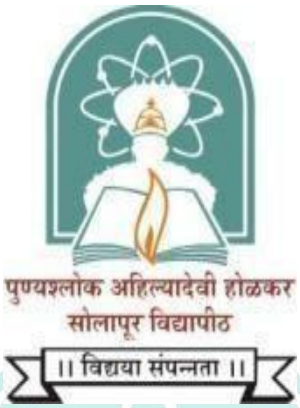
Punyashlok Ahilyadevi Holkar Solapur University, Solapur



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. II (Sem. III & IV)

(Syllabus to be implemented from June 2025)

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.

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, Diary 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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Nep 2020 Compliant Curriculum
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 discipline.
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.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science & Technology

Nep 2020 Compliant Curriculum

B. Sc (Electronics)

Program Specific Outcomes (PSOs)

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.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
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	Vocational and Skill Enhancement Courses (SEC/VSC)	Ability Enhancement Course (AEC), IKS, VEC	Field Project/ RP/CC/Internship/Apprenticeship/ Community Engagement & Services	Credits	Cumulative Credits
		Major		Minor						
		DSC	DSE		GE/ OE					
4.5 100-200	I	DSC1-1 (2+2)#	--		GE1/ OE1(2)	SEC1 (2)	L1-1(2) IKS (2) VEC1(2) (Indian Constitution)	--	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) (Environmental Studies)	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										
5.0/200	III	DSC1-3 (2+1)	---	DSC2-3 (2+1)	GE3 / OE3(2)	VSC1 (2) (DSC1)	L2-1 (2)	CC2 (2)	**22**	**44 UG Diploma (88)**
		DSC1-4 (2+1)	---	DSC-2-4 (2+1)		VSC2(2) (DSC2)				
	IV	DSC1-5 (2+1)	---	DSC2-5 (2+1)	GE4/ OE4 (2)	VSC3 (2) (DSC1)	L2 -2(2)	FP1/CEP1(2)	22	

		DSC1-6 (2+1)	--	DSC2-6 (2+1)		VSC4(2) (DSC2)					
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) DSC1-8 (3+2) DSC1-9 (3+2)	DSE1-1 (2+1) or DSE1-2 (2+1)	----	---	VSC3 (2) (Hands on Training related to DSE)	IKS 2 (2) (related to major subject)	--		22	**44 UG degree (132)**
	VI	DSC1-10 (3+2) DSC1-11 (3+2) DSC1-12 (3+2)	DSE1-3 (2+1) or DSE1-4 (2+1)	----	---	VSC4 (2) (Hands on Training related to DSE)		FP2/CEP2/OJT1 (2)		22	
	Total Credits 3 Yrs	**66-8#**	**6**	**12 +8#** **20**	**8**	**16**	**16**	**8**		**132**	
Exit option: Award of UG degree in Major with 132 Credits OR Continue with Major											
6.0/400	VII	DSC1-13 (4+2) DSC1-14 (4+2)	DSE1-5 (4+2)	Research Methodology (4)	---	----	----	---		22	**44 UG Honours Degree in Main faculty (176)**
	VIII	DSC1-15 (4+2) DSC1-16 (4+2)	DSE1-6 (4+2)		---	-----	----	OJT/In-house Project/ Internship/ Apprenticeship (4)		22	
	Total 4 Yrs	**90-8#**	**18**	**16+8#**	**8**	**16**	**16**	**12**		**176**	
Award of Bachelor of Science Honors., (B.Sc. Honors.) degree with Major and Minor (176 credits)											
OR											
6.0/400	VII	DSC1-13 (4)	DSE1-5	Research		------	----	----	Research Project (6)	22	

		DSC1-14 (4)	(4)	Methodology (4)						**44 UG Honours with research Degree in Main faculty (176)**
	VIII	DSC1-15 (4+2) DSC1-16 (4+2)	DSE1-6 (4)		----	-----	----	Research Project (6)	22	
	Total	**86-8#**	**14**	**16+8#**	**8**	**16**	**16**	**20**	**17**	
	4 Yrs								**6**	

#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.

Level/ Difficulty	Semester	Faculty		GE/ OE	Vocational and Skill Enhancement Courses (SEC/VSC)	Name of the paper	**Credits**	Marks
		Major	Minor					
	III	DSC1-3	-	-	-		2	50
		DSC1-4	-		-		2	50
		Practical's related to DSC 1-3 and DSC 1-4	-			Electronics Practicals Lab-III	2	50
			DSC2-3				2	50
			DSC-2-4				2	50
			Practical's related to DSC 2-3 and DSC 2-4			Electronics Practicals Lab-IV	2	50
				GE3 / OE3			2	50
					VSC1 (Major)	Hands on Training related to Major	2	50
					VSC2 (Minor)	Hands on Training related to Minor	2	50
5.0/200	IV	DSC1-5					2	50
		DSC1-6					2	50
		Practical's related to DSC 1-5 and DSC 1-6				Electronics Practicals Lab-V	2	50
			DSC2-5				2	50
			DSC-2-6				2	50
			Practical's related to DSC 2-5 and DSC 2-6			Electronics Practicals Lab-VI	2	50
				GE4/ OE4			2	50
					VSC3 (Major)	Hands on Training related to Major	2	50

					VSC4 (Minor)	Hands on Training related to Minor	2	50

Abbreviations:

OE: Generic/ Open Electives	**OJT:** On Job Training
VSEC: Vocational Skill and Skill Enhancement Courses	**FP:** Field projects
	CC: Co-curricular Courses
VSC: Vocational Skill Courses	**RP:** Research Project
SEC: Skill Enhancement Courses	**IKS:** Indian Knowledge System
AEC: Ability Enhancement Courses	

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B. Sc. II (Electronics) Semester-III** **Vertical: DSC 1-3** **Course Code:** **Course Name: Digital Electronics**
• **Teaching Scheme** **Credit: 02, Theory: 30 Periods** **Lectures:02 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Preamble

This course is designed as a major paper DSC1-3 serves as a foundational subject in digital electronics. It consists of two comprehensive units aimed at developing a solid understanding of combinational and sequential logic circuits, as well as semiconductor memory and data conversion technologies.

In Unit 1, students explore the principles and practical implementation of combinational and sequential circuits using standard digital ICs. The unit covers multiplexers, demultiplexers, encoders, decoders, flip-flops, counters, and shift registers—emphasizing timing diagrams and functional analysis.

Unit 2 introduces students to the architecture and classification of various semiconductor memories, both volatile and nonvolatile, including flash memory. It also provides in-depth knowledge of data converters, such as DACs and ADCs, focusing on conversion techniques and practical applications using ICs.

This course lays the groundwork for advanced studies in digital system design, embedded systems, and microprocessor-based applications.

Course Objectives

• To introduce the fundamental concepts of combinational and sequential logic circuits and explain their differences and applications in digital systems.

• To develop the ability to design and analyze combinational logic components such as multiplexers, demultiplexers, encoders, decoders, and BCD to 7-segment display drivers using standard ICs.

• To explain the working and application of flip-flops, including RS, D, JK, T, and Master-Slave configurations, with emphasis on their timing diagrams and usage in sequential circuits.

• To enable students to design and understand the operation of asynchronous and synchronous counters, combination counters, and various types of shift registers using standard ICs and timing diagrams.

• To provide knowledge of memory systems, including volatile, nonvolatile, and flash memory, along with their classification, characteristics, and real-world applications.

• To introduce the principles and functioning of data converters, including DACs and ADCs, and analyze their specifications and operation using ICs such as 0808 (DAC) and 0804 (ADC).

Course Outcomes (COs): After successful completion of this course, students will be able to:

- CO1: Understand the concepts of combinational and sequential logic circuits, including their types and differences.
- CO2: Analyze and implement combinational logic components such as multiplexers, demultiplexers, encoders, decoders, and BCD to 7-segment decoders, using standard ICs like 74153, 74148, 74138, and 7447.
- CO3: Explain the working and timing diagrams of various flip-flops (RS, Clocked RS, D, JK, JK-MS, T) and their applications in sequential circuits.
- CO4: Design and evaluate different types of counters (asynchronous, synchronous, combination)

and shift registers (SISO, SIPO, PISO, PIPO), including ICs like 7490 and 7495, using timing diagrams.

- CO5: Understand the architecture, classification, and operation of semiconductor memories, including volatile, nonvolatile, and flash memory technologies.
- CO6: Describe and analyze the working principles, techniques, and IC implementation of Digital to Analog Converters (DAC) and Analog to Digital Converters (ADC), such as IC 0808 and IC 0804, and evaluate their specifications and applications.

