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

Course Structure & Credit Distribution for
S.Y.B. Sc. (Electronics) Semester –IV
(2023 Pattern)

Sem.	Course Type	Course Code	Course Title	Theory/ Practical	No. of credits
IV	Major Mandatory	ELE-251-MJM	Instrumentation Techniques	Theory	02
	Major Mandatory	ELE-252-MJM	Fundamentals of Communication Systems	Theory	02
	Major Mandatory	ELE-253-MJM	C Programming and Graphics	Theory	02
	Major Mandatory	ELE-254-MJM	Electronics Practical-IV	Practical	02
	Minor	ELE-261-MN	Basics of Communication Principle	Theory	02
	Minor	ELE-262-MN	Lab Course II	Practical	02
	Open Elective (OE)	ELE-266-OE	Electronics Lab	Practical	02
	Skill Enhancement Course (SEC)	ELE-276-SEC	Circuit Simulator III	Practical	02

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM IV) (2023 Pattern)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : IV
Course Type : Major Mandatory (Theory)
Course Code : **ELE-251-MJM**
Course Title : **Instrumentation Techniques**
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives

1. To study the block diagram of electronic instrument.
2. To understand the working principles of popular instruments.
3. To know important technical specifications of instruments.
4. To learn the operating procedure of instruments.
5. To understand basic concepts and definitions in measurement.
6. Elaborate discussion about the importance of signal generators and analyzers in Measurement.
7. To study the instrumentation systems and perform its applications.

Course Outcomes

After completing the course student will able to

CO1: To understand the performance characteristics of instruments and fundamentals of measurement.
CO2: To learn the construction, working principles of electrical/ analog instruments, digital instruments.
CO3: To know the calibration procedure of electrical instruments.
CO4: Apply fundamental knowledge of measurement in monitoring various electrical instruments.
CO5: Extend the ranges of analog instruments.
CO6: Use the knowledge of performance characteristics for selection and use of Instruments.
CO7: Understand construction, working principle and types of oscilloscopes.

Topics and Learning Points

Unit1: Fundamentals of Measurement: (10)

Introduction, Block diagram of Instrumentation system, Need of Instrumentation, General Measurement System, Classification of Instruments, Static and Dynamic characteristics of instruments, Measurement of physical parameters, measurement system block diagram, Measurement characteristics like accuracy, precision, sensitivity, linearity, resolution, reliability, repeatability, errors, types of error.

Unit 2 : Digital Instruments : (10)

Introduction to digital instruments, Advantages of Digital instruments over Analog instruments, Block diagram, principle of operation, Accuracy of digital instruments, Its

applications in digital instruments,Construction and working principles of Digital Multimeter, Volt meter, Current meter, multi-meter.

Unit 3: Signal sources and Oscilloscope: (10)

Principle, block diagram, working and important specifications of signal and function generators, sweep generator, single trace CRO, dual channel and dual trace CRO comparison and applications, Concept of Digital Storage Oscilloscope (DSO). Concept of Power Supply and Block diagram.

Recommended Books:

1. Helfrik A. & Copper W., Modern Electronic Instrumentation and measurement techniques, PHI.
2. Kalsi H. S., Electronic Instrumentation, TMH.
3. Bouwens, Digital Instrumentations, TMH

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

PO1: Comprehensive Knowledge and Understanding

CO1: Understanding performance characteristics and fundamentals directly contributes to comprehensive knowledge.

CO2: Learning the construction and working principles enhances understanding of various instruments.

CO7: Understanding the construction and types of oscilloscopes aligns with comprehensive knowledge.

PO2: Practical, Professional, and Procedural Knowledge

CO2: Learning about the construction and working principles of instruments reflects practical and procedural knowledge.

CO3: Knowing the calibration procedure demonstrates professional knowledge necessary in the field.

CO4: Applying measurement knowledge to monitor instruments shows practical application of skills.

PO3: Entrepreneurial Mindset and Knowledge

CO5: Extending the ranges of analog instruments could foster innovative thinking, aligning with an entrepreneurial mindset.

PO4: Specialized Skills and Competencies

CO3: Calibration procedures represent a specialized skill essential for instrumentation.

CO5: Extending ranges of instruments showcases the application of specialized competencies.

CO6: Using performance characteristics for instrument selection reflects specialized skills in decision-making.

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

CO4: Applying knowledge of measurement in monitoring instruments involves problem-solving and analytical skills.

CO6: Selecting instruments based on performance characteristics also requires analytical reasoning.

PO6: Communication Skills and Collaboration

CO6: Using knowledge for the selection and use of instruments often requires teamwork and effective communication.

PO7: Research-related Skills

CO2 & CO3: Learning about instrument construction and calibration procedures can involve research into best practices and methodologies.

PO8: Learning How to Learn Skills

CO1 & CO4: Understanding performance characteristics and applying knowledge in monitoring instruments encourage self-directed learning.

PO9: Digital and Technological Skills

CO2 & CO7: Learning about digital instruments and oscilloscopes involves developing technological skills relevant in modern instrumentation.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

None of the COs directly address multicultural competence, though teamwork in selection and application (CO6) can be enhanced by such skills.

PO11: Value Inculcation and Environmental Awareness

None of the COs directly relate to value inculcation or environmental awareness, although ethical considerations in instrument use can be an underlying theme.

PO12: Autonomy, Responsibility, and Accountability

CO4: Applying fundamental knowledge in monitoring instruments reflects a sense of responsibility and accountability in practice.

PO13: Community Engagement and Service

None of the COs directly address community engagement, although practical applications of instrumentation can have community benefits.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM IV) (2023 Pattern)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : IV
Course Type : Major Mandatory (Theory)
Course Code : ELE-252-MJM
Course Title : Fundamentals of Communication Systems
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives

1. To study basics of communication systems.
2. To understand telephone system.
3. To understand Amplitude Modulation.
4. To understand AM demodulation techniques.
5. To understand demodulation techniques.
6. To understand pulse digital communication systems.
7. To learn the Digital communication system

Course Outcomes

After completing the course student will able to

CO1: Understand and identify the fundamental concepts and various components of communication systems.
CO2: Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system
CO3: Develop the ability to compare and contrast the strengths and weaknesses of various communication systems
CO4: Define the need of modulation for communication systems
CO5: Explain the behavior of the communication systems in the presence of noise.
CO6: Compare the different analog and digital modulation schemes for transmission of information.
CO7: To know the function of Digital communication system.

