communication systems, including their need, elements, and types. The unit also covers the impact of noise on communication systems and introduces various modulation and demodulation techniques. It includes detailed study of analog modulation methods such as amplitude modulation (AM) and frequency modulation (FM), along with basic concepts of digital modulation techniques.

Unit 2 introduces students to antenna fundamentals and radio wave propagation. It covers antenna parameters, types of antennas, and their applications. The unit also focuses on radio receivers, including the superheterodyne principle and block diagrams of AM and FM receivers. Additionally, it provides an introduction to television systems, including transmission, reception, and basic concepts of color television.

This course provides a strong foundation for advanced studies in communication engineering, wireless systems, broadcasting, and modern digital communication technologies.

Course Objectives

- To introduce the fundamental concepts of electronic communication systems, including their elements, types, and modes of communication.
- To develop an understanding of noise in communication systems and its effect on signal quality and system performance.
- To explain the principles of modulation and demodulation techniques, including amplitude modulation (AM), frequency modulation (FM), and basic digital modulation methods.

- To provide knowledge of antenna fundamentals, radiation patterns, and different types of antennas used in communication systems.
- To introduce the concepts of radio wave propagation, including ground wave, space wave, and sky wave propagation.
- To develop an understanding of radio receivers and television systems, including superheterodyne receivers and basic television transmission and reception.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to define and explain the basic concepts of communication systems, including elements, types, and modes of communication.
- CO2 (Understanding – L2): Students will be able to describe the effects of noise and analyze signal-to-noise ratio in communication systems.
- CO3 (Applying – L3): Students will be able to apply the principles of modulation and demodulation techniques in communication systems.
- CO4 (Analyzing – L4): Students will be able to analyze the performance and characteristics of antennas and different propagation methods.
- CO5 (Analyzing – L4): Students will be able to analyze the working of radio receivers based on the super heterodyne principle.
- CO6 (Evaluating – L5): Students will be able to evaluate television systems and communication techniques for effective signal transmission and reception.

Syllabus

Unit 1: Fundamentals of Communication and Modulation Techniques

1.1 Introduction to Communication System: Introduction, need and importance of communication systems, elements of electronic communication system, types of communication systems (analog and digital), concept of simplex, half-duplex, and full-duplex communication.

1.2 Noise in Communication: Types of noise, signal-to-noise ratio (S/N), noise figure, effect of noise on communication systems.

1.3 Modulation and Demodulation Techniques: Need and types of modulation.

1.3.1 Analog Modulation: Amplitude Modulation (AM): Principle, mathematical expression, modulation index, power distribution, frequency spectrum, concepts of DSB, SSB, and VSB. Frequency Modulation (FM): Principle, mathematical expression, modulation index, frequency spectrum, sidebands.

1.3.2 Digital Modulation (Basic Concepts): Introduction to PAM, PWM, PPM, PCM, ASK, FSK, TDM and FDM.

1.4 Demodulation Techniques: Demodulation of AM and FM (Envelope detector and Ratio detector).

Unit 2: Antenna, Propagation, and Communication Systems

2.1 Antenna Fundamentals: Principle of antenna, radiation pattern, antenna parameters, evaluation of ($\lambda/2$) antenna (without mathematical treatment), types of antennas: Yagi and Parabolic antennas (radiation pattern, frequency range, applications).

2.2 Radio Wave Propagation: Principle, types of propagation: ground wave, space wave, sky wave, concept of skip distance and virtual height.

2.3 Radio Receivers: Characteristics of receivers, super heterodyne principle, block diagram of AM and FM receivers.

2.4 Television Systems: Concept and block diagram of black and white television transmission and reception, interlaced scanning, television standards, bandwidth requirement, VSB, composite video signal, introduction to color television.

Reference Book

1. Principle of Communication Engineering by Anokh Singh, S. Chand Publication.
2. Communication electronics: Principles and applications by Frenzl, 3rd edition, TMH.
3. Radio Engineering (Applied electronics Vol.-II): by G. K. Mitthal, Khanna publication.
4. Electronic Communications (4th Edition) Dennis Roddy, John Coolen.



पुण्यश्लोक अहिल्यादेवी होळकर
सोलापूर विद्यापीठ

॥ विद्यया संपन्नता ॥

NAAC Accredited-2022
'B++' Grade (CGPA-2.96)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester V

Vertical: DSE 1-2 (Discipline Specific Elective-2)

Course Code:

Course Name: Fundamentals of VHDL

Teaching Scheme			Examination Scheme		
Credit: 02	Theory Periods: 30	Lectures: 02 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This course is designed as a discipline-specific elective focusing on the fundamentals of Hardware Description Language (VHDL) and its application in digital system design. It consists of two comprehensive units aimed at developing a strong understanding of VHDL programming, combinational and sequential circuit design, and simulation practices.

In Unit 1, students are introduced to the basics of HDL and the need for VHDL in digital design. The unit covers the structure of a VHDL program, including entity declaration, architecture body, and configuration. It also includes data types, objects, and operators used in VHDL, along with different modeling styles such as behavioral and dataflow modeling. Students learn to design combinational circuits like logic gates, adders, subtractors, multiplexers, demultiplexers, encoders, and decoders using VHDL.

Unit 2 focuses on the design of sequential circuits using VHDL, including latches, flip-flops, registers, and counters. It introduces process statements, concurrency, and timing concepts in VHDL. The unit also emphasizes testbench development, simulation techniques, and design examples such as parity generators, code converters, and simple ALU design.

This course provides a strong foundation for advanced studies in digital system design, FPGA-based design, VLSI systems, and embedded hardware development.

Course Objectives

- To introduce the fundamental concepts of Hardware Description Language (HDL) and the need for VHDL in digital system design.
- To develop an understanding of the structure of VHDL programs, including entity, architecture, data types, objects, and operators.
- To enable students to model and design combinational circuits using VHDL with different modeling styles such as behavioral and dataflow modeling.
- To provide knowledge of sequential circuits, including latches, flip-flops, registers, and counters, using VHDL.

- To introduce process statements, concurrency, and timing concepts in VHDL for effective digital system design.
- To develop the ability to write testbenches, perform simulation, and implement digital design examples such as parity generators and simple ALU.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to define and explain the basic concepts of HDL and the structure of VHDL programs.
- CO2 (Understanding – L2): Students will be able to describe data types, operators, and modeling styles used in VHDL.
- CO3 (Applying – L3): Students will be able to design and implement combinational circuits using VHDL.
- CO4 (Applying – L3): Students will be able to design and implement sequential circuits such as flip-flops, registers, and counters using VHDL.
- CO5 (Analyzing – L4): Students will be able to analyze VHDL designs using process statements, concurrency, and timing concepts.
- CO6 (Evaluating – L5): Students will be able to develop testbenches, simulate, and evaluate digital system designs using VHDL

Syllabus

Unit 1: Basics of VHDL and Combinational Circuit Design

Introduction to HDL and need of VHDL, Design flow for digital system design using VHDL

Structure of VHDL program: Entity declaration, Architecture body, Configuration, Data types and objects: Signals, Variables, Constants, Standard logic types, Operators in VHDL: Arithmetic, Logical and Relational, Modeling styles: Behavioral modeling, Dataflow modeling

Design of combinational circuits using VHDL: Basic logic gates, Half and Full Adder Half and Full Subtractor, Multiplexers and Demultiplexers, Encoders and Decoders.

Unit 2: Sequential Circuits and VHDL Design Practices

Introduction to sequential circuits, Latches and Flip-Flops: SR, D, JK, and T flip-flops, Registers and Counters: Shift registers, Synchronous and asynchronous counters Process statement and concurrency in VHDL, Timing concepts in VHDL

Testbench development: Writing testbenches, Simulation concepts, Design examples using VHDL: Parity generator and checker, Code converters, Introduction to simple ALU design.

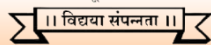
Reference Book

1. VHDL Programming by Example by Douglas L. Perry, McGraw-Hill Education 4th Edition, 2002
2. Digital Design with VHDL by Stephen Brown, Zvonko Vranesic, Pearson Education
3. Circuit Design with VHDL by Volnei A. Pedroni, MIT Press.
4. The Designer's Guide to VHDL by Peter J. Ashenden, Morgan Kaufmann Publishers



पुण्यश्लोक अहिल्यादेवी होळकर

सोलापूर विद्यापीठ



NAAC Accredited-2022
'B++' Grade (CGPA-2.96)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester V

Vertical: IKS-2

Course Code:

Course Name: Evolution of Electronics

Teaching Scheme			Examination Scheme		
Credit: 02	Theory Periods: 30	Lectures: 02 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This course is designed under the Indian Knowledge System (IKS) framework to provide a comprehensive understanding of the historical evolution and growth of electronics, with special emphasis on India's contributions and developments. It consists of two comprehensive units aimed at exploring the journey of electronics from early discoveries to modern technological advancements and the role of national policies and industries.

In Unit 1, students are introduced to the history of electronics, including early discoveries, development of vacuum tubes, semiconductors, transistors, and integrated circuits. The unit also highlights the evolution of communication systems. It further explores government policies and initiatives in India, including the role of organizations such as MeitY, and national programs like Make in India. The contributions of organizations like Indian Space Research Organization and Defense Research and Development Organization in advancing electronics and communication technologies are also discussed.

In Unit 2, students study the role of major public sector organizations such as Bharat Electronics Limited, Electronics Corporation of India Limited, Bharat Sanchar Nigam Limited, and others in the growth of the electronics sector. The unit also focuses on major technological revolutions in India, including satellite communication, telecom, mobile, and IT revolutions, along with initiatives like Digital India and key milestones in science and technology.