Unit 1	**Combinational and Sequential logic** **Periods: 15, Weightage: 15 Marks (UA)**

Concept of combinational and sequential logic circuit, types, comparison,
Multiplexer: 4-1 and 8-1 multiplexer, IC 74153,
De-multiplexer: 1-4 and 1-8 de-multiplexer , IC 74138 as 1 to 8 demux
Encoder: Binary to octal encoder, Priority encoder, IC 74148,
Decoder: 2-4 and 3-8 decoders, IC 74138 as 3 to 8 decoder, BCD-7 segment decoder (IC 7447).
Flip flop: RS flip flop using NOR gates, Clocked RS flip flop, D-flip flop, JK-flip flop, JKMS flip flop, T flip flop. (Timing diagrams are expected),
Counter: Basic counter operation, 4-bit asynchronous and synchronous counters, Combination counter, study of IC 7490 as MOD-2, MOD-5 and Decade counter. (Timing diagrams are expected)
Shift register: Types of shift registers (SISO, SIPO, PISO, PIPO), Right and Left shifting, Ring counter, Johnson counter, study of IC 7495. (Timing diagrams are expected).

Unit 2:- Semiconductor memories and data converters
Periods: 15, Weightage: 15 Marks (UA)

Memory: Memory cell, Classification of memory volatile, nonvolatile, type of volatile and nonvolatile memory and their comparison, Concept of flash memory,
Data converters: Basic concepts of DAC and ADC, specifications, Digital to analog conversion: Binary weighted and R - 2 R ladder networks, Analog to digital conversion: Flash, SAR, dual slope type ADC techniques, Study of DAC (IC 0808) & ADC (IC 0804) (Features & functional description)

Reference books

1. Digital Fundamental by Floyd, Pearson Education
2. Digital Principles and Applications by A. P. Malvino & D.P. Leach (TMH Delhi)
3. Modern Digital Electronics by R.P. Jain
4. Digital Systems: Principle and Applications by Ronald J. Tocci, Neat S Widemer, PEA
5. Digital Electronics, Circuits and Systems by V.K. Puri, TMH, New Delhi

पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ।। विद्यया संपन्नता ।। NAAC Accredited-2022 'B++' Grade (CGPA-2.96)	**Punyashlok Ahilyadevi Holkar Solapur University, Solapur** **B. Sc. II (Electronics) Semester-** **III Vertical: DSC1-4** **Course Code:** **Course Name: Semiconductor Devices**
• **Teaching Scheme** **Credit: 02,** **Theory: 30 Periods** **Theory :02 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Preamble

This course provides a foundational understanding of physics of semiconductor and electronic devices, forming the backbone of modern electronics. Divided into two units, the course begins with the basics of semiconductors and p-n junctions and progresses to an indepth study of diodes, transistors, and field-effect transistors (FETs).

Unit 1 introduces intrinsic and extrinsic semiconductors, p-n junction characteristics, and a variety of diodes including Zener, photo, and varactor diodes. Applications such as rectifiers, filters, and voltage regulators are also explored in detail.

Unit 2 focuses on semiconductor devices like BJTs and FETs. It includes their construction, configurations, characteristics, and switching applications. The unit also covers JFETs and MOSFETs, emphasizing their I-V characteristics and practical usage.

This course equips students with essential knowledge to analyze, design, and troubleshoot basic electronic circuits, serving as a foundation for further studies in analog and digital electronics, VLSI, and embedded systems.

Course Objectives

- To understand the principles of semiconductor materials and the behavior of p-n junctions.
- To study the construction and operation of various diodes and their practical applications in rectification and voltage regulation.
- To analyze the working and characteristics of bipolar junction transistors (BJTs) in different configurations.
- To introduce the basic principles of FETs, including JFETs and MOSFETs, and compare them with BJTs.
- To develop analytical skills through numerical problems related to transistor parameters and device performance.

Course outcomes	
After completing this course, students will be able to: ▪ CO1: Understand the behavior of intrinsic and extrinsic semiconductors, and explain the formation and properties of p-n junctions. ▪ CO2: Describe the construction, working, and I-V characteristics of various diodes including Zener, photo, and varactor diodes, and analyze their use in rectifiers and voltage regulation circuits. ▪ CO3: Analyze the input and output characteristics of BJTs in CE and CB configurations, and determine transistor parameters like α and β graphically. ▪ CO4: Explain the operation of BJTs as switches, and understand their switching characteristics in electronic circuits. ▪ CO5: Compare BJTs and FETs based on construction, operation, and characteristics, and evaluate the parameters of n-channel JFETs and their applications. ▪ CO6: Understand and analyze the characteristics of depletion and enhancement type MOSFETs, and describe their significance in modern electronics.	
Unit 1	Fundamentals of Semiconductor: **Periods: 15, Weightage: 15 Marks (UA)**
Intrinsic and extrinsic semiconductors, Formation of p-n junction, potential barrier, Junction capacitance. Construction, working, I-V characteristics of p-n junction diode, Zener diode, Photo diode, Varactor Diode, applications: diode as rectifiers: Half wave, full wave and bridge (ripple factor, efficiency, PIV). Filter, types of filter and CLC filter, Zener diode as a regulator.	
Unit 2	**Semiconductor devices:** **Periods: 15, Weightage: 15 Marks (UA)**
Construction and operation of BJT, their configurations, I/P and O/P characteristics of CE and CB configurations, Graphical determination of α and β, (Numerical examples are expected), BJT as a switch, switching characteristics, Basic principles of FET, Comparison between BJT and FET, Types of FET. Construction, working I-V characteristics, parameters of n-channel JFET, applications of FET, (Numerical examples are expected). Construction, working, I-V characteristics of Depletion and Enhancement MOSFET.	
Reference Books	
Electronic Devices and Circuits by Jacob Milman & Chrstes S Halkias, (MGH). 2. Electronic Devices and Circuits, An introduction by Allen Mottershed (PHI Delhi.) 3. A Text Book of Applied Electronics by R.S. Shedha (S. Chand & Co.) 4. Basic Electronics & Linear Circuits by N.N Bhargava, D.C. Kulshreshta, S.C. Gupta (TMH) 5. Principles of Electronics (10th Edition) by V.K. Mehta (S. Chand & Co.) 6. Electronics Devices and Circuit Theory by R. L. Bolysted & L. Nashelsky (Pearson)	

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. II (Electronics) Semester-III

Vertical: DSC 2-3

Course Code:

Course Name: Digital Techniques

• **Teaching Scheme** **Credit: 02, Theory: 30 Periods** **Theory :02 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Preamble:

This course is designed as a minor paper DSC2-3 which provides a comprehensive foundation in combinational and sequential digital circuits, which are essential for the design of modern digital systems. It is divided into two units focusing on Digital Circuits I (combinational logic) and Digital Circuits II (sequential logic).

Unit 1 focuses on combinational logic devices such as comparators, multiplexers, demultiplexers, encoders, decoders, and BCD to 7-segment display decoders. These circuits are fundamental for data selection, routing, and display in digital systems.

Unit 2 covers sequential circuits including flip-flops, counters, and shift registers. Students will learn the operation and timing of various flip-flops, the design and application of asynchronous and synchronous counters, and the implementation of data storage and transfer using shift registers.

Course Objectives:

To understand the design and application of combinational logic circuits such as comparators, multiplexers, demultiplexers, encoders, and decoders.

• To analyze and interpret the function and truth tables of various flip-flops and their role in memory elements.

• To study the operation of counters and their use in digital timing and sequencing applications.

• To understand the design and working of shift registers, ring counters, and Johnson counters for serial
and parallel data operations.

• To develop the ability to read, draw, and analyze logic diagrams and timing waveforms for digital components

Course Outcomes (COs):

After successful completion of this course, students will be able to:

▪ CO1: Design and analyze combinational logic circuits including comparators, multiplexers (4:1 and 8:1), and demultiplexers (1:4 and 1:8) using AND/NAND gates.

▪ CO2: Implement and evaluate encoders and decoders such as octal to binary, decimal to BCD encoders, priority encoders (IC 74148), and BCD to 7-segment decoders (IC 7447).

▪ CO3: Explain the operation and truth tables of flip-flops (RS, SR, D, JK, JKMS, and T), and use them in basic memory and control circuits.

▪ CO4: Analyze and construct counter circuits (asynchronous and synchronous) including MOD-2, MOD-5, and decade counters using IC 7490 with relevant timing diagrams.▪ CO5: Describe and design shift registers (SISO, SIPO, PISO, PIPO), and study special types such
as ring and Johnson counters using IC 7495 along with timing analysis.