Topics and Learning Points

UNIT- 1: Basics of communication and telephone systems (10)
Block diagram of communication system, Types of communication system: simplex, duplex, analog and digital communication, Electromagnetic spectrum ,base band and broad band communication, Noise concept and types, Signal to noise ratio, Noise figure,Noise temperature.

UNIT- 2: Amplitude Modulation and AM Receiver (10)
Need of modulation, Concept of modulation, AM waveform, mathematical expression of AM, Concept of sideband, Definition of modulation index, power distribution.
AM using diode/transistor, Demodulation, Demodulator circuit using diode.
AM Receiver: TRF and super-heterodyne receiver

UNIT- 3: Pulse Digital Communication Systems (10)

Block diagram of digital communication system, Study of bit rate, baud rate and bandwidth. Serial and parallel communication,

Concept of ASK, PSK, FSK, PAM, PWM, PPM, PCM, FDM and TDM.

Recommended Books:

1. Communication Electronics : Principles and applications by Louis E Frenzel 3rd edition TMH Publications.
2. Electronics Communication Systems : Keneddy
3. Telecommunication Switching Systems and Network : Vishwanathan Thiagarajan, PHI publication.
4. Electronics Communication Systems by Denis Roddy, John Coolen, PHI publication.

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

PO1:Comprehensive Knowledge and Understanding

Selected CO directly addresses the need for foundational knowledge in communication systems, crucial for further learning.

PO2:Practical, Professional, and Procedural Knowledge

CO3, 4 and 5 fosters practical skills in evaluating systems, preparing students for professional roles where decision-making is key.

PO3:Entrepreneurial Mindset and Knowledge

CO4 Understanding modulation can lead to innovative solutions in communications, fostering an entrepreneurial mindset.

PO4:Specialized Skills and Competencies

CO2 and CO6 Focuses on specialized knowledge, enhancing students' competencies in modulation techniques.

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

CO2 and CO5 Requires analytical reasoning and application skills to address noise in communication systems.

PO6:Communication Skills and Collaboration

The CO1, 5 and 6 supports the development of communication skills essential for collaboration.

PO7:Research-related Skills

CO2, CO4 and CO7 Encourages research-related skills by requiring comprehension of quantitative measures in communication systems.

PO8:Learning How to Learn Skills

Understanding noise effects promotes independent learning and critical thinking about system behavior.

PO9:Digital and Technological Skills

Directly enhances digital skills, crucial for navigating modern communication technologies.

PO10:Multicultural Competence, Inclusive Spirit, and Empathy

While not explicitly addressed, knowledge of communication systems can lead to greater awareness of diverse perspectives.

PO11:Value Inculcation and Environmental Awareness

May need integration into coursework, but understanding communication can promote awareness of societal issues. No direct alignment.

PO12:Autonomy, Responsibility, and Accountability

Fosters critical thinking and independent evaluation, promoting responsibility in decision-making.

PO13:Community Engagement and Service

While this PO isn't directly addressed, projects applying communication concepts could enhance community engagement.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM IV) (2023 Pattern)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : IV
Course Type : Major Mandatory (Theory)
Course Code : ELE 253 MJM
Course Title : C Programming and Graphics
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives

1. To understand fundamentals of C language.
2. To develop algorithm/flowcharts for problem solving.
3. To develop basic C programs.
4. To learn to user defined function, arrays and pointers.
5. To understand structure of C programming.
6. To develop C programs using String and it's programming.
7. To get the knowledge of basics of graphics and programs

Course Outcomes

By the end of the course, students will be able to:

CO1. To Understand the concepts of character set , I/O functions , loops and derived data types
CO2. To develop basic C programs.
CO3. Know functions, arrays and pointers.
CO4. To develop the programs using function, arrays.
CO5. To understanding the concept of strings and file in C.
CO6. Students to Develop and analyze the programs based on strings and file.
CO7. Students will get the basic Knowledge of C graphics.

Topics and Learning Points

Unit-1: **Character Array and pointers: [10L]**

Character Array-Declaration, Initialization, Reading and writing string ,operation on string ,Examples Pointers- Introduction, understanding pointers, accessing the address of a variable ,Declaration, Initialization ,Accessing a variables through its Pointer, Pointer and array ,pointer and character string, Programs.

Unit 2: User Defined function: [08L]

Introduction ,Need, A multi function program, Definition of function ,function of Declaration, Categories of functions ,Nesting of functions, Recursion ,passing arguments to function , passing array to function, Passing string to function.Programs.

Unit:-3- Basics of Graphics: **[12L]**

Introduction,Application of computer graphics, Concepts of graphics –Header file, graphics mode, graphics drivers, resolution, detects macros, exiting the graph mode, restoring the next mode graphics initialization, Graphics. Commands-getpixel, putpixel,moveto,line,lineto,polyline,circle,arc,ellipe,reactangle,bar,polygon,getmax x and getmax y function closegragh function ,setcolor, clear device, filling image. Programs.

Books:-

1. J. Jayasri The C Language Trainer with C Graphics and C++ WILEY.
2. Byron. S. Gottfried Schaum's Outline of Programming with C TMH.
3. E Balaguruswamy Programming in ANSI C The McGraw Hill publications.
4. Stephens Cochan Programming in C Prentice hall of India Ltd.
5. V. Rajaraman Computer Programming in C Prentice hall of India Ltd.
6. Madhusudan Mothe C for Beginners.