This course provides insights into the evolution of electronics in India and prepares students to understand the technological, industrial, and policy-driven growth of the electronics sector.

Course Objectives

- To introduce the historical evolution of electronics, including key discoveries, inventions, and the development of modern electronic devices.
- To develop an understanding of semiconductor technology, transistors, integrated circuits, and the evolution of communication systems.

- To provide knowledge of government policies, initiatives, and regulatory frameworks influencing the electronics sector in India.
- To explain the role of national organizations such as Indian Space Research Organisation and Defence Research and Development Organisation in advancing electronics and communication technologies.
- To introduce major public sector companies and their contributions to the development of electronics industries in India.
- To develop an understanding of major technological revolutions and milestones in electronics, communication, and information technology in India.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to recall the historical developments and key milestones in the evolution of electronics.
- CO2 (Understanding – L2): Students will be able to describe the development of electronic devices such as vacuum tubes, semiconductors, transistors, and integrated circuits.
- CO3 (Applying – L3): Students will be able to relate the evolution of communication systems to modern electronic applications.
- CO4 (Analyzing – L4): Students will be able to analyze the role of government policies and initiatives in shaping the electronics sector in India.
- CO5 (Analyzing – L4): Students will be able to analyze the contributions of major public sector organizations and industries in the growth of electronics.
- CO6 (Evaluating – L5): Students will be able to evaluate the impact of technological revolutions and national initiatives on the development of electronics and communication systems in India.

Syllabus

Unit 1:History of Electronics and Policies in India

Introduction, History of Electronics in India, Early discoveries and inventions, Development of vacuum tubes, Introduction to semiconductors, Transistor invention and impact, Integrated Circuits (ICs), Evolution of communication systems.
Review of Government Policies for Electronics, Introduction to projects and initiatives by MeitY (Govt. of India), Make in India and electronics sector, Role of ISRO in satellite communication, Role of DRDO in defense electronics, Electronics manufacturing policies, Standardization and regulations.

Unit-2 Electronics Industries in India and Revolutions in Electronics

Public Sector Companies: BEL, ECIL, BSNL, MTNL, BBNL, SECI, HTL, Digital India Corporation, NISG and CSC-e governance services India Ltd. (Brief description of each)
Satellite and Communication Revolution, Telecom Revolution, Mobile Revolution, IT Revolution, Railway Computerization, Digital India, Milestones of India in Science and Technology

References

Books:

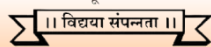
- Electronics Devices and Circuits by S. P. Bali
- Electronic Devices and Circuit Theory by Boylestad & Nashelsky –
- Principles of Electronics by V.K. Mehta –

Web Resources:

- Digital India Portal
- Official website of Ministry of Electronics and Information Technology (MeitY)
- Indian Space Research Organization (ISRO) official website
- Defense Research and Development Organization (DRDO) official website



पुण्यश्लोक अहिल्यादेवी होळकर
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Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester V

Vertical: Practical based on DSC 1-7

Course Code:

Course Name: Electronics Practical LAB VII

Teaching Scheme			Examination Scheme		
Credit: 02	Practical Periods: 40	Practical: 04 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This laboratory course is designed to provide hands-on experience in the analysis and design of linear and non-linear applications of operational amplifiers and related analog circuits. It complements the theoretical concepts covered in Linear Integrated Circuits and Applications by enabling students to implement and test various op-amp-based circuits.

The course begins with basic op-amp configurations such as inverting, non-inverting amplifiers, and voltage followers, followed by linear applications like summing amplifiers, integrators, and differentiators. It further includes non-linear applications such as comparators, precision rectifiers, and waveform shaping circuits.

The laboratory also covers waveform generation techniques, active filter design, and introduces advanced concepts such as phase-locked loops (PLL) and voltage-frequency converters. Students gain practical skills in circuit design, testing, and analysis using standard ICs like IC 741 and IC 565.

This course enhances practical understanding and prepares students for applications in analog electronics, signal processing, and instrumentation systems.

Course Objectives

- To provide hands-on experience in the design and analysis of op-amp-based circuits.
- To develop the ability to implement linear applications such as amplifiers, integrators, and differentiators.
- To enable students to design and test non-linear circuits such as comparators, rectifiers, and waveform shaping circuits.
- To introduce waveform generation techniques using op-amps and multivibrators.
- To provide practical knowledge of active filters and their frequency response.
- To familiarize students with advanced applications such as PLL and signal converters.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to identify components and explain the working of op-amp-based circuits.
- CO2 (Understanding – L2): Students will be able to describe the operation of linear and non-linear op-amp circuits.
- CO3 (Applying – L3): Students will be able to design and implement basic amplifier and signal processing circuits.
- CO4 (Applying – L3): Students will be able to implement waveform generation and filter circuits.
- CO5 (Analyzing – L4): Students will be able to analyze circuit performance using input-output characteristics and waveforms.
- CO6 (Creating – L6): Students will be able to design and test complete analog systems using op-amps and related ICs

List of Experiments

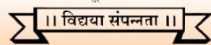
Minimum eight experiments from this group should be performed by the students.

1. Study of Op-Amp Parameters: Measurement of input offset voltage, input bias current, and slew rate.
2. Inverting and Non-Inverting Amplifier: Design and verify voltage gain and phase relationship.
3. Op-Amp as Adder and Subtractor: Design and verify summing and differential amplifier circuits.
4. Integrator and Differentiator Circuits: Design and observe output waveforms for different input signals.
5. Comparator and Schmitt Trigger: Study switching characteristics and hysteresis behavior.
6. Oscillators using Op-Amp : Design and study Phase Shift Oscillator / Wien Bridge Oscillator.
7. Multivibrator using Op-Amp: Design and study Astable and Monostable Multivibrator.
8. Active Filters: Design and study Band Pass / Band Stop filter and analyze frequency response.
9. Application of PLL (IC 565): Study PLL operation as a frequency multiplier.
10. V–F / F–V Converter (IC LM331): Study and verify voltage-to-frequency and frequency-to-voltage conversion.



पुण्यश्लोक अहिल्यादेवी होळकर

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'B++' Grade (CGPA-2.96)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester V

Vertical: Practical based on DSC 1-8

Course Code:

Course Name: Electronics Practical LAB VIII

Teaching Scheme			Examination Scheme		
Credit: 02	Practical Periods: 40	Practical: 04 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This laboratory course is designed to provide hands-on experience in programming of the 8051 microcontrollers for embedded system applications. It complements the theoretical concepts of microcontroller architecture and instruction set by enabling students to implement assembly language programs.

The course begins with the study of the 8051-microcontroller architecture, including its ports, memory organization, and registers. Students gain practical experience in assembly language programming for data transfer, arithmetic, logical, and control operations, along with time delay generation.

The laboratory further focuses on programming of timers, interrupts, and serial communication. It includes practical implementation of real-time applications such as waveform generation, switch interfacing, and communication with external devices using serial ports.

This course enhances practical skills in embedded system design and prepares students for advanced applications in microcontroller-based systems, automation, and real-time embedded solutions.

Course Objectives

- To provide hands-on experience in understanding the architecture and operation of the 8051 microcontrollers.
- To develop the ability to write and execute assembly language programs for arithmetic, logical, and control operations.
- To provide practical knowledge of timer and counter programming for delay and waveform generation.
- To introduce interrupt handling and its applications in embedded systems.
- To develop the ability to implement serial communication using the 8051 microcontrollers.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to identify the architecture, components, and features of the 8051 microcontrollers.

- CO2 (Understanding – L2): Students will be able to explain the instruction set and assembly language programming concepts of the 8051.
- CO3 (Applying – L3): Students will be able to develop assembly programs for data transfer, arithmetic, logical operations, and delay generation.
- CO4 (Applying – L3): Students will be able to analyze timer, interrupt, and serial communication programs in embedded systems.
- CO5 (Analyzing – L4): Students will be able to design and implement simple embedded system applications using the 8051 microcontrollers.

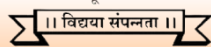
List of Experiments

Minimum eight experiments from this group should be performed by the students.

1. Data Transfer Programming: Study of data transfer instructions using assembly language with internal and external memory.
2. Arithmetic Operations (Addition and Subtraction): Write assembly programs to perform addition and subtraction operations.
3. Arithmetic Operations (Multiplication and Division): Write assembly programs to perform multiplication and division operations.
4. Logical Operations (AND and OR) : Perform bitwise and byte-wise AND and OR operations using assembly language.
5. Logical Operations (NOT and XOR): Perform bitwise and byte-wise NOT and XOR operations using assembly language.
6. Data Sorting Program: Develop assembly program for sorting data in ascending and descending order.
7. Software Delay Program: Generate time delay using software loops and subroutines.
8. Timer/Counter Programming: Generate accurate delay using timer/counter modes of 8051.
9. Waveform Generation using Timer: Generate square wave using timer mode on output pin.
10. Interrupt Programming (External/Internal): Write assembly program to handle interrupts.
11. Serial Communication Programming: Transmit and receive data using serial port (RS-232 interface).



पुण्यश्लोक अहिल्यादेवी होळकर
सोलापूर विद्यापीठ



NAAC Accredited-2022
'B++' Grade (CGPA-2.96)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester V

Vertical: Practical based on DSC 1-9

Course Code:

Course Name: Electronics Practical LAB IX

Teaching Scheme			Examination Scheme		
Credit: 02	Practical Periods: 40	Practical: 04 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This laboratory course is designed to provide hands-on experience in the study and application of various sensors and transducers used in measurement and control systems. It complements theoretical concepts by enabling students to understand the working principles, characteristics, and practical implementation of different types of transducers.

The course begins with experiments on resistive, inductive, and capacitive transducers used for measuring physical parameters such as temperature, displacement, pressure, and humidity. Students gain practical exposure to measurement techniques, calibration, and signal conditioning.