Unit I	**Digital circuits I** **Periods: 15, Weightage: 15 Marks (UA)**

XOR gate a magnitude(bit) comparator, Multiplexer: 4-1 and 8-1 multiplexer, De-multiplexer:

1-4 and 1-8 de-multiplexer (AND & NAND gate), Encoder: octal to binary and decimal to BCD encoder, Priority encoder, (74148), Decoder: 2-4 and 3-8 decoders), BCD to Decimal decoder, (AND & NAND gates), BCD-7 segment decoder (IC 7447)	
Unit 2	**Digital circuits II** **Periods: 15, Weightage: 15 Marks (UA)**
Flip flop: RS, SR, D, JK, JKMS and T flip-flop, (logic diagram, truth table) Counter techniques: Basic counter operation, types of counters, 4-bit asynchronous, synchronous counter Study of IC 7490 as MOD-2, MOD-5 and Decade counter. (Timing diagrams are expected), Shift registers: Types of shift registers SISO, SIPO, PISO, PIPO, Right and Left shifting, Ring counter, Johnson counter, study of IC 7495. (Timing diagrams are expected).	
Reference Books	
. Digital Fundamental by Floyd, Pearson Education 2. Digital Principles and Applications by A. P. Malvino & D.P. Leach (TMH Delhi) 3. Modern Digital Electronics by R.P. Jain 4. Digital Systems: Principle and Applications by Ronald J. Tocci, Neat S Widemer, PEA 5. Digital Electronics, Circuits and Systems by V.K. Puri, TMH, New Delhi 6. Digital Computer Electronics by Malvino Brown, 3rd Edition, TMH	

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B. Sc. II (Electronics) Semester-III** **Vertical: DSC 2-4** **Course Code:** **Course Name: Analog Electronics**

• **Teaching Scheme** **Credit: 02, Theory: 30 Periods** **Theory :02 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Preamble

This course is designed as a minor theory paper to introduce students to the basic principles of semiconductors and their applications in electronics. The course covers the essential characteristics, construction, and working of p-n junction diodes, transistors, power devices, and optoelectronic components. It builds foundational knowledge necessary for further study in applied electronics and embedded systems.

The syllabus is divided into two units:

Unit 1 focuses on the fundamentals of semiconductors, including diodes and their applications.

Unit 2 introduces transistors, field-effect devices, power components, and optoelectronic devices, emphasizing their operation and practical significance.

Course Objectives

To understand the nature of semiconductors, including intrinsic and extrinsic types.
• To study the formation and characteristics of p-n junctions and the operation of diodes under forward and reverse bias.
• To explore the use of diodes in rectification, clipping, and clamping applications.
• To explain the construction and functioning of BJT, FET, and UJT, and their biasing methods.
• To introduce power semiconductor devices (SCR, TRIAC, DIAC) and their uses in switching and control.
• To understand the operation of optoelectronic devices such as LED, LDR, Photo diode, and LASCR and their common applications.

Course Outcomes (COs):

After completing this course, students will be able to:
▪ CO1: Explain the properties and classification of semiconductor materials, and distinguish between intrinsic and extrinsic semiconductors.
▪ CO2: Describe the construction, biasing, and I–V characteristics of p–n junction and Zener diodes, and analyze their behavior under various conditions.
▪ CO3: Apply diodes in practical circuits, such as half-wave, full-wave, and bridge rectifiers, and understand their use as clippers and clampers.
▪ CO4: Understand the working principles and biasing techniques of BJT, FET, and UJT, and compare their construction and typical applications.
▪ CO5: Identify the structure, working, and applications of power semiconductor devices, including power BJT, SCR, TRIAC, and DIAC.▪ CO6: Describe the operation of optoelectronic components such as Photo diode, LED, LDR, and LASCR, and explain their use in light-sensitive and display systems.

Unit 1	**Fundamentals of Semiconductor** **Periods: 15, Weightage: 15 Marks (UA)**
Introduction, Types of material (metals, semiconductors and insulators), types of Semiconductors, Intrinsic & Extrinsic semiconductors, Concept of Energy band formation and forbidden energy gap, Formation of p-n junction, potential barrier, junction capacitance, static and dynamic resistance, Forward biased and reverse biased PN junction, construction and working of p-n junction diode, Zener diode I-V characteristics, forward and reverse biasing of diode and its I-V characteristics.	
Unit 2	**Semiconductor devices** **Periods: 15, Weightage: 15 Marks (UA)**
BJT and FET: Construction, working of BJT, FET and UJT, their comparison, types of biasing of BJT and FET and applications of BJT, FET and UJT. Power devices: Construction, working of SCR, TRIAC, DIAC and their applications. Optical devices: Construction, working of LDR, Photo diode, LED and their applications.	

References Books

1. Electronic Devices and Circuits by Jacob Milman & Chrstes S Halkias, (MGH).
2. Electronic Devices and Circuits, An introduction by Allen Mottershed (PHI Delhi.)
3. A Text Book of Applied Electronics by R.S. Shedha (S. Chand & Co.)
4. Basic Electronics & Linear Circuits by N.N Bhargava, D.C. Kulshreshta, S.C. Gupta (TMH)
5. Principles of Electronics (10th Edition) by V.K. Mehta (S. Chand & Co.)
6. Electronics Devices and Circuit Theory by R. L. Bolysted & L. Nashelsky (Pearson)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. II (Electronics) Semester-III

Vertical: GE3/OE3

Course Code:

Course Name: Solar Energy and Electronics

• Teaching Scheme	• Examination Scheme
Credit: 02, Theory: 30 Periods	**Total Marks :50**
Lectures:02 hours/week	**UA:30 Marks, CA: 20 Marks**

Course Objectives

- Understand the fundamentals of solar energy and its applications.
- Learn about photovoltaic (PV) systems and their electronic interfaces.
- Study design and performance of solar-powered systems.
- Explore the role of electronics in solar energy conversion and storage.

Unit 1	**Basics of Solar Energy** **Periods: 6, Weightage: 6 Marks (UA)**

- Solar radiation: concepts and measurement
- Solar spectrum and availability
- Solar energy applications and current trends

Unit 2	**Photovoltaic Principles and Technologies** **Periods: 6, Weightage: 6 Marks (UA)**

- Photovoltaic effect and working of solar cells
- Types of solar cells: monocrystalline, polycrystalline, thin film
- IV characteristics and efficiency

Unit 3	**Solar PV Systems and Electronics** **Periods: 6, Weightage: 6 Marks (UA)**

- Standalone vs grid-connected systems
- MPPT (Maximum Power Point Tracking) algorithms
- Role of power converters (DC-DC, inverters)
- Energy storage: batteries and charge controllers

Unit 4	**Design and Analysis of Solar Projects** **Periods: 6, Weightage: 6 Marks (UA)**

- Sizing of PV modules and battery bank
- Load estimation and system planning
- Simulation tools and analysis (basic introduction)

Unit 5	**Applications and Emerging Trends** **Periods: 6, Weightage: 6 Marks (UA)**

- Solar lighting systems, water pumps, streetlights
- IoT-based solar monitoring systems
- Smart solar systems and integration with microgrids

Course Outcomes

On successful completion of this course:

- Explain the principles of solar energy and PV systems. - Understand electronics used in solar energy systems. - Design and simulate solar-powered circuits. - Apply theoretical knowledge in practical renewable energy projects.
Reference books
1. Photovoltaic Systems by James P Dunlop 2. Solar Electricity Handbook by Michael Boxwell 3. Principles of Solar Engineering by D. Yogi Goswami and Frank Kreith 4. Photovoltaic: Design and Installation Manual by Solar Energy International (SEI) 5. Understanding Solar Power by Kevin Bumgarner 6. Photovoltaic Design and Installation for Dummies by Ryan Mayfield

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B. Sc. II (Electronics) Semester-III** **Vertical: Major - Practicals based on DSC 1-3 and DSC 1-4** **Course Code:** **Course Name: Electronics Practicals Lab-I**

• **Teaching Scheme** **Credit: 02, Practical: 60 Periods** **Practical :04 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Preamble: DSC 1-3

This laboratory course is designed to provide hands-on experience in digital electronics through the study and implementation of key combinational and sequential circuits. The course includes practical experiments with multiplexers, demultiplexers, encoders, decoders, flip-flops, counters, shift registers, DACs, and ADCs using standard digital ICs.
By performing these experiments, students will gain essential skills in analyzing logic behavior, interpreting timing diagrams, building circuits using digital ICs, and understanding the functional applications of these components in modern digital systems. This course acts as a vital supplement to theoretical knowledge, reinforcing foundational concepts and preparing students for advanced work in embedded systems and microcontrollers.

Course Objectives:

To provide practical knowledge of basic combinational and sequential logic components using digital ICs.
• To familiarize students with the working and real-time applications of encoders, decoders, multiplexers, and demultiplexers.
• To demonstrate the operation of flip-flops and their role in data storage and sequential logic design.
• To enable students to design and analyze counters and shift registers, including special types like ring and Johnson counters.
• To introduce students to digital-to-analog and analog-to-digital conversion techniques using R-2R ladder networks and ICs such as DAC0808 and ADC0804.
• To develop skills in circuit assembly, troubleshooting, and the interpretation of timing diagrams and datasheets.