Mapping Table:

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

Justification For The Mapping:-

PO1:- Comprehensive Knowledge and Understanding:

CO1:- Students to provides foundational knowledge essential for programming. Understanding character sets is crucial for text processing, while I/O functions enable interaction with users and files.

CO4:-Students will Developing programs that utilize arrays demonstrates knowledge of data structures, including how to declare, initialize, and manipulate arrays. Students analyze the efficiency and effectiveness of using arrays for storing and processing data.

CO6:- Students to grasp how to read from and write to files, manage file input/output, and understand data persistence, indicating a comprehensive understanding of real-world applications.

PO2:- Practical, Professional, and Procedural Knowledge.

CO1:-Understanding character sets is fundamental for encoding and decoding data. This knowledge is crucial for practical applications where data representation matters, such as in text processing

CO5:-Understanding strings is crucial for many programming tasks, such as user input and data manipulation. This knowledge supports practical applications in software development where string processing is common.

CO6:-Evaluating the effectiveness and efficiency of these programs cultivates critical thinking and analytical skills, which are essential for professional programming.

PO3:-Entrepreneurial Mindset and Knowledge:

CO3:- Mastering pointers introduces students to memory management and dynamic data structures, which are vital for optimizing resource use in applications. This understanding encourages innovative approaches to programming and software development.

CO4:- The ability to create functional and efficient programs enhances critical thinking and problem-solving skills, essential attributes for entrepreneurs looking to innovate within the tech industry

CO5:- Understanding strings and file handling empowers students to manage data effectively, enabling the development of applications that solve real-world problems. This knowledge is foundational for entrepreneurial ventures in software development**.**

PO4:-Specialized Skills and Competencies:

CO1:- Knowledge of derived data types enables the design of complex data structures, allowing students to solve problems more effectively and efficiently, thereby honing their specialized programming skills.

CO5:- Students Understanding strings is crucial for handling textual data in applications. This competency is essential for various programming tasks, such as data parsing and user interaction, making it a specialized skill.

CO7:- Studnets get Basic knowledge of C graphics broadens students' capabilities in creating visually appealing applications, enhancing their specialized skills in graphics programming.

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

CO1:- Mastery of fundamental concepts such as character sets, I/O functions, loops, and derived data types develops students' capacity for analytical reasoning and effective problem-solving in programming.

CO5:-Understanding strings and file handling enhances students' ability to tackle real-world data management challenges, fostering their application skills and analytical thinking.

CO7:- Basic knowledge of C graphics broadens students' problem-solving approaches, encouraging them to apply analytical reasoning to create visually appealing and user-friendly applications.

PO6:-Communication Skills and Collaboration:

CO1:- Understanding basic programming concepts fosters clear communication of ideas, enabling effective collaboration in team environments.

CO3: Knowledge of functions, arrays, and pointers enhances students' ability to engage in collaborative problem-solving and communicate technical concepts accurately.

CO4: Developing programs collaboratively promotes teamwork and interpersonal skills, emphasizing the importance of communication in successful software development.

PO7:-Research-related Skills:

CO4:- Developing programs using functions and arrays enhances students' ability to conduct research on coding techniques and algorithms, fostering analytical and evaluative skills.

CO6:- Analyzing string and file handling programs encourages critical thinking and research into effective data management practices, enhancing students' research-related skills.

CO7:-Learning C graphics promotes exploration and research into graphical programming techniques, fostering innovation and creative problem-solving.

PO8:-Learning How to Learn Skills:

CO1: Grasping foundational programming concepts encourages self-directed exploration and effective resource utilization, fostering learning how to learn skills.

CO2: Developing basic C programs through hands-on practice promotes iterative learning and adaptability, key aspects of lifelong learning.

CO3: Mastery of functions, arrays, and pointers enhances students' ability to approach complex topics independently, fostering a proactive learning mindset.

PO9:-Digital and Technological Skills:

CO4: Developing programs with functions and arrays highlights students' programming proficiency and their ability to apply digital skills to solve problems.

CO5: Understanding strings and file handling fosters essential data management skills, crucial for navigating today's digital landscape
CO6: Analyzing programs based on strings and files develops critical analytical skills and the ability to integrate various technologies, reinforcing students' digital competence.

PO11:-Value Inculcation and Environmental Awareness:

CO3:- Knowledge of functions, arrays, and pointers fosters responsible coding practices and an awareness of resource management, aligning with values of efficiency and environmental consciousness.

CO4: Developing programs encourages students to consider the societal impacts of their software solutions and promotes sustainable software practices, highlighting social responsibility.

CO5: Understanding strings and file management emphasizes ethical data handling and encourages practices that reduce environmental impact through efficient data processing.

PO12:- Autonomy,Responsibility , and Accountability:

CO2:- Developing basic C programs fosters autonomy in learning and instills a sense of responsibility for producing quality work, preparing students for accountability in their future careers.

CO3: Students get theKnowledge of functions, arrays, and pointers encourages students to be accountable for their coding decisions and fosters the independence necessary to tackle programming challenges effectively.

CO6:-Developing and analyzing programs based on strings and files promotes autonomy in problem-solving, instills a sense of responsibility for ethical data management, and encourages accountability in maintaining code quality.

PO13:-Community Engagement and Service:

CO3: Knowledge of functions, arrays, and pointers empowers students to create solutions that address community challenges and engage in collaborative service-oriented projects.

CO4: Developing programs using functions and arrays enables students to contribute directly to community-focused initiatives, fostering a sense of responsibility and service.