The laboratory further introduces electronic and smart sensors such as temperature sensors, light sensors, gas sensors, and motion sensors. It also includes interfacing and basic applications of these sensors in real-time systems. Additionally, students are introduced to actuators such as relays, motors, and opto-couplers used in control systems.

This course enhances practical skills in instrumentation, automation, and embedded system applications, preparing students for real-world engineering challenges.

Course Objectives

- To provide hands-on experience in understanding the working principles of various sensors and transducers.
- To develop the ability to measure physical parameters such as temperature, displacement, pressure, and light intensity.
- To enable students to analyze characteristics and performance of different transducers.
- To provide knowledge of electronic and smart sensors used in modern applications.
- To introduce interfacing concepts of sensors and actuators.
- To develop practical skills in measurement systems, calibration, and data interpretation.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to identify and explain different types of sensors and transducers.
- CO2 (Understanding – L2): Students will be able to describe the working principles of resistive, inductive, and capacitive transducers.
- CO3 (Applying – L3): Students will be able to measure physical parameters using appropriate sensors and transducers.
- CO4 (Applying – L3): Students will be able to interface sensors and actuators in basic measurement systems.
- CO5 (Analyzing – L4): Students will be able to analyze the characteristics and performance of sensors.
- CO6 (Creating – L6): Students will be able to design simple measurement and control systems using sensors and actuators.

List of Experiments

Minimum eight experiments from this group should be performed by the students.

1. Study of Potentiometer (Linear/Rotary): Measurement of displacement using resistive transducer.
2. Study of Strain Gauge / Load Cell: Measurement of force/weight and analysis of characteristics.
3. Study of RTD and Thermistor PT 100: Measurement of temperature and study of temperature sensor PT 100
4. Study of LVDT: Measurement of displacement and output characteristics.
5. Study of Capacitive Transducer: Measurement of displacement/humidity and variation in capacitance.
6. Study of Light Sensor (LDR / Photodiode: Design of Light activated turn ON/OFF circuit
7. Design of ON-OFF temperature controller: Study of Temperature Sensor (LM35 / DHT11) :
8. Study of Ultrasonic / IR Sensor: Distance measurement and obstacle detection.
9. Study of Gas Sensor (MQ-2) or Motion Sensor (PIR): Detection of gas or motion and output analysis.
10. Study of Actuators (Relay / DC Motor / Servo Motor): Control and operation of actuators using sensor signals.



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NAAC Accredited-2022
'B++' Grade (CGPA-2.96)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester V

Vertical: Practical based on DSE 1-1

Course Code:

Course Name: Electronics Practical LAB V on DSE 1-1

Teaching Scheme			Examination Scheme		
Credit: 01	Practical Periods: 30	Practical: 02 hours / per week	Total Marks 25	UA: 15 marks	CA: 10 marks

Course Preamble

This DSE 1-1 laboratory course is designed to provide hands-on experience in the fundamental concepts and applications of electronic communication systems. It complements theoretical knowledge by enabling students to implement and analyze various modulation, demodulation, and signal processing techniques used in communication.

The course begins with experiments on analog modulation techniques such as amplitude modulation (AM) and frequency modulation (FM), along with their demodulation methods. Students also gain exposure to pulse and digital modulation techniques and analyze the effects of noise on communication signals.

The laboratory further includes experiments related to antennas, signal propagation, and receiver systems. It also introduces practical aspects of communication systems such as superheterodyne receivers and basic television signal concepts.

This course enhances practical understanding of communication systems and prepares students for advanced studies in wireless communication, broadcasting, and signal processing technologies.

Course Objectives

- To provide hands-on experience in modulation and demodulation techniques used in communication systems.
- To develop the ability to analyze signal characteristics and the effect of noise in communication systems.
- To enable students to implement analog and basic digital modulation techniques.
- To introduce practical aspects of antennas and signal propagation.
- To provide knowledge of receiver systems and their characteristics.
- To develop practical skills related to communication and signal processing systems.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to identify components and basic concepts of communication systems.
- CO2 (Understanding – L2): Students will be able to describe modulation, demodulation, and noise effects in communication systems.
- CO3 (Applying – L3): Students will be able to implement AM, FM, and pulse modulation techniques.
- CO4 (Applying – L3): Students will be able to perform demodulation and analyze output signals.
- CO5 (Analyzing – L4): Students will be able to analyze receiver characteristics and signal propagation methods.
- CO6 (Creating – L6): Students will be able to design simple communication systems and signal processing setups.

List of Experiments

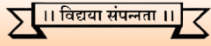
Minimum four experiments from this group should be performed by the students.

1. Study of Tuned RF Amplifier: Analysis of gain and frequency selectivity.
2. Study of Tuned IF Amplifier: Study of intermediate frequency amplification and bandwidth.
3. Amplitude Modulation (AM): Generation and observation of AM waveform and calculation of modulation index.& Demodulation of AM (Envelope Detector): Recovery of modulating signal from AM waveform.
4. Frequency Modulation (FM): Generation and analysis of FM waveform.
5. Pulse Modulation (PAM / PWM / PPM): Generation and comparison of pulse modulation techniques.
6. Study of ASK/FSK
7. Time Division Multiplexing
8. Study of PCM / Digital Communication Basics: Sampling, quantization, and encoding concepts (simulation/kit-based).
9. Study of Yagi UDA /Parabolic Antenna.
10. Study Radiation Pattern & Antenna Parameters.
11. Study of Super Heterodyne Principle in radio receiver.

OR



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Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester V

Vertical: Practical based on DSE 1-2

Course Code:

Course Name: Electronics Practical LAB V on DSE 1-2

Teaching Scheme			Examination Scheme		
Credit: 01	Practical Periods: 30	Practical: 02 hours / per week	Total Marks 25	UA: 15 marks	CA: 10 marks

Course Preamble

. This DSE 1-2 laboratory course is designed to provide hands-on experience in digital system design using VHDL (VHSIC Hardware Description Language). It complements theoretical concepts by enabling students to model, simulate, and analyze combinational and sequential digital circuits using industry-standard tools.

The course begins with the fundamentals of VHDL programming, including the structure of a VHDL program, data types, operators, and modeling styles. Students gain practical experience in designing combinational circuits such as logic gates, adders, subtractors, multiplexers, and encoders using behavioral and dataflow modeling.

The laboratory further covers sequential circuit design, including latches, flip-flops, registers, and counters. It also introduces advanced concepts such as process statements, concurrency, timing, and testbench development for simulation and verification.

This course enhances practical skills in hardware description, simulation, and digital system design, preparing students for applications in FPGA design, embedded systems, and VLSI design.

Course Objectives

- To introduce the fundamentals of VHDL and digital system design using hardware description language.
- To develop the ability to model combinational circuits using VHDL.
- To enable students to design and simulate sequential circuits such as flip-flops, registers, and counters.
- To provide knowledge of VHDL constructs such as processes, concurrency, and timing concepts.
- To introduce testbench development and simulation techniques for verification of digital circuits.
- To develop practical skills in designing digital systems using VHDL.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to identify and explain VHDL syntax, data types, and program structure.
- CO2 (Understanding – L2): Students will be able to describe combinational and sequential circuit modeling using VHDL.
- CO3 (Applying – L3): Students will be able to design and simulate combinational circuits such as adders, multiplexers, and encoders.
- CO4 (Applying – L3): Students will be able to implement sequential circuits such as flip-flops, registers, and counters.
- CO5 (Analyzing – L4): Students will be able to analyze timing behavior and verify designs using testbenches.
- CO6 (Creating – L6): Students will be able to design and simulate complete digital systems such as parity generators and simple ALUs using VHDL.

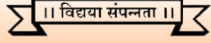
List of Experiments

Minimum four experiments from this group should be performed by the students.

1. Study of Basic Logic Gates using VHDL – 1 : AND, OR, NOT gates.
2. Study of Basic Logic Gates using VHDL – 2 : NAND, NOR, XOR, XNOR gates.
3. Half Adder and Full Adder using VHDL: Design and simulation.
4. Half Subtractor and Full Subtractor using VHDL: Design and verification.
5. Multiplexer and Demultiplexer using VHDL: Design and simulation.
6. Encoder and Decoder using VHDL: Implementation and testing.
7. Study of Flip-Flop – 1 : Clocked RS Flip-Flop & JK Flip-Flop.
8. Study of Flip-Flop – 2 : D – Flip-Flop & T Flip-Flop.
9. Study of XOR Gate as Code Converter: Binary to Gray code / Gray to Binary code.
10. Study of Parity Generator: Even parity generator/Odd parity generator.
11. Study of Counters: asynchronous/Synchronous Counter.



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Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester V

Vertical: VSC-3

Course Code:

Course Name: VHDL LAB (Hands on Training related to DSE)

Teaching Scheme			Examination Scheme		
Credit: 02	Practical Periods: 40	Practical: 04 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This laboratory course is designed to provide practical exposure to VHDL-based digital system design using simulation tools such as Xilinx Vivado, ModelSim, and GHDL. It focuses on developing hands-on skills in modeling, simulation, and verification of digital circuits using VHDL.

The course begins with the implementation of basic logic gates and code converters, followed by the design of combinational circuits such as adders, subtractors, multiplexers, demultiplexers, encoders, and decoders. It further includes the study and implementation of sequential circuits such as flip-flops, counters, and shift registers. Advanced experiments include shift counters and the design of a simple 4-bit ALU using VHDL.

This laboratory course strengthens the understanding of digital electronics and prepares students for advanced studies in FPGA design, VLSI systems, and embedded hardware development.