Course outcomes:

CO1: Demonstrate the working of multiplexers and demultiplexers using IC 74153 and understand their role in data routing and control applications.
▪ CO2: Analyze and implement encoders and decoders, including BCD to 7-segment display decoder, using ICs like 74148, 74138, and 7447.
▪ CO3: Understand and verify the operations of RS, D, and JK flip-flops, and describe their use in memory and control circuits.
▪ CO4: Construct and analyze counters such as divide-by-2, divide-by-5, and decade (divide-by-10) counters using IC 7490.
▪ CO5: Design and interpret the behavior of shift registers for left/right shifting, including Johnson and ring counters using IC 7495.
▪ CO6: Implement digital-to-analog and analog-to-digital conversion circuits using the R-2R ladder network, DAC0808, and ADC0804, and evaluate their functionality based on output characteristics.

Sr. No.	List of Experiments (DSC 1-3) (any seven)

1. Study of Multiplexer and De-multiplexer (74153).
2. Study of Encoder (74148)
3. Study of Decoder (74138).
4. Study of BCD to 7-segment display decoder driver.
5. Study of RS, D and JK Flip flop.
6. Study of Counters (divided by 2, 5 and 10) using IC-7490.
7. Study of Left shift and Johnson counter using IC 7495.
8. Study Right shift and Ring counter using IC7495.
9. DAC using R-2R Ladder network (4 bits).
10. Study of DAC (IC 0808).
11. Study of ADC (IC 0804).

Reference books

1. Digital Fundamentals by Thomas L. Floyd
2. Digital Electronics: Principles and Integrated Circuits
3. Practical Digital Electronics by Gary M. Miller
4. Digital Principles and Applications by Malvino and Leach

Course Preamble: DSC 1-4

This laboratory course is designed to provide hands-on experience with semiconductor devices, reinforcing theoretical concepts through practical application. The experiments focus on analyzing the characteristics and performance of diodes, transistors, and field-effect transistors (FETs), which are foundational components in analog and digital electronics.

Students will experimentally study different types of diodes—including p-n junction, Zener, photo, and varactor diodes—as well as the working of rectifier circuits with and without filters. The course also covers the behavior and characteristics of BJT, JFET, and MOSFET, equipping students with the skills needed to analyze, interpret, and apply these devices in electronic circuits.

This course bridges the gap between theory and practice, fostering a deeper understanding of semiconductor devices and preparing students for advanced electronics coursework and real-world applications.

Course Objectives:

To provide practical knowledge of different types of diodes, including their I-V characteristics and applications.

• To enable students to analyze rectifier circuits with and without filters and understand load regulation.

• To understand the working of Zener diodes as voltage regulators through experimentation.

• To experimentally study the characteristics of BJTs, JFETs, and MOSFETs and compare their behaviors.

• To develop skills in measurement, observation, data analysis, and the use of electronic testing equipment.

Course outcomes:

After successful completion of this course, students will be able to:

CO1: Observe and interpret the I-V characteristics of p-n junction, Zener, photo, and varactor diodes, and understand their specific applications.

CO2: Construct and evaluate rectifier circuits (full-wave and bridge) and analyze their load regulation and filter performance using CLC filters.

CO3: Demonstrate the use of a Zener diode as a voltage regulator and understand its role in power supply circuits.

CO4: Analyze and compare the input/output characteristics of BJTs, and understand their operation in active, cut-off, and saturation regions.
CO5: Evaluate the characteristics of FET devices (JFET and MOSFET) and interpret their parameters and behavior for practical applications.

Sr. No.	List of Experiments DSC 1-4 (any seven)

1. Characteristics of p-n junction Diode.
2. Characteristics of Zener diode.
3. Characteristics of Photo Diode.
4. Characteristics of Varactor Diode.
5. Study of Full wave rectifier. (load regulation).
6. Study of Bridge rectifier with CLC filter.
7. Study of Zener diode as a voltage regulator.
8. Characteristics of BJT.
9. Characteristics of JFET.
10. Characteristics of MOSFET.

Reference books

1. Electronic Devices and Circuits by Jacob Milman & Chrstes S Halkias, (MGH).
2. Electronic Devices and Circuits, An introduction by Allen Mottershed (PHI Delhi.)
   A Text Book of Applied Electronics by R.S. Shedha (S. Chand & Co.)
3. Basic Electronics & Linear Circuits by N.N Bhargava, D.C. Kulshreshta, S.C. Gupta (TMH)
4. Principles of Electronics (10th Edition) by V.K. Mehta (S. Chand & Co.)
5. Electronics Devices and Circuit Theory by R. L. Bolysted & L. Nashelsky (Pearson)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. II (Electronics) Semester-III

Vertical: Minor - Practicals based on DSC 2-3 and DSC 2-4

Course Code:

Course Name: Electronics Practicals Lab-II

• **Teaching Scheme** **Credit: 02, Practical: 60 Periods** **Practical: 04 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Preamble:
(DSC 2-3)

This course is designed as a minor practical paper (DSC2-3P) to provide students with hands-on experience in fundamental digital electronics. It focuses on implementing and analyzing essential sequential and combinational logic circuits using standard ICs.

Through a series of carefully structured experiments, students gain practical understanding of flip-flops, counters, shift registers, multiplexers, demultiplexers, encoders, decoders, and BCD to 7-segment display circuits. These are the core building blocks of digital systems used in computing, embedded systems, and automation.

The course reinforces theoretical knowledge, enhances circuit analysis skills, and prepares students to troubleshoot and design basic digital circuits.

Course Objectives:

• To enable students to practically implement and test flip-flops and understand their role in memory and control circuits.

• To provide exposure to digital counting techniques using binary and decade counters.

• To study serial and parallel data transfer operations using shift registers and their special forms (Ring and Johnson counters).

• To explore the working of combinational logic components such as multiplexers, demultiplexers, encoders, and decoders.

• To understand BCD to 7-segment decoding and its application in digital display systems.

• To develop skills in wiring, observation, circuit testing, and troubleshooting using digital ICs and logic components.

Course Outcomes (COs):

After completing this course, students will be able to:

▪ CO1: Construct and analyze basic flip-flops (RS, D, JK) using digital ICs and interpret their truth tables and applications in digital circuits.

▪ CO2: Design and test counter circuits using IC 7490 to achieve divide-by-2, divide-by-5, and divide-by-10 operations.

▪ CO3: Implement left shift, right shift, Johnson, and ring counters using IC 7495, and analyze timing diagrams and data flow.

▪ CO4: Build and test a 4:1 multiplexer and 1:4 demultiplexer, and understand their use in data routing and selection logic.

▪ CO5: Study and verify the functionality of encoders and decoders, including priority encoder (IC 74148), decoder (IC 74138), and BCD to 7-segment display decoder.

List of Experiments - DSC 2-3 (any seven)

1. Study of RS, D and JK Flip flop
2. Study of Counters (divided by 2, 5 and 10) using IC-7490
3. Study of Left shift and Johnson counter using IC 7495
4. Study Right shift and Ring counter using IC7495
5. Study of Multiplexers (4:1)
6. Study of De-multiplexer (1:4)
7. Study of Encoder using IC 74148
8. Study of Decoder using 74138
9. Study of BCD to 7 segment display decoder.

List of Experiments- DSC 2-4 (any seven)

1. PN junction diode Characteristics
2. Zener diode Characteristics
3. LDR Characteristics
4. Photo-diode Characteristics
5. LED Characteristics
6. CE configuration Characteristics
7. JFET Characteristics
8. UJT Characteristics
9. SCR/DIAC/TRIAC Characteristics

Reference books

1. Digital Fundamental by Floyd, Pearson Education
2. Digital Principles and Applications by A. P. Malvino & D.P. Leach (TMH Delhi)
3. Modern Digital Electronics by R.P. Jain
4. Digital Systems: Principle and Applications by Ronald J. Tocci, Neat S Widemer, PEA
5. Digital Electronics, Circuits and Systems by V.K. Puri, TMH, New Delhi
6. Digital Computer Electronics by Malvino Brown, 3rd Edition, TMH

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B. Sc. II (Electronics) Semester-III** **Vertical: Hands on Training related to DSC 1 (Major)** **Course Code:** **Course Name: VSC 1 (DSC 1)** **Proteus (or any other simulation tool) for Analog and Combinational Logic Circuits**

• **Teaching Scheme** **Credit: 02, Practical: 60 Periods** **Practical :04 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Learning Objectives