CO5: Understanding strings and file handling equips students to develop applications that effectively manage community-related data, enhancing engagement and resource accessibility.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM IV) (2023 Pattern)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : IV
Course Type : Major Mandatory (Theory)
Course Code : ELE 254 MJM
Course Title : Electronics Practical-IV
No. of Credits : 02
No. of Teaching Hours : 60

Course Objectives

1. To make use of different basic concepts for building different applications.
2. To understand design procedures of different electronic circuit as per requirement.
3. To build experimental setup and test the circuits.
4. To develop skills of analyzing test results of given experiments.
5. Understand the concept of Sensor.
6. To know the modulation techniques.
7. Understand the working of power supply

Course Outcomes

After completing the course student will able to

1. Design and implement hardware circuit to test performance and application in communication electronics.
2. Design any power supply circuit and test it.
3. Design any instrumentation based application circuit and test it.
4. Design and test analog modulation circuit.
5. To understand the benefits of electronics in communication systems.
6. Design, Build and test modulator and demodulator.
7. Develop op-amp based circuits

Topics and Learning Points

List of Practicals (Instrumentation): Any Four
1. Temperature measurement system using LM – 35
2. Study of Function generator
3. Multirange voltmeter
4. Study of CVCC/SMPS.
5. Study of LDR based system
6. Variable power supply using IC 317.
7.Study of Fixed voltage regulator supply.

List of Practicals (Communication Principles): Any Four
1. Time Division Multiplexing circuit.
2. Frequency Shift Keying(FSK) using XR 2206 2.
3. Hamming Code generation and error detection.

4. Study of PAM,PPM and PWM
5. Design, Build and test Amplitude Modulator and Demodulator.
6. Delta Modulation circuit using opamp

Practical list c programming:- Any Three

1. Recursive functions – factorial of a number Fibonacci series using C.
2. Prime number generation using C.
3. Draw basic shapes using C graphics Commands.
4. C program to print a string in Reverse Order.
5. Parallel Equivalent resistance of N resistors.
6. Calculate frequency of I) Wein bridge oscillator.
   II) phase Shift Oscillator.
7. Resonant frequency of series L(mh),C(uf).
8. Reactance of Inductance, capacitance,in ohm at given Frequency.

Activities:

1. Industrial Visit.
2. To learn any Software
3. Internet browsing
4. Study Tour

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

PO1:-Comprehensive Knowledge and Understanding:

All the CO ensures students grasp foundational knowledge about how electronics contribute to communication systems, circuit designing.

PO2:-Practical, Professional, and Procedural Knowledge:

All the Cos involve the practical application and design of electronic circuits, which are commonly used in various applications, enhancing students' practical knowledge and skills in this area.

PO3:-Entrepreneurial Mindset and Knowledge:

Selected CO focuses on applying professional skills to create and test instrumentation circuits, relevant to industry standards.

PO4:-Specialized Skills and Competencies:

CO4 develops specialized competencies in modulation techniques, crucial for effective communication systems.CO6 enhances specialized skills in designing critical communication components, aligning with PO4. CO7 focuses on the development of specialized skills with operational amplifiers, fundamental for various electronic applications.

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

CO1 requires students to analyze and troubleshoot circuit performance, enhancing problem-solving abilities.

CO3 engages analytical reasoning to optimize instrumentation circuits, further developing problem-solving skills.

CO4 encourages analytical thinking when evaluating and improving modulation circuits, fostering deeper problem-solving capabilities.

PO6:-Communication Skills and Collaboration:

Understanding and articulating the benefits of electronics fosters effective communication and collaboration in team settings.

PO7:- Research-related Skills:

CO5 promotes research skills as students investigate current technologies and trends in communication electronics.

PO8:- Learning How to Learn Skills:

Encourages self-directed learning and exploration of technological advancements in communication, aligning with the goal of lifelong learning.

PO9:-Digital and Technological Skills:-

CO1 enhances digital and technological skills through hands-on experience in circuit design and testing, which are critical in today's tech landscape.

CO4 Engaging with modulation techniques builds essential technological skills relevant to modern communication systems.

PO10:- Multicultural Competence, Inclusive Spirit, and Empathy:

While not explicitly covered in the COs, understanding diverse communication technologies can foster cultural awareness and inclusivity.

PO11:- Value Inculcation and Environmental Awareness

This could be enhanced by incorporating discussions on sustainable practices in electronic design, although it is not explicitly addressed in the COs.

PO12:- Autonomy, Responsibility , and Accountability:

CO2 instills a sense of responsibility in designing reliable circuits, encouraging students to be accountable for their work.

CO6 fosters autonomy by requiring students to take full responsibility for the design and functionality of communication devices.

CO7 promotes responsibility in ensuring that circuits meet design specifications and performance criteria.

PO13:-Community Engagement and Service:

Potential for integration through projects that address community needs using communication technologies, but not explicitly covered in the COs.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM IV) (2023 Pattern)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : IV
Course Type : Minor (Theory)
Course Code : ELE-261-MN
Course Title : Basics of Communication principle
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives

1. To study basics of communication systems.
2. To study basic knowledge and prepare concepts of modulation.
3. To understand Amplitude Modulation.
4. To understand AM demodulation techniques.
5. To understand Frequency Modulation.
6. To understand demodulation techniques.
7. To learn the Digital communication system

Course Outcomes

After completing the course student will able to

CO1: Understand and identify the fundamental concepts and various components of communication systems.

CO2: To understand the concept of Multiplexing and multiple accessing.

CO3: Develop the ability to compare and contrast the strengths and weaknesses of various communication systems

CO4: Define the need of modulation for communication systems

CO5: Explain the behavior of the communication systems in the presence of noise.

CO6: Compare the different analog and digital modulation schemes for transmission of information. CO7: Calculate the bit error rate for different digital modulation schemes.

Topics and Learning Points

Unit-1: **Basics of communication systems**: **(08L)**

Block diagram of communication system, Types of electronic communication systems: analog and digital communication, base band and broad band communication, simplex and duplex communication, Serial communication (Synchronous and Asynchronous , Parallel communication, Definition of Signal bandwidth, channel bandwidth, data rate, baud rate. Noise in communication, classification of noise, Signal to noise ratio,channel capacity.

Unit 2: Modulation and Demodulation: (14L)

Modulation and Demodulation - Introduction to concepts of modulation and demodulation, need of modulation, Modulation techniques: Analog modulation: Amplitude, and Frequency modulation, Equation of Amplitude Modulated wave,modulation index and frequency spectrum. Examples. Digital modulation: Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) .AM using diode Modulator and Demodulator circuits by using diode detector.Concept of ASK,FSK.