Course Objectives

- To introduce students to VHDL simulation tools and the basic environment for digital circuit design and verification.
- To develop the ability to design and simulate basic logic gates and code converters using VHDL.
- To enable students to implement combinational circuits such as adders, subtractors, multiplexers, demultiplexers, encoders, and decoders.
- To provide hands-on experience in designing sequential circuits including flip-flops, counters, and shift registers.
- To introduce advanced sequential circuits such as ring counters and twisted ring counters using VHDL.
- To develop the ability to design and simulate a simple 4-bit ALU for arithmetic and logical operations.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to identify and explain VHDL tools and basic digital circuit components.
- CO2 (Understanding – L2): Students will be able to describe the working of combinational and sequential circuits using VHDL models.

- CO3 (Applying – L3): Students will be able to design and simulate basic combinational circuits using VHDL.
- CO4 (Applying – L3): Students will be able to design and implement sequential circuits such as flip-flops, counters, and shift registers.
- CO5 (Analyzing – L4): Students will be able to analyze the behavior and performance of digital circuits through simulation and test cases.
- CO6 (Creating – L6): Students will be able to design and implement a complete digital system such as a 4-bit ALU using VHDL.

List of Experiments

Minimum eight experiments from group A to C should be performed by the students.

Xilinx Vivado, ModelSim, GHDL, or any other tool is used for VHDL LAB

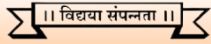
Practical's.

1. Study of Basic Logic Gates - 1 : AND, OR, NOT
2. Study of Logic Gates - 2 : NAND, NOR, XOR, XNOR
3. Study of XOR Gate as Code Converter: Binary to Gray code / Gray to Binary code
4. Study of Parity Generator: Even parity generator/Odd parity generator
5. Study of Half Adder and Full Adder
6. Study of Half Subtractor and Full Subtractor
7. Study of Multiplexers/Demultiplexers.
8. Study of Encoders/Decoders.
9. Study of Flip-Flop – 1 : Clocked SR & JK flip flops.
10. Study of Flip-Flop – 2 : D flip flop &T flip flops.
11. Study of Counters: asynchronous/Synchronous Counter.
12. Study of Shift Registers: SISO/SIPO/PISO/PIPO.
13. Study of Shift Counters: Ring/Twisted Ring counter.
14. Study of 4-bit ALU: (Addition/Subtraction/Logical operations (AND, OR, XOR))



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Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester VI

Vertical: DSC 1-10

Course Code:

Course Name: Power Electronic Devices and Applications

Teaching Scheme			Examination Scheme		
Credit: 03	Theory Periods: 30	Lectures: 03 hours / per week	Total Marks 75	UA: 45 marks	CA: 30 marks

Course Preamble

This course is designed as a major paper focusing on the fundamentals and applications of power electronic devices and circuits used in modern electrical and electronic systems. It consists of two comprehensive units aimed at developing a strong understanding of power semiconductor devices, thyristor technology, and power conversion techniques.

In Unit 1, students explore various power semiconductor devices such as power diodes, BJTs, MOSFETs, IGBTs, and SITs, including their construction, characteristics, and applications. The unit also covers thyristor (SCR) technology, including its operating principles, V-I characteristics, triggering methods, commutation techniques, and protection mechanisms. Additionally, it introduces other members of the thyristor family such as GTO and PUT.

Unit 2 introduces students to power converters and their applications. It covers controlled rectifiers, inverters, choppers, and cyclo-converters, along with their operating principles and circuit configurations. The unit also focuses on practical applications of power electronic devices such as motor speed control, battery chargers, emergency lighting systems, and concepts of UPS and SMPS.

This course provides a strong foundation for advanced studies in power electronics, electric drives, renewable energy systems, and industrial automation.

Course Objectives

- To introduce the fundamental concepts of power semiconductor devices, including their construction, characteristics, and switching behavior.
- To develop an understanding of thyristor (SCR) operation, characteristics, triggering methods, commutation techniques, and protection circuits.
- To explain the working and applications of thyristor family devices such as GTO and PUT.
- To provide knowledge of controlled rectifiers and phase control techniques used in power conversion.
- To introduce the basic principles and operation of inverters, choppers, and cyclo-converters.
- To develop an understanding of practical applications of power electronic devices in systems such as motor control, UPS, SMPS, and battery charging.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to define and explain the basic concepts of power semiconductor devices and their characteristics.
- CO2 (Understanding – L2): Students will be able to describe the operation and characteristics of thyristors and related devices.
- CO3 (Applying – L3): Students will be able to apply the principles of triggering, commutation, and protection in SCR-based circuits.
- CO4 (Analyzing – L4): Students will be able to analyze the performance of controlled rectifiers and power converter circuits.
- CO5 (Analyzing – L4): Students will be able to analyze the operation of inverters, choppers, and cyclo-converters.
- CO6 (Evaluating – L5): Students will be able to evaluate power electronic systems for applications such as motor control, UPS, and power supply systems.

Syllabus

Unit 1: Power Semiconductor Devices and Thyristor Technology

1.1 Power Semiconductor Devices: Power diode: Construction, switching characteristics, applications, effect of forward and reverse recovery time. Power BJT and MOSFET: Construction, switching characteristics, and applications. IGBT and SIT: Construction, working, and applications. Thermal considerations and heat sink for power devices.

1.2 Thyristor (SCR): Operating principle using two-transistor analogy, V-I characteristics, latching current (I_L) and holding current (I_H), advantages, disadvantages, and applications.

1.2.1 Thyristor Family Devices: GTO and PUT: Construction, working, V-I characteristics, and applications.

1.2.2 Turn-On Methods of SCR: Forward break-over triggering, dv/dt triggering, thermal triggering, light triggering, and gate triggering.

1.2.3 Triggering Circuits: R, RC, UJT, and PUT triggering circuits (operation with waveforms).

1.2.4 Turn-Off Methods of SCR: Class A, Class B, Class C, and Class D commutation techniques (working with waveforms).

Unit 2: Power Converters and Applications

2.1 Controlled Rectifiers: Concept of phase control (firing angle and conduction angle). Single-phase half-wave-controlled rectifier with resistive and inductive load. Effect of freewheeling diode. Single-phase full-wave controlled rectifier with resistive and inductive load.

2.2 Inverters: Classification of inverters, transistor inverter, series and parallel inverter using SCR, basic principle of single-phase half-bridge and full-bridge inverter. Basic idea of PWM control in inverters

2.3 Choppers: Basic concept of chopper, basic chopper circuit, step-down (buck) and step-up (boost) chopper using SCR.

2.4 Cyclo-converter: Basic concept, types (step-up and step-down),

2.5 Applications of Power Devices: DC motor speed control, flasher circuit, battery charger, emergency lighting system. Block diagram and concept of UPS and SMPS

Reference Book

1. Power Electronics- M. H. Rashid (PHI)
2. Power Electronics- Dr. P. S. Bimbra, (Khanna Publication)
3. Power Electronics- P. C. Sen (TMH)
4. Thyristor Engineering- M. S. Berde (Khanna Publication)



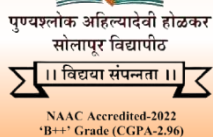
Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester VI

Vertical: DSC 1-11

Course Code:

Course Name: Embedded System Design.



Teaching Scheme			Examination Scheme		
Credit: 03	Theory Periods: 30	Lectures: 03 hours / per week	Total Marks 75	UA: 45 marks	CA: 30 marks

Course Preamble

This course is designed as a major paper focusing on the fundamentals and design of embedded systems using microcontrollers and Embedded C programming. It consists of two comprehensive units aimed at developing a strong understanding of embedded system architecture, programming techniques, and interfacing of hardware components.

In Unit 1, students are introduced to the fundamentals of embedded systems, including their definition, characteristics, architecture, and applications. The unit also covers C programming concepts required for embedded system design, followed by the fundamentals of Embedded C, including program structure, super loop concept, and programming for time delay, waveform generation, I/O interfacing, serial communication, and interrupts.

Unit 2 focuses on interfacing various input/output devices with microcontrollers, including switches, displays, relays, motors, ADCs, and DACs. It also includes case studies on designing embedded systems for real-world applications such as temperature and humidity measurement, and DC motor control using PWM techniques.

This course provides a strong foundation for advanced studies in embedded systems, IoT, robotics, and real-time system design.

Course Objectives

- To introduce the fundamental concepts of embedded systems, including architecture, characteristics, and applications.
- To develop an understanding of C programming concepts required for embedded system design.
- To enable students to write Embedded C programs for time delay generation, waveform generation, I/O interfacing, serial communication, and interrupt handling.
- To provide knowledge of interfacing various hardware devices such as switches, displays, relays, motors, ADCs, and DACs with microcontrollers.
- To introduce PWM techniques and their application in embedded system design.

- To develop the ability to design embedded systems for real-world applications such as environmental monitoring and motor control.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to define and explain the basic concepts, architecture, and applications of embedded systems.
- CO2 (Understanding – L2): Students will be able to describe C programming concepts and Embedded C structure used in embedded systems.
- CO3 (Applying – L3): Students will be able to develop Embedded C programs for time delay, waveform generation, I/O interfacing, and serial communication.
- CO4 (Applying – L3): Students will be able to interface various hardware devices such as displays, sensors, ADCs, and motors with microcontrollers.
- CO5 (Analyzing – L4): Students will be able to analyze embedded system designs using PWM techniques and interrupt handling.
- CO6 (Creating – L6): Students will be able to design and develop microcontroller-based embedded systems for applications such as temperature/humidity monitoring and motor control.

Syllabus

Unit 1. Embedded Systems Design and Embedded C

1.1 Fundamentals of ESD: Definition of an embedded system, Basic architecture of embedded system, characteristics of embedded systems, Applications of embedded systems. Minimum 89s51 based hardware for general embedded system.