•	To gain software based practical approach knowledge by applying the virtual experimental approaches to correlate with the theory.
•	To learn software skills in practicals.
•	To learn application of Proteus (or any other simulation tool) for Simple Analog and Combinational Logic
Sr. No	**List of Practical's (Analog Circuits) (any six)**
1.	Simulation study of I-V characteristics of Semiconductor Diode
2.	Simulation study of Zener diode as a Voltage Regulator
3.	Simulation study of Full-wave Rectifier using Centre-tapped Transformer OR Bridge Rectifier
4.	Simulation study of Diode as a Clipper (positive & negative with/without bias)
5.	Simulation of Diode as a Clamper (positive & negative with/without bias)
6.	Simulation study for Application of LDR as a Burglar Alarm
7.	Simulation study of Common-Emitter Configuration Characteristics (I/P or O/P)
8.	Simulation study of Transfer Characteristics of JFET
9.	Simulation study for Application of FET as VVR
Sr. No	**List of Practical's (Combinational Logic Circuits) (any six)**
1.	Simulation study of 4 to 1 multiplexer using IC74153 or Logic Gates
2.	Simulation study of 1 to 4 de-multiplexer using Logic Gates
3.	Simulation Study of 3 to 8 decoder using 74138 or Study of BCD to 7-Segment decoder using 7447
4.	Simulation study of RS, D and JK flip-flops using ICs or Basic gates
5.	Simulation study of divide-by-2, divide-by-5 and divide-by-10 counters using IC7490
6.	Simulation study of Shift Register using IC7495.
7.	Simulation study of D to A converter using R-2R Ladder Network

8.	Simulation study of 8-bit DAC using DAC0800/DAC0808
9.	Simulation study of 8-bit ADC using single-channel ADC0804
Learning Outcomes	
After completion of the course, Student should be able to-	
1.	Use Proteus IDE (or other simulation tool) for drawing the circuit diagrams
2.	Run the simulation for the drawn circuit.
3.	Verify the results with theoretical results
Reference Books	
1.	
2.	
3.	
4.	

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B. Sc. II (Electronics) Semester-III** **Vertical: Hands on Training related to DSC 2 (Minor)** **Course Code:** **Course Name: VSC 2 (DSC 2)** **Basic Arduino Interfacing using Proteus IDE**
• **Teaching Scheme** **Credit: 02, Practical: 60 Periods** **Practical :04 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Learning Objectives

•	To learn the use of Proteus IDE for simulation
•	To learn Arduino Interfacing using Arduino Firmware in Proteus Environment
•	To Run the simulation and Verify the results.
•	To learn the use of various Arduino Libraries and other device libraries in simulation
Sr. No	**List of Practicals (any Eight)**
1.	LED Blinking Program using Arduino Firmware and its Libraries.
2.	Controlling LEDs through Switches using Arduino Firmware and its Libraries.
3.	7-Segment Display Interfacing using Arduino Firmware and its Libraries.
4.	Sensing Variable Analog Input from Potentiometer using Arduino Firmware and its Libraries.
5.	Temperature and Humidity Sensor Interfacing using Arduino Firmware and its Libraries.
6.	Motion Detection Sensor Interfacing using Arduino Firmware and its Libraries.
7.	Ultrasonic Sensor Interfacing using Arduino Firmware and its Libraries.
8.	Gas Sensor Interfacing using Arduino Firmware and its Libraries.
9.	LED Brightness Control using Arduino Firmware and its Libraries.
10.	Relay Module Control through PIR sensor using Arduino Firmware and its Libraries.

Learning Outcomes

After completion of the course, Student should be able to-

	Learned, How to use Arduino Firmware in Proteus Environment
	Learned the use different libraries required to be imported for interfacing programs

	Learned, the use of Arduino Firmware without actually using the hardware in Proteus Environment
Reference Books	
1.	
2.	
3.	
4.	

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. II (Electronics) Semester-IV

Vertical: DSC 1-5

Course Code:

Course Name: Electronics Devices

• **Teaching Scheme** **Credit: 02, Theory: 30 Periods** **Lectures:02 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Preamble

This course provides a comprehensive understanding of transistor biasing techniques, amplifier configurations, and the design and analysis of feedback amplifiers and oscillators. Spread across two major units, the course builds foundational and advanced knowledge of analog electronics, essential for any student pursuing studies in electronics, instrumentation, or electrical engineering.

Unit 1 covers the principles of transistor biasing, DC load line analysis, and the design of amplifiers, including multistage and power amplifiers. It also introduces differential amplifiers, focusing on their operation, gain parameters, and practical biasing methods.

Unit 2 focuses on feedback amplifiers—analyzing the effects of feedback on amplifier performance—as well as oscillator circuits, detailing the conditions for sustained oscillation and the operation of RC and LC oscillators, including Wien bridge, Hartley, and Colpitts oscillators.

This course prepares students to analyze, design, and troubleshoot analog electronic circuits, and serves as a bridge to more advanced studies in communication systems, analog IC design, and signal processing.

Course Objectives

• To introduce the concept of transistor biasing, operating point, and the need for stabilization in amplifier circuits.
• To explain the working and analysis of single-stage and multistage transistor amplifiers, including power and differential amplifiers.
• To study the principles and impact of feedback in amplifier circuits and analyze different types of feedback topologies.
• To understand the operation and analysis of various transistor oscillators, and derive conditions for oscillation using Barkhausen criterion.
• To develop problem-solving skills through numerical analysis and graphical methods applied to amplifier and oscillator circuits

Course outcome:

After successful completion of this course, students will be able to:
▪ CO1: Explain the concept of transistor biasing, analyze the DC load line, and determine the operating point using different biasing methods including voltage divider bias.
▪ CO2: Understand the operation and necessity of multistage amplifiers, and analyze different amplifier configurations such as RC, transformer-coupled, and direct-coupled amplifiers with respect to their frequency response.
▪ CO3: Analyze the characteristics and working of power amplifiers, including Class A, Class B push-pull, Class AB, and complementary symmetry amplifiers, identifying distortion effects like crossover distortion.
▪ CO4: Describe the working of differential amplifiers, derive key performance parameters such as differential gain (Ad), common-mode gain (Ac), and CMRR, and understand biasing techniques like constant current and current mirror bias.

▪ CO5: Analyze the effects of negative feedback in amplifiers on parameters like gain, bandwidth, distortion, and impedance; and solve numerical problems involving current series feedback circuits.
▪ CO6: Understand the principle of oscillation using Barkhausen criterion, and analyze and design various RC and LC oscillators (Wien bridge, phase shift, Hartley, and Colpitts), including their circuit operation and frequency formulas.

Unit 1	**Transistor biasing and amplifiers** **Periods: 15, Weightage: 15 Marks (UA)**

Transistor Biasing: Concept of transistor biasing, DC load line, Operating point, Stability factor, Methods of transistor biasing type fixed Bias, Emitter Bias, Study of Voltage divider bias with mathematical treatment,
Amplifiers: Basic action of transistor amplifier, need of multistage amplifiers and their types RC, TC, DC (frequency response).
Power Amplifiers: Types of power amplifiers , Class B push pull amplifier, cross over distortion, complementary-symmetry amplifier, Class AB amplifier.
Differential amplifier: Need of differential amplifier, Types of differential amplifiers, Emitter coupled differential amplifier, Operation, Common mode gain and Differential mode gain, Derivation of AD, AC and CMRR, Constant current bias, Current mirror bias.

Unit 2	**Feedback amplifiers and Oscillators** **Periods: 15, Weightage: 15 Marks (UA)**

Feedback amplifiers: Theory of feedback amplifier, positive and negative feedback, Effect of negative feedback on Gain, Bandwidth, Distortion, Noise, Input impedance and Output impedance, Types of negative feedback, Analysis of current series feedback circuit (Numerical Examples), Transistor Oscillators: Barkhausen criterion for oscillation, RC oscillators: Wien bridge oscillator, Phase shift oscillator, LC oscillators: Hartley oscillator, Colpitts's oscillator, (Circuit description, formula for oscillation and Numerical Examples) Piezoelectric crystal and its equivalent circuit,

Reference books

1. A text book of Applied Electronics by R. S. Sedha. S. Chand Publication.
2. Electronic Devices and Circuits by Boylstead
3. Basic Electronics (Solid State) by B. L. Theraja, S. Chand & Company Ltd.
4. Basic Electronics and Linear Circuits by N. N. Bhargaya D. C. Kulshreshtha TMH
5. Op-Amps and Linear Integrated Circuits by Ramakant Gaikwad, Pearson.

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B. Sc. II (Electronics) Semester-IV** **Vertical: DSC 1-6** **Course Code:** **Course Name: Pulse and Switching Circuits**
• **Teaching Scheme** **Credit: 02, Theory: 30 Periods** **Theory :02 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Preamble

This course offers a detailed study of wave shaping circuits, timing circuits, and multivibrator circuits using transistors, logic gates, and integrated circuits. The course is divided into two major units designed to build foundational and applied knowledge in pulse and switching electronics.
Unit 1 introduces students to the principles of linear and nonlinear wave shaping, including differentiators, integrators, clippers, and clampers. It also explores time base generators using UJT and RC circuits, with a focus on their linearity and applications in waveform generation.
Unit 2 provides in-depth coverage of multivibrator circuits using BJTs, gates, and IC 555 timers. The operation, analysis, and design of astable, monostable, and bistable multivibrators are discussed along with applications such as sequential timers, voltage-controlled oscillators, and battery chargers.
This course is essential for understanding the basics of digital signal generation, waveform conditioning, and timing control—skills critical in analog electronics, embedded systems, and communication engineering.