Unit:- 3 Multiplexing and Multiple Accessing: (08L)

Study of Multiplexing: Frequency Division Multiplexing(FDM), Time Division Multiplexing (TDM), Code Division Multiplexing (CDM), Study of Multiple Accessing: FDMA, TDMA, CDMA examples .

Recommended Books:

1. Communication Electronics : Principles and applications by Louis EFrenzel 3 rd edition TMH Publications.
2. Electronics Communication Systems : Keneddy
3. Telecommunication Switching Systems and Network: Vishwanathan Thiagarajan, PHIpublication.
4. Electronics Communication Systems by Denis Roddy, John Coolen, PHI publication.

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

Justification For The Mapping

PO1:- Comprehensive Knowledge and Understanding:

CO1:- Identifying various components of communication systems often involves using modern tools and technologies.

CO4:- Students are Understanding why modulation is needed, including its benefits such as improving signal-to-noise ratio, etc. is essential for applying knowledge in designing and analyzing communication systems.

CO5:-explaining how communication systems perform under the influence of noise, a critical aspect of communication theory. This involves understanding how noise affects signal integrity, how different types of noise impact system performance, and what techniques.

CO6:-Students must grasp the theory behind different modulation techniques and how they affect signal transmission and reception.

PO2:- Practical, Professional, and Procedural Knowledge.

CO1:-Identifying and understanding communication system components helps students develop professional skills in system design and analysis.

CO2:-To Understand Multiplexing (such as Time Division Multiplexing, Frequency Division Multiplexing) and multiple access techniques (such as TDMA, FDMA, CDMA) are fundamental for efficiently utilizing communication channels.

CO5:-Understanding how noise impacts communication allows engineers to develop practical solutions such as noise reduction techniques, signal processing methods, and error correction strategies.

CO6:-Understanding the relative advantages and limitations of analog and digital modulation techniques enables engineers to solve practical problems and optimize system performance.

PO3:-Entrepreneurial Mindset and Knowledge:

CO1:-understanding of communication systems enables entrepreneurs to identify gaps and opportunities in the market. CO3:-Entrepreneurs need to assess different communication systems to identify which technologies or products offer the most value to the market.

CO5:-An understanding of how noise impacts communication systems helps entrepreneurs anticipate and manage these risks, developing strategies to mitigate the effects of noise and ensure system robustness.

PO4:-Specialized Skills and Competencies:

CO1:-Students with a strong grasp of these concepts can effectively use industry-standard tools and methodologies to implement and evaluate advanced communication systems.

CO3:-Understanding the strengths and weaknesses of various communication systems allows engineers to tailor solutions to specific needs.

CO5:-Understanding the impact of noise on communication systems is essential for solving complex problems related to signal integrity and system performance.

CO7:- Mastery in calculating BER involves using various analytical tools and methods, including simulations and theoretical models.

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

CO1:-students are mastering fundamental concepts and components of communication systems, students build a foundation for applying knowledge, solving problems, and performing analytical reasoning in the context of communication technologies.

CO3:-To compare and contrast different communication systems, students must apply their understanding of each system’s underlying principles.

CO7:-Determining BER requires a deep understanding of the relationship between modulation schemes and error probabilities, including trade-offs between complexity, power efficiency, and bandwidth usage. Students must analyze these relationships critically and reason through the implications of different modulation choices, which directly supports the analytical reasoning components

PO6:-Communication Skills and Collaboration:

CO1:-Understanding the fundamental concepts and components of communication systems is essential for articulating technical information clearly.

CO3:-Students may need to work in teams to analyze systems, debate the merits of different approaches, and come to a consensus on which system is best suited for a particular application.

CO4:-Understanding and explaining modulation allows students to effectively contribute to teamwork, ensuring that all members have a clear understanding of the communication system.

PO7:-Research-related Skills:

CO1:-When engaging in research, students often need to focus on specific components of communication systems, such as antennas, modulation techniques, or noise reduction methods. By understanding and identifying these components.

CO4:-Defining the need for modulation helps students identify the key performance factors (such as bandwidth efficiency and power requirements), allowing them to conduct experiments, collect data, and draw conclusions on the most effective techniques.

CO7:- Understanding various digital modulation schemes (e.g., PSK, QAM, FSK) and their theoretical background.

PO8:-Learning How to Learn Skills:

CO1:-To provide students with a foundation in communication systems, which is critical for developing lifelong learning skills, as understanding the basics is essential for continuous knowledge.

CO2:-Understanding these basic concepts allows students to stay current with advancements such as new multiplexing schemes (e.g., OFDM in 5G) or multiple access techniques

CO4:--Students will be understanding the need for modulation, which is one of the most fundamental concepts in communication systems.

PO9:-Digital and Technological Skills:

CO1:-Students a deep understanding of communication system components enables students to effectively utilize digital tools (such as simulation software, network analyzers, and communication protocols).

CO5:-By understanding the behavior of communication systems under noisy conditions, students can apply various digital technologies such as error correction codes, filtering, and modulation schemes that help reduce the impact of noise.

PO11:-Value Inculcation and Environmental Awareness:

CO1:-students can be made aware of the ethical implications of communication technologies, ensuring that they value privacy, transparency, and ethical use of technology in society.

CO7:-Students who understand how to optimize digital modulation schemes to achieve lower BER can contribute to the development of green technologies.