1.2 Programming with the C: Introduction to C programming: Basic Structure of C program, character set, keywords and identifiers, constants and variables, concept of global declaration and local declaration, data types and data ranges, expressions and operators. Study of IO statements, Control Statements, Arrays, Loops, User`s defined functions. Simple examples.

1.3 Fundamentals of Embedded C: Basic Structure of Embedded C program, Need of Operating System, Concept of Super loop. An embedded C program for

1. Generation of Time delay with and without use of timers.
2. Square wave generation,
3. Programming of I/O port and Serial Port
4. Interrupts.

Unit 2. Interfacing of Devices and Designing of Embedded System

2.1 Devices Interfacing: Development of both Hardware and software for interfacing of Switches, Thumbwheel switch, Relays, LEDs, Transistor, Opto-coupler, Seven Segment Display, 16 X 2 LCD, Stepper Motor, ADC 0804/0809 and DAC 0808, DAC by using PWM technique.

2.2 Case Study: Designing of microcontroller 89s51 based embedded system for

1. Measurement of Temperature of an environment.
2. Measurement of humidity of an environment.
3. Designing of microcontroller 89s51 based embedded system for DC motor control using PWM technique. (Flowchart of the necessary embedded software is expected only).

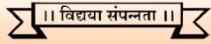
Reference Book

1. Embedded C - Michael J Point
2. The 8051 Microcontroller and Embedded Systems – Using Assembly and C Mohammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay 2nd Edition, Pearson Education
3. Microcontrollers: Theory and Applications by Ajay Deshmukh.



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'B++' Grade (CGPA-2.96)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester VI

Vertical: DSC 1-12

Course Code:

Course Name: Electronics Instrumentation.

Teaching Scheme			Examination Scheme		
Credit: 03	Theory Periods: 30	Lectures: 03 hours / per week	Total Marks 75	UA: 45 marks	CA: 30 marks

Course Preamble

This course is designed as a major paper focusing on the principles and applications of electronic instrumentation used in measurement and control systems. It consists of two comprehensive units aimed at developing a strong understanding of signal conditioning techniques, instrumentation systems, data acquisition, and modern measuring instruments.

In Unit 1, students are introduced to the fundamentals of electronic instrumentation, including the basic requirements and block diagram of measurement systems. The unit covers signal conditioning techniques such as excitation methods, grounding, shielding, and various signal conditioning components including amplifiers and display units. It also introduces programmable instrumentation amplifiers and precision amplifiers used in high-accuracy measurement systems.

Unit 2 focuses on signal transformation techniques and data acquisition systems (DAS), including single-channel and multi-channel systems and data loggers. The unit also covers various measuring instruments such as digital multimeters, oscilloscopes, signal generators, and LCR meters. Additionally, it includes recording devices and case studies of practical instruments such as pH meters, conductivity meters, and temperature measurement systems.

This course provides a strong foundation for advanced studies in instrumentation engineering, industrial automation, process control, and data acquisition systems.

Course Objectives

- To introduce the fundamental concepts of electronic instrumentation and signal conditioning techniques used in measurement systems.
- To develop an understanding of excitation methods, grounding, shielding, and various signal conditioning components such as amplifiers and display units.
- To provide knowledge of programmable instrumentation amplifiers and precision amplifiers used in accurate measurement systems.
- To explain signal transformation techniques and the working of data acquisition systems including data loggers.

- To introduce various measuring instruments such as DMM, CRO, DSO, function generators, and LCR meters.
- To develop an understanding of recording devices and practical measurement systems such as pH, conductivity, and temperature measurement instruments.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to define and explain the basic concepts of electronic instrumentation and measurement systems.
- CO2 (Understanding – L2): Students will be able to describe signal conditioning techniques and the working of various instrumentation components.
- CO3 (Applying – L3): Students will be able to apply signal conditioning and amplification techniques in measurement systems.
- CO4 (Analyzing – L4): Students will be able to analyze the operation of data acquisition systems and signal transformation techniques.
- CO5 (Analyzing – L4): Students will be able to analyze the working of electronic measuring instruments and recording devices.
- CO6 (Evaluating – L5): Students will be able to evaluate the performance of practical instrumentation systems such as pH meters, temperature measurement systems, and data acquisition setups.

Syllabus

Unit 1: Signal Conditioning and Instrumentation Fundamentals

General block diagram for electronic instrument design for measurement, Minimum requirements of instrumentation systems, Block diagram of DC and AC signal conditioning techniques, Excitation methods, Grounding techniques, Electromagnetic and electrostatic shielding, Signal Conditioning Components: Signal conditioners, Bridge amplifier, Pre-amplifiers, Instrumentation amplifier, Isolation amplifiers, Chopper amplifiers, Display units

Programmable Instrumentation Amplifiers: Need of programmable instrumentation amplifier Salient features, Block diagram and pin description of AD620, Salient features, block diagram, and pin description of precision amplifiers AD594/595.

Unit 2: Data Acquisition Systems and Measuring Instruments

Signal Transformation & DAS: Offset compensation, 4–20 mA current transmission, Ratio metric conversion, Logarithmic conversion, Data Acquisition Systems (DAS): Need of DAS, Single-channel DAS, Multi-channel DAS, Data loggers: Basic operation, Compact data loggers, Computer-based DAS Measuring Instruments: Digital multimeter (DMM), Signal and function generator, Analog CRO, Digital Storage Oscilloscope, LCR Q Meter (principle, block diagram, working)

Recording Devices: X-Y recorder, Magnetic recorder, Digital data recorder

Case Studies (Principle, Block Diagram, Working): pH meter, Conductivity meter, Temperature meter.

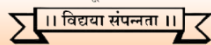
Reference Book

1. Electronic Instrumentation by K. S. Kalsi, TMH Publication.
2. Electronic Measurements by U. A. Bakshi and V. U. Bakshi, Technical Publication.
3. Instrumentation Measurement and Analysis by Nakara Choudhary (TMH)
4. Transducers Interfacing Handbook by D H Sheingold, Analog Devices Inc.
5. A Course in Electrical and Electronics Measurements and Instrumentation by A K Sawhney, Dhanpat Rai Publication.



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Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester VI

Vertical: DSE 1-3 (Discipline Specific Elective-1)

Course Code:

Course Name: Modern Communication.

Teaching Scheme			Examination Scheme		
Credit: 02	Theory Periods: 30	Lectures: 02 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This course is designed as a discipline-specific elective focusing on modern communication technologies used in optical, satellite, wireless, and computer-based communication systems. It consists of two comprehensive units aimed at developing a strong understanding of advanced communication methods and their real-world applications.

In Unit 1, students are introduced to optical and satellite communication systems. The unit covers the fundamentals of fiber optic communication, including its working principle, components, and applications. It also includes satellite communication concepts such as satellite orbits, transponders, uplink and downlink, and applications in broadcasting and communication systems.

Unit 2 focuses on wireless and computer communication systems. It includes mobile communication concepts such as cellular systems and handoff mechanisms, as well as microwave and radar communication techniques. The unit also introduces computer communication concepts, including data communication, networking, internet technologies, and wireless standards such as Bluetooth and Wi-Fi.

This course provides a strong foundation for advanced studies in wireless communication, networking, satellite systems, and modern digital communication technologies.

Course Objectives

- To introduce the fundamental concepts of optical fiber communication, including its working principle, components, and applications.
- To develop an understanding of satellite communication systems, including orbits, transponders, uplink, and downlink concepts.
- To explain the principles of mobile communication systems, including cellular concepts and handoff mechanisms.
- To provide knowledge of microwave and radar communication systems, including their components and applications.

- To introduce the fundamentals of computer communication, including data transmission, modems, and networking concepts.
- To develop an understanding of modern communication technologies such as the Internet, Bluetooth, and Wi-Fi.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to define and explain the basic concepts of optical, satellite, and wireless communication systems.
- CO2 (Understanding – L2): Students will be able to describe the working principles of fiber optic and satellite communication systems.
- CO3 (Applying – L3): Students will be able to apply the concepts of mobile and wireless communication systems in practical scenarios.
- CO4 (Analyzing – L4): Students will be able to analyze microwave and radar communication systems and their components.
- CO5 (Analyzing – L4): Students will be able to analyze computer communication systems, networking concepts, and data transmission techniques.
- CO6 (Evaluating – L5): Students will be able to evaluate modern communication technologies such as Internet, Bluetooth, and Wi-Fi for effective communication.

Syllabus

Unit 1: Optical and Satellite Communication Systems

1.1 Fiber Optic Communication: Need of light wave communication, working principle of optical fiber, definition of bit rate, baud rate, bandwidth, channel capacity, block diagram of optical fiber communication system, optical sources and detectors, fiber optic cables and types, splicing and connectors, applications of optical communication.

1.2 Satellite Communication: Satellite orbits, satellite communication system, earth station, transponders, uplink and downlink concept, applications of satellite communication (TV distribution, surveillance, satellite phones).

Unit 2: Wireless and Computer Communication Systems

2.1 Mobile Communication: Concept of cell, basic cellular system and its operation, handoff mechanism, power requirements, basic block diagram of transmitter and receiver.

2.2 Microwave Communication: Basics of microwave communication, advantages, transmission lines, waveguides and cavity resonators, microwave semiconductor devices (Gunn diode), microwave tubes (Klystron).