Course Objectives

• To explain the need and function of wave shaping circuits and distinguish between linear and nonlinear shaping techniques.
• To analyze the design and operation of RC timing circuits and UJT-based relaxation oscillators.
• To study the construction and working of multi-vibrators using BJTs, including their waveforms, frequency/gate width derivation, and applications.
• To understand Schmitt triggers, hysteresis behavior, and their use in waveform conditioning.
• To explore the design and application of multi-vibrators using logic gates and IC 555 timers, including practical use cases.
• To develop analytical and problem-solving skills through numerical examples and circuit analysis.

Course outcome

After completing this course, students will be able to:
- CO1: Understand and analyze linear wave shaping circuits such as differentiators and integrators, and explain conditions for their effective operation.
- CO2: Explain the operation of nonlinear wave shaping circuits like diode clippers and clampers and identify their role in signal conditioning.
- CO3: Describe the generation of time base waveforms using RC circuits and UJT, and analyze UJT-based relaxation oscillators with linearity considerations.
- CO4: Analyze and design collector-coupled multi-vibrators using BJTs (astable, monostable, and bistable), derive expressions for frequency/gate width, and sketch input/output waveforms.
- CO5: Explain the operation of a Schmitt trigger, draw hysteresis curves (UTP, LTP), and apply it for waveform shaping and noise reduction.
- CO6: Design and implement multi-vibrator circuits using logic gates and IC 555 timers, including real-world applications such as timers, battery chargers, and voltage-controlled oscillators.

Unit 1	**Wave shaping and Timing Circuits** **Periods: 15, Weightage: 15 Marks (UA)**

Wave shaping Circuits: Need of wave shaping circuit, linear wave shaping circuits: Differentiator and Integrator (condition for good differentiator and integrator), Nonlinear wave shaping: Diode Clipping and Clamping circuits.

Time base Circuits: General features of Time base signals, Concept of RC time base circuit, Construction and working of UJT and its application as a relaxation oscillator, Linearity considerations with constant current source, Miller integrator.

Unit 2	**Multi-vibrator Circuits** **Periods: 15, Weightage: 15 Marks (UA)**

Multi-vibrators using BJT: Types of multi-vibrator, collector coupled astable multi-vibrator (Operation, Wave forms, Derivation of output frequency), collector coupled Monostable multivibrator (Operation, triggering methods, Waveforms, Derivation of gate width), collector coupled bistable multi-vibrator (Operation, triggering methods, Wave forms), Schmitt's Trigger: Operation, Hysteresis curve (UTP, LTP), (Uses and Numerical Examples).

Multi-vibrators using Gates: Astable multi-vibrator using gates, Monostable multi-vibrator using gates and IC 74121.

Multi-vibrators using IC 555: functional block diagram of IC-555. pin configuration, Applications of IC 555: Astable multi-vibrator: (Operation, wave forms, Derivation of frequency and duty cycle), Monostable multi-vibrator: (Operation, wave forms, Derivation of gate width), (Numerical examples), applications of IC 555 as a Sequential Timer, Battery charger, Voltage controlled oscillator.

Reference Books

1. Pulse and Switching circuits by Millman and Taub
2. A Text of Applied Electronics by R. S. Sedha, S. Chand Publication
3. Hand book of Electronics by Sony Gupta
4. Electronic Devices and Circuit by Boylestead
5. Linear Integrated Circuit – D. Roy Choudhari, Shail Jain (Wiley Eastern Ltd.)

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B. Sc. II (Electronics) Semester-IV** **Vertical: DSC 2-5 (Minor)** **Course Code:** **Course Name: Basic Diode and Transistor Circuits**

• **Teaching Scheme** **Credit: 02, : 30 Periods** **Lectures:02 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Preamble

This course provides a foundational understanding of semiconductor devices and their practical applications in analog electronic circuits. Under NEP 2020, which emphasizes skill-based and concept-oriented learning, this course aims to blend theoretical knowledge with hands-on experience. It introduces students to diodes and bipolar junction transistors (BJTs), focusing on their characteristics, biasing methods, and application in rectifiers, amplifiers, and switching circuits. The course fosters analytical thinking, design skills, and experimental competence crucial for further studies in electronics and emerging technologies.

Learning Objectives

- To introduce the Electronics and characteristics of diodes and transistors.
- To analyze the operation of diodes in rectifiers, regulators, clippers, and clampers.
- To understand the different configurations and operating modes of BJTs.
- To study transistor biasing, stabilization, and amplifier design.
- To develop basic circuit-building and testing skills through laboratory experiments.

Learning Outcomes:

- CO1: Explain the behavior and characteristics of semiconductor diodes and transistors.
- CO2: Design and analyze diode-based circuits such as rectifiers, voltage regulators, and waveform shapers.
- CO3: Demonstrate understanding of BJT operation, biasing techniques, and amplifier configurations.
- CO4: Construct, simulate, and test basic analog circuits using diodes and transistors.
- CO5: Apply problem-solving skills in analyzing and troubleshooting electronic circuits.

Unit I	**Basic Diode** **Periods: 15, Weightage: 15 Marks (UA)**

- Diode Circuits:- Half-wave, full-wave, and bridge rectifiers, output voltage and current, Efficiency, ripple factor, and PIV, Capacitor and inductor filters, Clipping and clamping circuits (biased and unbiased),Voltage multiplier circuits

Unit 2	**Transistor Circuits** **Periods: 15, Weightage: 15 Marks (UA)**

- Transistor as a switch and amplifier, BJT regions of operation: Cut-off, active, saturation, Necessity of biasing, DC load-line, Operating Point Q, Stability Factor, Biasing methods: Fixed bias, voltage divider bias, Basic action of transistor amplifier, Common-Emitter and Common-Collector (Emitter Follower) amplifiers, Concept of Feedback Amplifiers - positive and negative feedbacks, Advantages and

Disadvantages of negative feedback, Barkhausen criterion for oscillations, types of oscillators
Reference Books
1. Electronic Devices and Circuits by Jacob Milman & Chrstes S Halkias, (MGH).
2. Electronic Devices and Circuits, An introduction by Allen Mottershed (PHI Delhi.)
3. A Text Book of Applied Electronics by R.S. Shedha (S. Chand & Co.)
4. Basic Electronics & Linear Circuits by N.N Bhargava, D.C. Kulshreshta, S.C. Gupta (TMH)
5. Principles of Electronics (10th Edition) by V.K. Mehta (S. Chand & Co.)
6. Electronics Devices and Circuit Theory by R. L. Bolysted & L. Nashelsky (Pearson)

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B. Sc. II (Electronics) Semester-IV** **Vertical: DSC 2-6 (Minor)** **Course Code:** **Course Name: Sensors and Transducers**
• **Teaching Scheme** **Credit: 02, Theory: 30 Periods** **Theoru:02 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Preamble

This course is designed as a minor theory paper (DSC2-6) to introduce students to the fundamentals of measurements and instrumentation systems. It emphasizes the importance of accurate measurement in scientific and industrial processes, exploring both the principles and classification of sensors and transducers used in modern instrumentation.

Unit 1 focuses on the fundamental concepts of measurement, including system components, static and dynamic characteristics, calibration, and types of instruments.

Unit 2 covers the classification, working principles, and applications of various transducers and sensors, such as strain gauges, RTDs, LVDTs, and phototransistors.

Learning Objectives

• To understand the need and purpose of measurements in scientific and engineering applications.

• To introduce the basic structure and characteristics of measurement systems, including static and dynamic behavior.

• To explain the types of instruments and the importance of calibration.

• To differentiate between sensors and transducers and understand their classifications.

• To study the principles and construction of commonly used resistive, capacitive, inductive, photoelectric, and piezoelectric transducers.

• To develop the ability to select appropriate transducers for specific measurement applications based on criteria like sensitivity and range.

Course Outcomes (COs)

After successful completion of this minor theory course on basics of measurement techniques and sensors student will be able to

- CO1: Explain the basic need for measurements and describe the components of a measurement system.
- CO2: Interpret static and dynamic characteristics of measurement systems and their response behaviors.
- CO3: Differentiate between mechanical, electrical, and electronic instruments, and understand the

importance of system calibration.