PO13:-Community Engagement and Service:

CO1:-strong understanding of communication systems enables students to contribute to projects that expand access to communication networks in underserved or rural areas.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM IV) (2023 Pattern)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : IV
Course Type : Minor (Practical)
Course Code : ELE-262-MN
Course Title : Lab Course –II
No. of Credits : 02
No. of Teaching Hours : 60

Course Objectives

1. To Develop proficiency in software tools like Pinnacle and PCB software to enhance the practical understanding of electronics.
2. To Conduct surveys on emerging technologies in the field of electronics and articulate findings in a structured report.
3. To Understand the working principles and applications of operational amplifiers (op-amps) in various circuit configurations such as adder, subtractor, and converters.
4. To Gain hands-on experience in designing and building analog circuits, including two-stage amplifiers and current-voltage (I-V) converters.
5. To Strengthen knowledge of digital electronics through practical experiments on diode matrix ROM, binary-to-gray conversions, and parity generators/checkers.
6. To Understand key digital communication concepts by studying practical implementations of frequency shift keying, pulse modulation techniques, and time-division multiplexing.
7. To Learn and apply concepts of analog and digital modulation by designing and testing modulators and demodulators, including amplitude and frequency modulation circuits.

Course Outcomes

After completing the course student will able to

CO1:Gain hands-on experience in using Pinnacle and PCB software, essential for practical circuit design and development.

CO2:Develop research skills through internet surveys on the latest advancements in electronics and report findings effectively.

CO3:Demonstrate the ability to build and analyze operational amplifier circuits, including their application as adder, subtractor, and various converters.

CO4:Student can successfully design, build, and test analog circuits such as two-stage amplifiers, V-to-I and I-to-V converters using operational amplifiers.

CO5:Student Acquire a deep understanding of digital logic systems by conducting experiments related to binary-gray conversions, parity checkers, and priority encoders.

CO6:Gain practical knowledge in communication systems by designing and experimenting with pulse amplitude modulation (PAM), pulse position modulation (PPM), and pulse width modulation (PWM).

CO7: Demonstrate the ability to design and implement modulation systems, such as amplitude and frequency modulation, including error detection and correction using Hamming codes and other methods.

Topics and Learning Points

(Any 15 Practical's)

Group A: Activities: (Any 2)

1) To learn Pinnacle Software
2) To learn PCB Software
3) Internet survey on recent technologies in Electronics
4) Study tour and its report writing

Group B: Linear Integrated Circuit (Any 3)

1) Study of op-amp as adder
2) Study of op-amp as subtractor
3) Designing and build two stage amplifier using transistor
4) Designing and build V to I converter using opamp
5) Designing and build I to V converter using opamp

Group C: Digital Based Practical (Any -3)

1) Study of Diode Matrix Rom
2) Study of Binary to Gray Conversion
3) Study of Parity generator and checker
4) Study of Priority Encoder
5) Study of Gray to Binary Conversion

Group D: Communication Principles (Any -5)

1) Study of PAM,PPM and PWM
2) Frequency Shift Keying(FSK) using XR 2206
3) Time Division Multiplexing circuit
4) Hamming Code generation and error detection
5) Design, Build and test Amplitude Modulator and Demodulator.
6) Delta Modulation circuit using opamp
7) Design, Build and test Frequency Modulator and Demodulator.

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

PO1: Comprehensive Knowledge and Understanding

CO1: Strongly related because hands-on experience with Pinnacle and PCB software enhances a student's understanding of practical circuit design and development.

CO3 - Strongly related as building and analyzing operational amplifier circuits deepen understanding of key electronics concepts such as adders, subtractors, and converters.

CO5 - Strongly related because experiments in digital logic systems like binary-gray conversions, parity checkers, and priority encoders are essential for a comprehensive understanding of digital electronics.

PO2: Practical, Professional, and Procedural Knowledge

CO1 -Strongly related because hands-on experience with Pinnacle and PCB software directly develops practical skills in circuit design and professional procedures in electronics.

PO3: Entrepreneurial Mindset and Knowledge

CO1: Partially related as while gaining hands-on experience with Pinnacle and PCB software is crucial for practical skills, it has limited direct impact on fostering an entrepreneurial mindset.

PO4: Specialized Skills and Competencies

CO3 : Strongly related because building and analyzing operational amplifier circuits involves developing specialized skills and competencies in electronic circuit design and analysis.

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

CO7: Strongly related because designing and implementing modulation systems involves significant problem-solving and analytical reasoning, particularly in error detection and correction using methods like Hamming codes.

PO6: Communication Skills and Collaboration

CO5: Moderately related as conducting experiments in digital logic systems may involve some level of communication and collaboration, though it is not the primary focus of the CO.

PO7: Research-related Skills

CO2: Strongly related because developing research skills through internet surveys and effectively reporting findings directly enhances the ability to conduct research and analyze advancements in electronics.

PO8: Learning How to Learn Skills

CO4 : Moderately related because designing, building, and testing analog circuits requires learning and applying new skills, though it focuses more on practical application than on learning strategies themselves.

PO9: Digital and Technological Skills

CO3: Moderately related as building and analyzing operational amplifier circuits involves digital and technological skills, but it is more focused on analog circuit design rather than purely digital technologies.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

CO4: Partially related as designing, building, and testing analog circuits primarily focuses on technical skills, with limited direct impact on multicultural competence or empathy.

PO11: Value Inculcation and Environmental Awareness

CO6 : Partially related as gaining practical knowledge in communication systems focuses mainly on technical aspects of modulation techniques, with limited direct emphasis on value inculcation or environmental awareness.

PO12: Autonomy, Responsibility, and Accountability

CO7 : Moderately related because designing and implementing modulation systems involves taking responsibility for accurate system design and error correction, which supports developing autonomy and accountability in technical tasks.

PO13: Community Engagement and Service

CO7: Partially related as designing and implementing modulation systems primarily focuses on technical skills, with minimal direct involvement in community engagement or service.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM IV) (2023 Pattern)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : IV
Course Type : Open Elective (Practical)
Course Code : **ELE-266-OE**
Course Title : **Electronics Lab**
No. of Credits : 02
No. of Teaching Hours : 60

Course Objectives

1. To familiarize students with the installation and troubleshooting of common electrical and electronic systems, such as CCTV, UPS, and DTH receivers.
2. To provide hands-on experience in testing the performance of various motors, including DC motors and stepper motors.
3. To develop skills in identifying and testing different analog and digital integrated circuits (ICs) using IC testers.
4. To enable students to troubleshoot and repair essential systems like data projectors, emergency lights, and circuit breakers.
5. To teach students the use of Electronic Design Automation (EDA) tools for circuit design, simulation, and layout development.
6. To provide practical knowledge in computer hardware assembly and peripheral device installation, including hard drives, printers, and scanners.
7. To engage students in internet and market surveys on emerging technologies and software tools in electronics, enhancing their research skills.