2.3 Radar Communication: Concept of RADAR, pulsed radar system.

2.4 Computer Communication: Digital data communication concepts, modems (basic concept), computer networks: LAN, MAN, WAN, network topologies (Star, Ring, Bus), concept of Internet, Bluetooth and Wi-Fi and their standards

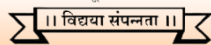
Reference Book

1. Communication Electronics – Frenzel (TMGH)
2. Analog and Digital Communication Systems – Martin S. Rodden
3. Digital and Data Communications – Martin (PHI)
4. Hand Book of Electronic Communications – Miller
5. Optical Fiber Communication - Senior
6. Mobile Communication – Shiller



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Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester VI

Vertical: DSE 1-4 (Discipline Specific Elective-2)

Course Code:

Course Name: Fundamentals of LabVIEW.

Teaching Scheme			Examination Scheme		
Credit: 02	Theory Periods: 30	Lectures: 02 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This course is designed as a discipline-specific elective focusing on the fundamentals of graphical programming using LabVIEW for virtual instrumentation and data acquisition applications. It consists of two comprehensive units aimed at developing a strong understanding of LabVIEW programming, user interface design, and real-time data processing.

In Unit 1, students are introduced to the concept of virtual instrumentation and the LabVIEW environment, including the front panel, block diagram, and icon/connector. The unit covers basic data types, controls and indicators, and the dataflow programming model. It also includes fundamental programming structures such as loops and case structures, along with the creation of simple Virtual Instruments (VIs) for mathematical operations and basic signal generation.

Unit 2 focuses on advanced LabVIEW concepts, including file handling, arrays and clusters, and graphical data representation using waveform graphs and charts. It introduces modular programming through SubVIs, error handling techniques, and basics of data acquisition systems. The unit also emphasizes application development such as data logging, signal monitoring, and debugging of LabVIEW programs.

This course provides a strong foundation for advanced studies in virtual instrumentation, data acquisition systems, industrial automation, and real-time monitoring applications.

Course Objectives

- To introduce the concept of virtual instrumentation and the LabVIEW programming environment.
- To develop an understanding of basic LabVIEW components such as front panel, block diagram, data types, and controls and indicators.
- To enable students to use dataflow programming and implement basic programming structures such as loops and case structures.
- To provide knowledge of creating Virtual Instruments (VIs) for basic mathematical operations and signal generation.

- To introduce advanced concepts such as file handling, arrays, clusters, graphs, and modular programming using SubVIs.
- To develop the ability to design simple data acquisition and data logging applications using LabVIEW.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to define and explain the basic concepts of virtual instrumentation and the LabVIEW environment.
- CO2 (Understanding – L2): Students will be able to describe data types, controls, indicators, and programming structures used in LabVIEW.
- CO3 (Applying – L3): Students will be able to develop simple Virtual Instruments (VIs) for mathematical operations and signal generation.
- CO4 (Applying – L3): Students will be able to implement loops, case structures, and modular programming using SubVIs.
- CO5 (Analyzing – L4): Students will be able to analyze data using graphs, charts, and file handling techniques in LabVIEW.
- CO6 (Creating – L6): Students will be able to design and develop data acquisition and signal monitoring applications using LabVIEW.

Syllabus

Unit 1: Introduction to LabVIEW and Basic Programming

Introduction to Virtual Instrumentation, Overview of LabVIEW environment, Front Panel, Block Diagram, and Icon/Connector, Data types in LabVIEW: Numeric, Boolean, String, Arrays and Clusters
 Basic programming concepts: Controls and Indicators, Dataflow programming model, Structures in LabVIEW: While Loop, For Loop, Case Structure, Sequence Structure, Functions and tools: Arithmetic and Logical functions, Comparison functions, Creating simple VI (Virtual Instruments): Basic mathematical operations, Signal generation (basic level).

Unit 2: Advanced LabVIEW Concepts and Applications

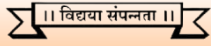
File handling in LabVIEW: Reading and writing data files, Arrays and Clusters (advanced use)
 Graphs and Charts: Waveform graph, Waveform chart, Modular programming: SubVI creation and usage, Error handling techniques, Introduction to Data Acquisition (DAQ): Basics of DAQ systems, Interfacing concepts (theoretical) Application development: Simple data logging system, Signal monitoring applications, Debugging and testing of VI.

Reference Book

1. LabVIEW for Everyone: Graphical Programming Made Easy and Fun by Jeffrey Travis, Jim Kring
Pearson Education
2. Learning with LabVIEW by Robert H. Bishop, Pearson Education
3. LabVIEW Graphical Programming Cookbook by Yik Yang, Packt Publishing
4. Introduction to LabVIEW for Scientists and Engineers by Lisa K. Wells, Jeffrey Prentice Hall



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B.Sc. III: Semester V

Vertical: Practical based on DSC 1-10

Course Code:

Course Name: Electronics Practical LAB X

Teaching Scheme			Examination Scheme		
Credit: 02	Practical Periods: 40	Practical: 04 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

The DSC 1-10 laboratory X course is designed to provide hands-on experience in the study and application of power semiconductor devices and power electronic circuits used in modern electrical and electronic systems. It complements theoretical knowledge by enabling students to understand the operation, characteristics, and practical implementation of power devices such as diodes, transistors, MOSFETs, IGBTs, and thyristors.

The course begins with experiments on power semiconductor devices and their switching characteristics. It further includes the study of thyristor (SCR) operation, triggering methods, and commutation techniques. Students gain practical knowledge of various triggering circuits and protection methods used in power electronic systems.

The laboratory also focuses on power converters such as controlled rectifiers, inverters, choppers, and cycloconverters. It includes application-based experiments like motor speed control, battery chargers, and power supply systems.

This course enhances practical skills in power electronics and prepares students for applications in industrial drives, renewable energy systems, and power control systems.

Course Objectives

- To provide hands-on experience in the operation and characteristics of power semiconductor devices.
- To develop an understanding of thyristor operation, triggering methods, and protection techniques.
- To enable students to implement and analyze controlled rectifiers and power converter circuits.
- To provide practical knowledge of inverter and chopper circuits.
- To introduce applications of power electronics such as motor control and power supplies.
- To develop skills in analyzing performance of power electronic circuits.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to identify and explain power semiconductor devices and their characteristics.

- CO2 (Understanding – L2): Students will be able to describe the operation of thyristors, triggering, and commutation techniques.
- CO3 (Applying – L3): Students will be able to implement power electronic circuits such as rectifiers and converters.
- CO4 (Applying – L3): Students will be able to operate inverter and chopper circuits for power control applications.
- CO5 (Analyzing – L4): Students will be able to analyze performance of power electronic circuits under different load conditions.
- CO6 (Creating – L6): Students will be able to design simple power electronic systems for applications such as motor control and power supplies.

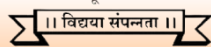
List of Experiments

Minimum eight experiments from this group should be performed by the students.

1. Study of Switching Characteristics of POWER MOSFET /POWER BJT
2. Study of V-I characteristics of SCR.
3. Study of SCR firing by UJT.
4. Study of Full Wave Controlled Rectifier.
5. Study of single-phase SCR based inverter / transistor-based inverter.
6. Study of step-down DC chopper operation.
7. Design of Light Dimmer circuit by using TRIAC / SCR
8. Study of Speed control of motor using SCR.
9. Study of flasher circuit using SCR.
10. Design and built SMPS circuit for study of load regulation.



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B.Sc. III: Semester V

Vertical: Practical based on DSC 1-11

Course Code:

Course Name: Electronics Practical LAB XI

Teaching Scheme			Examination Scheme		
Credit: 02	Practical Periods: 40	Practical: 04 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This laboratory DSC1-11 course is designed to provide hands-on experience in embedded system design using the 89S51 microcontroller and Embedded C programming. It complements theoretical concepts by enabling students to develop, test, and implement embedded applications using hardware and software integration.

The course begins with the fundamentals of embedded systems and C programming, including program structure, data types, control statements, and functions. Students gain practical experience in writing Embedded C programs for real-time applications.

The laboratory further focuses on Embedded C programming concepts such as time delay generation, waveform generation, I/O port programming, serial communication, and interrupt handling. Students also learn to interface basic hardware components with the microcontroller.

This course enhances practical skills in embedded system development and prepares students for applications in automation, IoT, and real-time control systems.

Course Objectives

- To provide hands-on experience in embedded system design using the 89S51 microcontroller.
- To develop the ability to write and execute Embedded C programs.
- To enable students to implement time delay and waveform generation techniques.
- To provide practical knowledge of I/O port and serial communication programming.
- To introduce interrupt handling in embedded systems.
- To develop skills in integrating hardware and software for real-time applications.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to identify the architecture and features of embedded systems and microcontrollers.
- CO2 (Understanding – L2): Students will be able to explain C programming concepts and Embedded C structure.

- CO3 (Applying – L3): Students will be able to develop Embedded C programs for basic operations and control structures.
- CO4 (Applying – L3): Students will be able to implement I/O interfacing, time delay, and waveform generation programs.
- CO5 (Analyzing – L4): Students will be able to analyze timer, serial communication, and interrupt-based programs.
- CO6 (Creating – L6): Students will be able to design and develop simple embedded applications using the 89S51 microcontroller.

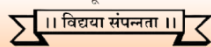
List of Experiments

Minimum eight experiments from this group should be performed by the students.

1. LED Blinking using Software Delay (Embedded C) : Generate time delay using software loops to blink LED.
2. Square Wave Generation using Timer (Embedded C): Generate square wave using timer module.
3. Interfacing of ADC with Microcontroller (Embedded C): Read analog input and display digital output.
4. Interfacing of DAC with Microcontroller (Embedded C): Generate waveforms (e.g., ramp/triangular wave).
5. Interfacing of 16×2 LCD Display (Embedded C): Display characters and messages on LCD.
6. Stepper Motor Interfacing (Embedded C): Control rotation and direction of stepper motor.
7. DC Motor Speed Control using PWM (Embedded C): Control motor speed using PWM technique.
8. Interfacing of Thumbwheel Switch and Seven Segment Display: Display input value on 7-segment display.
9. Serial Communication with PC (Embedded C): Transmit and receive data using serial port.
10. Interrupt Programming using Embedded C: Handle external/internal interrupts in embedded system.