- CO4: Define and distinguish between sensors and transducers, and explain their roles in instrumentation.
- CO5: Classify sensors/transducers based on operating principles and energy types, and understand the criteria for their selection.
- CO6: Explain the working principles and applications of various types of transducers: Resistive (e.g., strain gauges, RTDs), Capacitive (e.g., variable gap/area), Inductive (e.g., LVDT, RVDT), Photoelectric (e.g., phototransistors, photovoltaic cells), Piezoelectric transducers

Unit 1	**Sensors and Transducers - Part-I** **Periods: 15, Weightage: 15 Marks (UA)**

Fundamentals of Measurements:- Introduction, basic needs of measurements, block diagram of measurement system, characteristics of measurement Systems, (static and dynamic), Need of system calibration, definition and purpose of instrumentation, types of instruments (Mechanical, Electrical, Electronic)

Definition and Classification of Transducers, basic requirement of transducer, selection criteria for transducer, concept of active and passive Transducers.

Unit 2	**Sensors and Transducers - Part-II** **Periods: 15, Weightage: 15 Marks (UA)**

Study of following Sensors :- Light Sensors-(LDR, Photocell, PIR, IR), Temperature Sensors-(RTD, Thermistor, LM35), Electro-mechanical Sensors- (Strain gauge Load cell, LVDT, Piezoelectric), Ultrasonic sensors, Capacitive sensors

Applications of Sensors - LDR, Thermistor, LM35, Load-cell, Ultrasonic, PIR, IR

Reference Books

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. Basic Electronics – B L Thereja S Chand.
6. A Text Book of Applied Electronics by R.S. Shedha (S. Chand & Co.)

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B. Sc. II (Electronics) Semester-IV** **Vertical: Electronics – GE4/OE4** **Course Code:** **Course Name: Electronic Waste Management and Sustainability**

• **Teaching Scheme** **Credit: 02, Theory: 30 Periods** **Lectures:02 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Objectives

- To understand the sources and types of electronic waste (e-waste).
- To examine the environmental and health impacts of improper e-waste disposal.
- To study sustainable practices in electronics manufacturing and disposal.
- To create awareness of policies, recycling techniques, and green electronics.

Unit 1	**Introduction and E-waste Management Techniques** **Periods: 15, Weightage: 15 Marks (UA)**

Introduction to E-Waste: - Definition and classification of e-waste , - Sources of e-waste: consumer electronics, industrial, institutional, etc., - Global and Indian statistics on e-waste generation, - E-waste composition: hazardous and valuable materials.

Environmental and Health Impact:- - Effects of heavy metals and toxic chemicals, - Health risks to informal workers, - Pollution from incineration and landfilling, - Case studies of e-waste impact in India and abroad

E-Waste Management Techniques:- Collection, segregation, dismantling, Recycling processes: mechanical, chemical, thermal, Recovery of precious metals, Safe handling and disposal methods

Unit 2	Sustainable Practices and Legal and Policy Framework **Periods: 15 , Weightage: 15 Marks (UA)**

Sustainable Practices:- Green electronics design (Design for Environment, RoHS compliance), Eco-labeling and certification, Role of consumers in reducing e-waste, Circular economy and extended producer responsibility (EPR)

Legal and Policy Framework:- Indian e-waste management rules and guidelines, International conventions: Basel Convention, WEEE Directive (EU), Role of government, NGOs, and industry in policy implementation

Course Outcomes

On successful completion of this course:

•	The basics of E-waste and how to handle e-waste
•	Sources of E-waste and techniques to recycle E-waste
•	Sustainable Practices for E-waste management
•	Government Legal Policies and Framework

Reference books
1. Electronic Waste Management by R. E. Hester, R. M. Harrison, Publisher- Royal Society of Chemistry. 2. E-Waste: Impacts, Challenges and Sustainable Management by Ramzy Kahhat, Eric Williamson, Publisher- Routledge 3. Electronic Waste: Recycling Techniques by Majeti Narasimha Vara Prasad, Publisher- Springer 4. Managing Electronic Waste: A Global Challenge by Linda Luther, Publisher- Nova Science Publishers

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. II (Electronics) Semester-IV

Vertical: Practicals based on DSC 1-5 and DSC 1-6

Course Code:

Course Name: Electronics Practicals Lab-III

- **Teaching Scheme**
  Credit: 02, Practical: 60 Periods
  Practical :04 hours/week
- **Examination Scheme**
  Total Marks :50
  UA:30 Marks, CA: 20 Marks

Course Preamble

Electronics Devices

This laboratory course is designed to complement theoretical knowledge of analog electronics by providing hands-on experience in the design, implementation, and testing of BJT-based amplifier and oscillator circuits. Through practical exposure, students explore the operation of single-stage and multistage amplifiers, feedback systems, and various oscillator types.

The course emphasizes understanding transistor biasing, measuring gain, input/output impedance, and evaluating the stability and performance of amplifiers and oscillators under different configurations. Students also gain practical skills in designing and testing RC, Wein bridge, Hartley, and Colpitts oscillators, as well as differential amplifiers and complementary symmetry amplifiers.

This lab aims to build a strong foundation for advanced electronics, circuit design, and communication systems by encouraging experimental analysis and design thinking.

Pulse and Switching Circuits:-

This course offers a detailed study of wave shaping circuits, timing circuits, and multivibrator circuits using transistors, logic gates, and integrated circuits. The course is divided into two major units designed to build foundational and applied knowledge in pulse and switching electronics.

Unit 1 introduces students to the principles of linear and nonlinear wave shaping, including differentiators, integrators, clippers, and clampers. It also explores time base generators using UJT and RC circuits, with a focus on their linearity and applications in waveform generation.

Unit 2 provides in-depth coverage of multivibrator circuits using BJTs, gates, and IC 555 timers. The operation, analysis, and design of astable, monostable, and bistable multivibrators are discussed along with applications such as sequential timers, voltage-controlled oscillators, and battery chargers.

This course is essential for understanding the basics of digital signal generation, waveform conditioning, and timing control—skills critical in analog electronics, embedded systems, and communication engineering

Sr. No.	List of Experiments (Electronics Devices) (Any seven)

1. Designing of biasing network using BJT.
2. Study of single stage CE / CB amplifier. (Gain, I/P & O/P impedance)
3. Emitter follower (Gain, I/P & O/P impedance)
4. Negative feedback amplifier. (Frequency response & feedback factor)
5. RC Phase shift oscillator (Design & testing)
6. Wein bridge oscillator using BJT (Design & testing)
7. Hartley oscillator (Design & testing)
8. Colpitts's oscillator (Design &testing)
9. Study of complimentary symmetry amplifier.
10. Study of Differential amplifier using BJT. (differential gain)

Sr. No.	List of Experiments (Pulse and Switching Circuits) (any seven)

1. Study of Clipper circuit.
2. Study of Clamper circuit.
3. Miller Integrator.
4. UJT oscillator with constant current source.
5. Astable multi-vibrator using BJT.
6. Monostable multi-vibrator using BJT
7. Bistable multi-vibrator using BJT (AC & DC) triggering
8. Schmitt's trigger (hysteresis curve & square wave testing)
9. Astable multi-vibrator using IC 555.
10. Monostable multi-vibrator using IC 555
11. Astable multi-vibrator using IC7400
12. Monostable multi-vibrator using IC74121

Course Outcomes

Electronic Circuits:-

After successful completion of this course, students will be able to:

- CO1: Design and construct BJT biasing networks, and analyze the stability of operating points using appropriate biasing techniques.
- CO2: Measure and evaluate the performance of single-stage CE and CB amplifiers, including gain, input impedance, and output impedance.
- CO3: Analyze and interpret the behavior of emitter follower (common collector) amplifiers, focusing on their impedance characteristics and voltage gain.
- CO4: Construct and analyze negative feedback amplifiers, and evaluate the impact of feedback on frequency response and gain stability.
- CO5: Design, build, and test transistor-based RC oscillators such as RC phase shift and Wien bridge oscillators, verifying frequency of oscillation and waveform.
- CO6: Implement and analyze LC oscillators including Hartley and Colpitts oscillators, and verify their design parameters through practical testing.
- CO7: Examine the working of complementary symmetry power amplifiers and identify crossover distortion.
- CO8: Construct and study differential amplifier circuits, and measure differential gain while understanding the concept of common-mode rejection.

Pulse and Switching Circuits:-

After successful completion of this course, students will be able to:

- CO1: Construct and analyze nonlinear wave shaping circuits like clipper and clamper circuits and evaluate their effect on waveform shaping.
- CO2: Implement Miller integrator circuits and understand their use in waveform generation and timing applications.
- CO3: Design and test a UJT-based relaxation oscillator using a constant current source and analyze its time-base characteristics.
- CO4: Design, build, and evaluate multi-vibrators using BJTs (astable, monostable, and bistable), including waveform analysis and triggering techniques.
- CO5: Analyze the operation of Schmitt triggers, observe hysteresis curves, and use them for noise immunity and signal conditioning.
- CO6: Construct multi-vibrator circuits using IC 555, determine parameters like frequency and pulse width, and explore practical applications such as timers and pulse generators.
- CO7: Implement and test multi-vibrators using digital ICs (IC 7400 and IC 74121) and evaluate their output characteristics and timing control features.