Course Outcomes

After completing the course student will able to

CO1:- Students will be able to install and troubleshoot systems like CCTV, UPS, and DTH receivers efficiently.
CO2:- Students will be able to test and evaluate the performance of DC motors and stepper motors, understanding their operational characteristics.
CO3:- Students will be able to identify and test the functionality of various analog and digital ICs using IC testers, ensuring proper component selection.
CO4:-Students will be able to troubleshoot and repair common devices, such as data projectors, regulated power supplies, circuit breakers, and emergency lighting systems.
CO5:-. Students will be able to utilize EDA tools for circuit simulation, design, and layout development, including applications like BCD to 7-segment decoders.
CO6:- Students will be able to assemble and configure computer systems, including the installation of hardware components like hard drives, dual OS, and peripheral devices such as printers and scanners.

CO7:- Students will be able to conduct internet and market surveys on the latest electronic technologies and software, demonstrating improved research and analytical skills.

Topics and Learning Points

(Any 15 Practical's)

1) Install closed circuit television
2) Install online/offline UPS
3) Test performance of the given(Fractional horse power) DC motors
4) Test performance of the Given Stepper motor.
5) Identify/test various Ics (analog & Digital) using IC tester.
6) Troubleshoot the data projector.
7) Troubleshoot the circuit breaker (MCB & ELCB).
8) Install DTH receiver (indoor & outdoor unit).
9) Troubleshoot the regulated power supply circuit of given equipment.
10) Troubleshoot the Emergency light system.
11) Create new file using given EDA tool to develop the layout of the regulated power supply circuit
12) Measure dc current and dc voltage of the given circuit using node analysis through EDA simulation tool.
13) Use EDA tool to draw & simulate BCD to 7 segment decoder.
14) Familiarize the computer system Layout: Marking positions of SMPS, Motherboard, FDD, HDD, CD, DVD and add on cards.
15) Install Hard Disk and configure to the Pc's
16) Printer Installation and Servicing and troubleshoot
17) Install and Configure Dual OS Installation
18) Install and configure Scanner, Web cam, Cell phone and bio-metric device with system and troubleshoot the problems.

Activities: (Any 2)

1) Internet survey on recent technologies in Electronics
2) To learn PCB Software
3) To learn Pinnacle Software
4) Market Survey.

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

PO1: Comprehensive Knowledge and Understanding

CO1 : Strongly related as installing and troubleshooting systems like CCTV, UPS, and DTH receivers requires a deep understanding of various technologies and their applications.
CO5 : Strongly related because using EDA tools for circuit simulation and design, including applications like BCD to 7-segment decoders, demands a thorough comprehension of electronic principles and practices.

PO2: Practical, Professional, and Procedural Knowledge

CO1 : Strongly related as installing and troubleshooting systems like CCTV, UPS, and DTH receivers involves hands-on practical skills and professional procedures.
CO4 : Strongly related because troubleshooting and repairing devices such as data projectors and regulated power supplies require practical skills and adherence to procedural knowledge.

PO3: Entrepreneurial Mindset and Knowledge

CO1 : Partially related as installing and troubleshooting systems like CCTV, UPS, and DTH receivers involves technical skills rather than directly fostering an entrepreneurial mindset.
CO3 : Partially related because identifying and testing analog and digital ICs is more focused on technical proficiency than on developing entrepreneurial skills or knowledge.

PO4: Specialized Skills and Competencies

CO3 : Strongly related as identifying and testing the functionality of analog and digital ICs involves developing specialized skills and competencies in electronics and component selection.

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

CO1 : Strongly related as installing and troubleshooting systems like CCTV, UPS, and DTH receivers requires effective application of knowledge, problem-solving skills, and analytical reasoning to address and resolve technical issues.

PO6: Communication Skills and Collaboration

CO5: Partially related as utilizing EDA tools for circuit simulation and design primarily focuses on technical skills, with limited direct emphasis on communication and collaboration.

PO7: Research-related Skills

CO3 : Moderately related as identifying and testing the functionality of analog and digital ICs involves some level of research and analysis to ensure proper component selection, though it is not the primary focus of research skills.

PO8: Learning How to Learn Skills

CO4 : Moderately related as troubleshooting and repairing devices involves acquiring practical skills and adapting learning methods, though it is more focused on hands-on experience rather than learning strategies.

PO9: Digital and Technological Skills

CO1 : Moderately related because installing and troubleshooting systems like CCTV, UPS, and DTH receivers involves digital and technological skills, but is more focused on practical application rather than advanced technological proficiency.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

CO4 : Partially related as troubleshooting and repairing common devices focuses primarily on technical skills with limited emphasis on multicultural competence or empathy.

PO11: Value Inculcation and Environmental Awareness

CO6 : Partially related as assembling and configuring computer systems primarily involves technical skills, with limited direct connection to value inculcation or environmental awareness.

PO12: Autonomy, Responsibility, and Accountability

CO7 : Strongly related as conducting internet and market surveys on the latest electronic technologies requires taking initiative, responsibility, and accountability in research and analysis.

PO13: Community Engagement and Service

CO1 : Partially related as installing and troubleshooting systems like CCTV, UPS, and DTH receivers focuses more on technical skills rather than direct community engagement or service.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM IV) (2023 Pattern)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : IV
Course Type : Skill Enhancement Course (SEC) (Practical)
Course Code : ELE-276-SEC
Course Title : Circuit Simulator III
No. of Credits : 02
No. of Teaching Hours : 60

Course Objectives

1. To develop hands on skills for different circuits using PSpice simulator.
2. To get knowledge about entering a design simulation and build a solid foundation in the overall use of software.
3. To enhance technical knowledge about the DC bias simulations, transient analysis simulations, sweep simulation by sweeping component values, operating frequencies or global parameters.
4. To increase employment opportunities of students to simulate several types of analog circuits, transformers, digital circuits.
5. To develop hands on working for simulation of several types of mixed analog and digital circuits and stress analysis.
6. To develop hands on working experience with reference to Solve, Simulate and analyze Electrical & Electronics Circuits using PSPICE environments.
7. To configure and run smoke analysis.