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B.Sc. III: Semester V

Vertical: Practical based on DSC 1-12

Course Code:

Course Name: Electronics Practical LAB XII

Teaching Scheme			Examination Scheme		
Credit: 02	Practical Periods: 40	Practical: 04 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This laboratory DSC 1-12 course is designed to provide hands-on experience in electronic instrumentation and measurement systems. It complements theoretical concepts by enabling students to understand signal conditioning techniques, data acquisition systems, and the working of modern measuring instruments.

The course begins with experiments on signal conditioning methods, including amplification, filtering, grounding, and shielding techniques. Students gain practical exposure to instrumentation amplifiers and bridge circuits used for precise measurements.

The laboratory further focuses on data acquisition systems (DAS), signal transformation techniques, and transmission methods such as 4–20 mA current loops. It also includes the study and operation of various electronic measuring instruments such as digital multimeters, oscilloscopes, function generators, and LCR meters.

Additionally, students explore recording devices and practical instrumentation systems such as temperature, pH, and conductivity measurement systems.

This course enhances practical skills in instrumentation, process control, and industrial measurement systems

Course Objectives

- To provide hands-on experience in signal conditioning techniques used in instrumentation systems.
- To develop an understanding of instrumentation amplifiers and bridge circuits.
- To enable students to analyze and use data acquisition systems for measurement.
- To provide practical knowledge of electronic measuring instruments such as CRO, DSO, and DMM.
- To introduce signal transmission and transformation techniques such as 4–20 mA systems.
- To develop skills in analyzing and working with real-world instrumentation systems.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to identify components and basic concepts of electronic instrumentation systems.
- CO2 (Understanding – L2): Students will be able to describe signal conditioning and measurement techniques.
- CO3 (Applying – L3): Students will be able to use measuring instruments such as CRO, DMM, and function generators.
- CO4 (Applying – L3): Students will be able to implement basic signal conditioning and data acquisition circuits.
- CO5 (Analyzing – L4): Students will be able to analyze performance of instrumentation systems and DAS.
- CO6 (Evaluating – L5): Students will be able to evaluate practical measurement systems such as temperature and pH measurement setups.

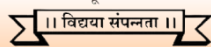
List of Experiments

Minimum eight experiments from this group should be performed by the students.

1. Study of Programmable Gain Amplifier (AD620): Measurement of gain and input-output characteristics.
2. Study of Precision Amplifier (AD595): As a signal conditioning.
3. Instrumentation Amplifier using LM324 / TL084: Design and verification of instrumentation amplifier.
4. Study of Wheatstone Bridge Circuit: Measurement of small resistance changes.
5. Study of 4–20 mA Current Loop using Signal Conditioning Circuit.
6. Study of Simple Data Acquisition System (DAS) using Op-Amp and Measuring Instruments.
7. Study of Isolation Amplifier using Opto-Coupler (PC817),
8. Study of Temperature Measurement using Sensor (LM35 / Thermistor).
9. Study of Conductivity Measurement using Resistive Method.
10. Study of Signal Filtering (Low Pass / High Pass using Op-Amp).



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Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester V

Vertical: Practical based on DSE 1-3

Course Code:

Course Name: Electronics Practical LAB VI on DSE 1-3

Teaching Scheme			Examination Scheme		
Credit: 01	Practical Periods: 30	Practical: 02 hours / per week	Total Marks 25	UA: 15 marks	CA: 10 marks

Course Preamble

The practical based on DSE 1-3 is laboratory course, designed to provide practical understanding of modern communication systems including optical, satellite, wireless, and computer communication technologies. It complements theoretical concepts by enabling students to study signal transmission, reception, and analysis using various communication techniques and instruments.

The course begins with experiments related to optical communication systems, focusing on the working of optical fibers, signal transmission characteristics, and basic components such as sources and detectors. It also introduces satellite communication concepts through block diagram analysis and system-level understanding.

The laboratory further covers wireless communication systems including mobile communication, microwave communication, and radar systems. Students gain practical exposure to signal generation, modulation techniques, and receiver characteristics.

In addition, the course includes experiments related to computer communication concepts such as data transmission, modulation techniques, and network fundamentals.

This course enhances practical skills in communication systems and prepares students for applications in telecommunications, networking, and modern wireless technologies.

Course Objectives

- To provide practical understanding of optical and satellite communication systems.
- To develop knowledge of signal transmission and reception in communication systems.
- To enable students to study modulation techniques used in modern communication.
- To introduce wireless communication concepts including mobile and microwave systems.
- To provide exposure to communication instruments and signal analysis techniques.
- To develop understanding of computer communication and networking fundamentals.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to identify components and basic concepts of modern communication systems.
- CO2 (Understanding – L2): Students will be able to explain principles of optical, satellite, and wireless communication systems.
- CO3 (Applying – L3): Students will be able to perform experiments related to signal generation, modulation, and transmission.
- CO4 (Applying – L3): Students will be able to analyze communication signals using CRO and other instruments.
- CO5 (Analyzing – L4): Students will be able to analyze performance of communication systems under different conditions.
- CO6 (Evaluating – L5): Students will be able to evaluate basic communication and networking systems and their applications.

List of Experiments

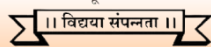
Minimum four experiments from this group should be performed by the students.

1. Data communication using OFC
2. Characterization of LASER Diode. (<https://oc-iitr.vlabs.ac.in/exp/characterization-laser-diode/>)
3. Intensity modulation of laser output through an optical fiber. (<https://oc-iitr.vlabs.ac.in/exp/intensity-modulation/>)
4. Measurement of data rate for digital optical link (<https://oc-iitr.vlabs.ac.in/exp/measurement-digital-optical/>)
5. Measurement of Numerical Aperture/Optical Power. (<https://oc-iitr.vlabs.ac.in/exp/measurement-numerical-aperture/>)
6. Study of DTMF (Dual-Tone Multi-Frequency)
7. Bluetooth Communication using mobile & Bluetooth Module.
8. Wi-Fi Communication using mobile & Wi-Fi Module.
9. Study the Characteristics of Reflex Klystron. (<https://meiitr.vlabs.ac.in/exp/reflex-klystron/>)
10. Study the Characteristics of Gunn Diode. (<https://me-iitr.vlabs.ac.in/exp/gunn-diode/>)
11. Study of Wave Guide & Cavity Resonance. (study the Basic Properties of E-plane Tee, H-plane Tee and Magic Tee. (Virtual Lab : <https://me-iitr.vlabs.ac.in/exp/plane-tee-magic-tee/>))
12. Study of FSK modulation
13. Study of Star/Ring Topology.
14. Study of AGC circuit.

OR



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B.Sc. III: Semester V

Vertical: Practical based on DSE 1-4

Course Code:

Course Name: Electronics Practical LAB VI on DSE 1-4

Teaching Scheme			Examination Scheme		
Credit: 01	Practical Periods: 30	Practical: 02 hours / per week	Total Marks 25	UA: 15 marks	CA: 10 marks

Course Preamble

The practical based on DSE 1-4 is laboratory course, designed to provide practical understanding of LabVIEW. LabVIEW is a powerful graphical programming platform widely used for data acquisition, instrument control, automation, and signal processing. This course introduces students to the fundamentals of virtual instrumentation and the LabVIEW environment, enabling them to design, develop, and debug Virtual Instruments (VIs).

The course begins with basic programming concepts such as data types, dataflow programming, and structures, and gradually progresses to advanced topics including file handling, modular programming, data acquisition, and real-world application development. Emphasis is placed on hands-on learning to develop problem-solving skills using graphical programming.

Course Objectives

- To understand the concept of virtual instrumentation and the features of LabVIEW.
- To develop basic programming skills using LabVIEW's graphical programming approach.
- To apply control structures, data types, and functions in designing simple Virtual Instruments (VIs).
- To explore advanced features such as file handling, modular programming, and error handling.
- To introduce students to data acquisition systems and their applications.
- To design and implement real-time applications such as data logging and signal monitoring systems.

Course Outcomes

- CO1 (Understanding – L2): Students will be able to explain the basic concepts of virtual instrumentation and the LabVIEW development environment.
- CO2 (Applying – L3): Students will be able to develop simple Virtual Instruments (VIs) using basic programming concepts such as data types, controls, indicators, and dataflow model.

- CO3 (Applying – L3): Students will be able to implement loops, case structures, and functions to solve basic engineering problems.
- CO4 (Applying – L3): Students will be able to use arrays, clusters, file handling, and graphs/charts for data manipulation and visualization.
- CO5 (Analyzing – L4): Students will be able to design and analyze modular programs using SubVIs and apply error handling techniques.
- CO6 (Evaluating – L5): Students will be able to develop and evaluate applications such as data logging and signal monitoring using basic data acquisition concepts.

List of Experiments

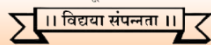
Minimum four experiments from this group should be performed by the students.

1. Study of Boolean Logical Operations (AND, OR, NOT, NOR, NAND, XOR using Boolean function in Lab view & display the output on LED's)
2. Create a simple VI to perform basic Arithmetic operations (Addition, Subtraction, Multiplication, Division).
3. Study of Basic Data types and Controls. : Creating Indicators & Controls on front panel
4. Develop a VI using loops (While Loop and For Loop) to generate and display repetitive outputs (e.g., number counting or waveform generation).
5. Design a VI using Case Structure to implement decision-making logic (e.g., even/odd checker or calculator).
6. Create a VI to generate and display signals using waveform graph/chart (e.g., sine wave, square wave).
7. Study the Arrays in LabVIEW: Create and manipulate arrays to perform operations like: Sorting and Searching
8. Study the Clusters in LabVIEW: Create cluster elements, Bundle and Unbundle operations
9. Develop a simple data logging system by writing and reading data from a file (basic file handling in LabVIEW).
10. Design any one simple system in LabVIEW.