Reference books

Electronic Circuits:-

1. A text book of Applied Electronics by R. S. Sedha. S. Chand Publication.
2. Electronic Devices and Circuits by Boylstead
3. Basic Electronics (Solid State) by B. L. Theraja, S. Chand & Company Ltd.
4. Basic Electronics and Linear Circuits by N. N. Bhargaya D. C. Kulshreshtha TMH
5. Op-Amps and Linear Integrated Circuits by Ramakant Gaikwad, Pearson.

Pulse and Switching Circuits:-

1. Pulse and Switching circuits by Millman and Taub
2. A Text of Applied Electronics by R. S. Sedha, S. Chand Publication
3. Hand book of Electronics by Sony Gupta
4. Electronic Devices and Circuit by Boylestead
5. Linear Integrated Circuit – D. Roy Choudhari, Shail Jain (Wiley Eastern Ltd.)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. II (Electronics) Semester-IV

Vertical: Practicals based on DSC 2-5 and DSC 2-6

Course Code:

Course Name: Electronics Practicals Lab-IV

• **Teaching Scheme** **Credit: 02, Practical: 60 Periods** **Practical :04 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Course Objectives

•	To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
•	To learn measuring skills in practical.
•	To perform calculations to obtain the experimental results.
•	To test whether the experimental results hold good with theoretical results.

List of Experiments

Sr. No.	Name of the Experiment

Basic Diode and Transistor Circuits:- (any six)

1. Study of PN junction diode characteristics
2. Zener diode VI characteristics and voltage regulation
3. Half-wave and full-wave rectifier circuits with/without filters
4. Study of Clipper / Clamper circuit
5. BJT characteristics in CE configuration
6. BJT as a switch
7. Transistor biasing (voltage-divider method) and Q-point determination
8. Single-stage CE amplifier: Frequency response and gain calculation

Sensors and Transducers:- (any six)

1. Study of strain gauge (load cell)
2. Study of temperature sensor PT 100.
3. Study of LVDT
4. Study of Light activated turn ON/OFF circuit using LDR/Photo-diode/Photo-transistor
5. Study of ON-OFF temperature controller using LM35/RTD/Thermistor
6. Study of photo sensor (LDR/Photodiode/Phototransistor)

7. Application of PIR sensor
8. Application of Ultrasonic Sensor

Course Outcomes

On successful completion of this practical course student will be able to:

	Understand the use of different sensors
	Understand the principles of and applications of sensors.
	Understand the concepts learned in Sensors and Transducers
	Plan to conduct simple experiments and give oral and presentation of the results.

References Books

Basic Diode and Transistor Circuits:-

1. Electronic Devices and Circuits by Jacob Milman & Chrstes S Halkias, (MGH).
2. Electronic Devices and Circuits, An introduction by Allen Mottershed (PHI Delhi.)
3. A Text Book of Applied Electronics by R.S. Shedha (S. Chand & Co.)
4. Basic Electronics & Linear Circuits by N.N Bhargava, D.C. Kulshreshta, S.C. Gupta (TMH)
5. Principles of Electronics (10th Edition) by V.K. Mehta (S. Chand & Co.)
6. Electronics Devices and Circuit Theory by R. L. Bolysted & L. Nashelsky (Pearson)

Sensors and Transducers:-

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. Basic Electronics – B L Thereja S Chand.
6. A Text Book of Applied Electronics by R.S. Shedha (S. Chand & Co.)

Course Outcmes:-

1. Learned the fundamental characteristics of Electronic Devices like simple diode, Zener diode, Transistor, Various sensors etc.
2. Learned the use and applications of different electronic semiconductor devices and sensors or modules
3. Apply this practical knowledge in Real-life Applications.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. II (Electronics) Semester-IV

Vertical: Hands on Training - DSC 1 (Major)

Course Code:

Course Name: VSC 3 (DSC 1)

Arduino Interfacing - Advanced Level

• **Teaching Scheme** **Credit: 02, Practical: 60 Periods** **Practical :04 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Learning Objectives

•	Study the need of advanced level interfacing with Arduino
•	Learn the use of various modules required for interfacing
•	Learn the programming techniques for advanced level interfacing
•	Gain the knowledge of using Proteus IDE for advanced level interfacing
	List of Practical **(Using Hardware and using Proteus IDE with Arduino Firmware & libraries) (minimum 60% using real hardware) (any ten)**

1. 16 x 2 LCD display Interfacing with Arduino Board
2. 4 x 4 Matrix-Keyboard module Interfacing with Arduino Board
3. Dot-Matrix Display module Interfacing with Arduino Board
4. Stepper-motor module Interfacing and Control with Arduino Board
5. Melody Tone Generation using Arduino board
6. Blue-tooth module Interfacing with Arduino Board and Android app
7. Wireless Communication between two Arduino's using RF modules
8. DC Motor Controller(speed and direction) module Interfacing with Arduino Board
9. RTC module DS1307 Interfacing with Arduino Board

10 Voice-controlled Automation using Blue-tooth, Arduino Board and Android App

11. Multiplexed 7-Segment Display module Interfacing with Arduino Board
12. Servo Motor module Interfacing with Arduino Board

Learning Outcomes

After completion of the course, Student should be able to-	
1.	Use different interfacing modules with Arduino
2.	Use Arduino IDE and burn program in the Arduino flash memory
3.	Use Arduino Firmware and device libraries for simulated interfacing
4.	Using this knowledge, student should build some real-life project for him
Reference Books	
1.	
2.	
3.	
4.	

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. II (Electronics) Semester-IV

Vertical: Hands on Training - DSC 2 (Minor)

Course Code:

Course Name: VSC 4 (DSC 2)

Proteus (or any other simulation tool) for Simple Analog Electronic Circuit Simulation

• **Teaching Scheme** **Credit: 02, Practical: 60 Periods** **Practical :04 hours/week**	• **Examination Scheme** **Total Marks :50** **UA:30 Marks, CA: 20 Marks**

Learning Objectives

•	Learn to use Proteus IDE for Simple Analog Electronic Circuit Simulation
•	Learn various features of Proteus to Simulate the circuit - drawing circuit, connecting the components, using different instruments like CRO, meters etc.
•	Understand the advantages of using simulation tools like Proteus with real hardware circuits.
•	Acquire enough knowledge to simulate any given circuit, Digital or Analog
Sr. No	**List of Practical (any ten)**

1. Simulation of half-wave and full-wave rectifiers with/without filter
2. Simulation study of I-V characteristics of semiconductor diode.
3. Simulation study of Zener diode I-V characteristics/ as Voltage regulator
4. Simulation study of Diode as a Clipper (with/without bias)
5. Simulation study of Diode as a Clamper (with/without bias)
6. Simulation study of Diode in voltage multiplier circuit
7. Simulation study of input/output characteristics of CE configuration
8. Simulation study of Transfer characteristics of JFET
9. Application of LDR in Burglar Alarm circuit simulation
10 Application of FET as VVR simulation
11. Simulation to study the frequency response of CE amplifier.
12. Simulation study of Voltage-divider bias circuit and test the circuit for Q point and voltage-gain.

Learning Outcomes

After completion of the course, Student should be able to-

1. Use the Proteus IDE/Simulation tool for testing analog electronic circuits
2. Use various features available in Proteus IDE/Simulation tool
3. Make use of Proteus IDE/simulation tool for any simple digital or analog circuit simulation

4. Demonstrate live the use of Proteus simulation tool in-front of audience.	
Reference Books	
1.	
2.	
3.	
4.	

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science & Technology.

Nature of Question Paper

B. Sc. (Part- II) w.e.f. AY 2025-26

University Assessment (UA)

Time: Total Marks: 30

Instructions

1) All Questions are compulsory.

2) Figure to right indicate full marks.

Q.1	Choose correct alternative. (MCQ)	6 Marks
1)	a) b) c) d)	
2)		
3)		
4)		
5)		
6)		
Q.2.	Answer the following. (Any three)	6 Marks
A)		
B)		
C)		
D)		
E)		
Q.3.	Answer the following (Any two).	6 Marks
A)		
B)		
C)		
Q.4.	Answer the following (Any two).	6 Marks

A)		
B)		
C)		
Q.5.	Answer the following (Any one)	6 Mark
A)		
B)		

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science & Technology

Nature of Question Paper

B. Sc. (Part- II) w.e.f. AY 2025-26

College Assessment (CA)

Time: Total Marks: 20

- Internal Evaluation System for 20 Marks
  - Choose any two of the following
  - Home Assignment / Unit Test / Tutorial /Seminar

Pattern of Examination:

- External Evaluation + Internal Evaluation
- 30 Marks + 20 Marks = 50 Marks

- Passing Criteria:
  - Written Exam – 12 out of 30
  - Continuous Assessment (CA) – 08 out of 20

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