Course Outcomes

After completing the course student will able to

CO1: Create, design and develop problem solving ability.
CO2: To edit a stimulus and run a parametric analysis.
CO3: Understand state of the art, technology and development
CO4: Develop soft skills needed.
CO5: Get knowledge of self-employability.
CO6: Explain PSPICE EDA tools
CO7: To get acquainted with PSpice software and its various features.

Topics and Learning Points

List of Practicals (Any 15)

1. Simulation of Wein Bridge Oscillator/ Phase shift oscillator using PSpice simulator.
2. Design and simulate low pass filter using PSpice simulator.
3. Design and simulate high pass filter using PSpice simulator.
4. Design and simulate an amplifier using PSpice simulator.
5. Design and simulate operational amplifier using PSpice simulator.
6. Study and simulate concept of filter using PSpice simulator.

7. Design and simulate integrator using op. amp. By PSpice simulator.
8. Study and simulate relaxation oscillator using PSpice.
9. Smoke analysis using PSpice.
10. Study of IV characteristics of transistor using PSpice.
11. MOSFET switching simulation using PSpice.
12. Schmitt trigger circuit analysis using PSpice.
13. R-2R ladder circuit simulation using PSpice.
14. Design and simulate Adder circuit using logic gates in PSpice.
15. Study of 3 bit synchronous up counter using Flip Flop in PSpice.
16. Study of 3 bit synchronous down counter using Flip Flop in PSpice.
17. Simulation of decoder using PSpice.
18. Study of decimal to BCD encoder using logic gates in PSpice.
19. Study of Multiplexer using PSpice simulator.
20. Study of Demultiplexer using PSpice simulator.

Activity List: (Any one Activity equivalent to two experiments)

5. Industrial Visit.
6. Study Tour
7. Internet Survey on different Simulators in Electronics
8. Any one extra practical done by student from the above list but, excluding regular laboratory Practicals.

Table of Mapping

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

Justification of Mapping

PO1: Comprehensive Knowledge and Understanding:
CO1: This CO directly supports a deep understanding of foundational theories and methodologies by fostering skills in problem-solving, which is integral to comprehending and applying core principles in the field.
CO4: While soft skills are valuable for professional development, they do not directly contribute to the comprehensive understanding of foundational theories and methodologies in the field.

PO2: Practical, Professional, and Procedural Knowledge:
CO6: Explaining PSPICE tools involves practical knowledge of industry-standard tools and their application, reflecting a strong alignment with professional and procedural expertise.
CO7: Acquaintance with PSpice software provides hands-on experience with industry tools and best practices, demonstrating a strong alignment with practical and procedural knowledge.

PO3: Entrepreneurial Mindset and Knowledge:
CO4: Developing soft skills is crucial for fostering an entrepreneurial mindset, including communication, leadership, and innovation.
CO5: Knowledge of self-employability directly supports an entrepreneurial mindset by preparing graduates to identify opportunities and manage their own ventures.

PO4: Specialized Skills and Competencies
CO1: Directly relates to developing specialized problem-solving skills.
CO2: Involves technical skills and analytical abilities.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO3: Supports the PO by fostering adaptability and readiness to learn about current technology and development, which are crucial for problem-solving and practical application.
CO7: Familiarity with PSpice software involves analytical reasoning and application, making this CO strongly aligned with the PO.

PO6: Communication Skills and Collaboration
CO1: Problem-solving often requires collaboration and communication to share ideas and solutions, but the focus of CO1 is more on individual skill development.
CO2: This CO is more technical and focuses on individual analytical skills rather than collaboration or communication.

PO7: Research-related Skills
CO2: Running a parametric analysis requires using research-related skills such as data collection, analysis, and interpretation, making it strongly aligned with this PO.
CO7: Familiarity with PSpice features may involve inquiry and analysis but doesn't require in-depth research methodologies, making it a moderate fit with this PO.

PO8: Learning How to Learn Skills
CO3: Staying updated with the latest technology requires self-directed learning and the ability to adapt to evolving knowledge, aligning strongly with the PO.
CO7: Getting familiar with software involves some level of self-directed learning, but the focus is on specific software features rather than general learning adaptability.

PO9: Digital and Technological Skills
CO5: Self-employability may require the use of digital platforms for business, but this CO focuses more on personal career knowledge than technological skills.
CO6: PSPICE EDA tools are a key aspect of digital proficiency, as mastering these tools requires deep knowledge of software and digital applications.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy
CO1: Problem-solving can occur in diverse teams where multicultural competence may be useful, but it is not the central focus of this CO.
CO4: Soft skills development is crucial for working in diverse, multicultural settings, as it includes communication, empathy, and understanding different perspectives.

PO11: Value Inculcation and Environmental Awareness
CO2: This CO is more technical and focused on analysis, with limited relevance to ethical issues or environmental awareness.

CO5: Self-employability focuses more on personal career development and less on ethical values or environmental sustainability.

PO12: Autonomy, Responsibility, and Accountability
CO1: Problem-solving often requires independent thinking, accountability for solutions, and responsibility in applying knowledge, making this CO strongly aligned with the PO.
CO5: Self-employability requires autonomy, responsibility for personal development, and accountability in career decisions, making this CO strongly aligned with the PO.

PO13: Community Engagement and Service
CO3: Technological understanding can potentially be applied to societal well-being, but the direct focus on community service is limited.
CO4: Soft skills are essential for effective community engagement, as they facilitate communication, teamwork, and collaboration in service-oriented activities.