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Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester VI

Vertical: VSC-4

Course Code:

Course Name: LabVIEW Programming. (Hands on Training related to DSE)

Teaching Scheme			Examination Scheme		
Credit: 02	Practical Periods: 40	Practical: 04 hours / per week	Total Marks 50	UA: 30 marks	CA: 20 marks

Course Preamble

This course is designed as a Vocational Skill Course (VSC) to provide hands-on training in LabVIEW programming and its applications in virtual instrumentation and data acquisition systems. It is aligned with theoretical concepts from related courses and focuses on developing practical skills through laboratory experiments.

The course introduces students to the LabVIEW environment, including the front panel, block diagram, and tool palette for creating Virtual Instruments (VIs). It covers basic programming concepts such as arithmetic operations, loops, case structures, arrays, and clusters. Students gain practical experience in implementing these concepts through various experiments.

The course further emphasizes data visualization using graphs and charts, file handling for data logging, and modular programming using SubVIs. It also includes the design and implementation of simple real-world applications such as data logging, temperature monitoring, and signal monitoring systems.

This course enhances practical skills in graphical programming and prepares students for applications in industrial automation, instrumentation, and real-time data acquisition systems.

Course Objectives

- To introduce the LabVIEW environment and tools used for creating Virtual Instruments (VIs).
- To develop the ability to implement basic programming concepts such as arithmetic operations, loops, and case structures in LabVIEW.
- To provide hands-on experience in working with arrays and clusters for data manipulation.
- To enable students to visualize data using graphs and charts for signal analysis.
- To introduce file handling techniques for data logging and storage in LabVIEW.
- To develop the ability to design modular programs using SubVIs and implement simple real-world applications.

Course Outcomes

- CO1 (Remembering – L1): Students will be able to identify and explain the LabVIEW environment and basic components of Virtual Instruments.
- CO2 (Understanding – L2): Students will be able to describe programming structures such as loops, case structures, arrays, and clusters.
- CO3 (Applying – L3): Students will be able to develop LabVIEW programs for arithmetic operations, iterative calculations, and logical decision-making.
- CO4 (Applying – L3): Students will be able to implement data visualization and file handling techniques for data logging applications.
- CO5 (Analyzing – L4): Students will be able to analyze and organize programs using modular programming concepts such as SubVI.
- CO6 (Creating – L6): Students will be able to design and develop simple real-world applications such as data logging, temperature monitoring, or signal monitoring systems using LabVIEW.

Syllabus

Experiment 1: Study the basic Arithmetic Operations: Design a VI to perform: Addition, Subtraction, Multiplication, and Division

Experiment 2: Study the Loop implementation: While Loop, For Loop, Example: Sum of numbers / Iterative calculations

Experiment 3: Study the Case Structure, Design VI using Case Structure, Example: Even/Odd number checker

Experiment 4 : Study of Basic Data types and Controls. : Creating Indicators & Controls on front panel

Experiment 5: Study the Arrays in LabVIEW: Create and manipulate arrays to perform operations like: Sorting and Searching

Experiment 6: Study the Clusters in LabVIEW: Create cluster elements, Bundle and Unbundle operations

Experiment 7: Study the use of Graphs and Charts in LabVIEW: Display data using: Waveform Graph, Waveform Chart for generate and visualize signals

Experiment 8: Study the File Handling concept in LabVIEW: Write data to file, read data from file, Example: Data logging

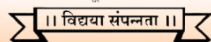
Experiment 9: Study the Creation of SubVI in LabVIEW: Convert a VI into SubVI for study the modular programming approach

Experiment 10: Design any one simple system in LabVIEW: Simple data logging system, or Temperature monitoring system (simulated) or Signal monitoring system



पुण्यश्लोक अहिल्यादेवी होळकर

सोलापूर विद्यापीठ



NAAC Accredited-2022
'B++' Grade (CGPA-2.96)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III: Semester VI

Vertical: FP

Course Code:

Course Name: Field Project

Examination Scheme

Credit: 02	Total Marks 50	UA: 30 marks	CA: 20 marks
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Course Preamble

The Field Project course is designed to provide students with practical exposure to real-world environments beyond the classroom. It enables students to apply theoretical knowledge gained during the program to solve industry, societal, or field-based problems. Through field visits, data collection, analysis, and reporting, students develop essential skills such as observation, problem-solving, teamwork, and communication.

This course emphasizes experiential learning, encouraging students to interact with industries, communities, or organizations to understand practical challenges and propose feasible solutions. It also enhances students' ability to document findings and present them effectively.

Course Objectives

- To provide hands-on experience in real-world or field-based environments.
- To bridge the gap between theoretical knowledge and practical application.
- To develop skills in data collection, analysis, and interpretation.
- To enhance problem-solving and critical thinking abilities.
- To improve communication, teamwork, and report-writing skills.
- To encourage students to propose practical and feasible solutions to real-life problems.

Course Outcomes

- CO1 (Understanding – L2): Students will be able to explain the field problem, objectives, and methodology of the selected project.
- CO2 (Applying – L3): Students will be able to apply appropriate tools and techniques for data collection and field investigation.
- CO3 (Applying – L3): Students will be able to organize and document collected data systematically.
- CO4 (Analyzing – L4): Students will be able to analyze field data to identify key issues and patterns.
- CO5 (Evaluating – L5): Students will be able to evaluate possible solutions and justify the most suitable approach for the identified problem.
- CO6 (Creating – L6): Students will be able to develop and present a comprehensive field project report with conclusions and recommendations.

Expected Activities (Examples):

- a) Energy audit of homes, institutions, or industries
- b) Study of solar energy systems and efficiency analysis
- c) Environmental monitoring (air, water, noise pollution measurement)
- d) Battery management system
- e) Study of electrical energy consumption and conservation methods
- f) Weather parameter measurements (temperature, humidity, pressure)
- g) Any applied electronics aspect such as renewable energy, electronics applications, or community-based technology solutions

Report Structure / Format:

Title Page

Certificate

Index

Introduction (about Field Project and objectives)

Methodology:

Study area description

Instruments used

Experimental procedures

Data collection methods

Results:

Observations

Tables and graphs

Photographic evidence

Data interpretation

Discussion and Conclusion

References

Evaluation Methods:

College Assessment: Attendance and participation, Field diary and observations, and

Practical involvement

University Assessment: Report submission, Presentation, and Viva-voce

BSc III Sem V and VI
Electronics
Pattern of Examination

Pattern of Examination:

For 3 credits (75 Marks)

UA+CA= 45 Marks + 30 Marks = 75 Marks

For 2 credits (50 Marks)

UA+CA = 30 Marks +20 Marks = 50 Marks

Passing Criteria:

For 3 credits (75 Marks)

UA 18 out of 45

CA 12 out of 30

For 2 credits (50 Marks)

UA 12 out of 30

CA 08 out of 20



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॥ विद्या संपन्नता ॥

NAAC Accredited-2022
'B++' Grade (CGPA-2.96)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

B.Sc. III (Electronics)

Marks Distribution and Nature of Question Paper

Nature of Question Paper for University Assessment (UA)

Total Marks for UA: **45**

Total Questions: **05**

Marks of each question: **09**

Que.1. A) Multiple Choice Question (with four options) (5)

- | | | | |
|--------|-----|-----|-----|
| 1) (a) | (b) | (c) | (d) |
| 2) (a) | (b) | (c) | (d) |
| 3) (a) | (b) | (c) | (d) |
| 4) (a) | (b) | (c) | (d) |
| 5) (a) | (b) | (c) | (d) |

B) True or False / One Sentence / One word (4)

- 1)
- 2)
- 3)
- 4)

Que.2. Attempt any Three of the following (9)

- 1)
- 2)
- 3)
- 4)

Que.3. A) Attempt any One of the following (4)

- 1)
- 2)

Que.3. B) Attempt any One of the following (5)

- 1)
- 2)

Que.4. Attempt any One of the following (5)

- 1)
- 2)

Que.4. Attempt any One of the following (4)

- 1)
- 2)

Que.5. Attempt any One of the following (9)

- 1)
- 2)

Marks Distribution for College Assessment (CA) Theory DSC (30 Marks)

Marks for CA	Internal Test	Industrial visit/ Industrial Case Study / Visit to industrial exhibition / Participation in Conference / Workshop / Seminars	Home Assignments:
30	10	10	10

Marks Distribution for College Assessment (CA) Theory DSE (20 Marks)

Marks for CA	Internal Test	Home Assignments:
20	10	10

Practical Papers

Three Practical's of DSC (Discipline Specific Core) for each semester. **One** practical of DSE (Discipline Specific Elective) for each semester. **One** practical of VSC (Vocational Skill Course) for each semester. **One** Field Project at Semester 6

Marks Distribution for University Assessment (UA) for Practical (30 Marks)

Head	Marks Allotted
Circuit diagram	06
Circuit Connection	06
Observation / Program writing	06
Calculation, graph / Program execution	06
Result	03
Oral	03
Total	30

Marks Distribution for Field Project (UA) for Practical (30 Marks)

Head	Marks Allotted
Theme or Idea	03
Working Model	10
Project Report	07
Oral and Presentation	10
Total	30

Marks Distribution for College Assessment (CA) for Practical (20 Marks)

Head	Marks Allotted
Certified Journal	05
Internal Practical Test	10
Home Assignment	05
Total	20