Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati

(Autonomous)

Three/Four Year Honours/Honours with Research B. Sc. Degree

Program in Electronics

(Faculty of Science)

CBCS Syllabus

S.Y.B. Sc. (Electronics)

For Department of Electronics

<u>NEP-2.0</u>

Choice Based Credit System Syllabus

(2024 Pattern)

(As Per NEP-2020)

To be implemented from Academic Year 2024-2025

Title of the Programme: F.Y.B. Sc. (Electronics)

Preamble

AES's Tuljaram Chaturchand College has decided to change the syllabus of various faculties from June, 2023 by taking into consideration the guidelines and provisions given in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcomes for the development of the students. The credit structure and the courses framework provided in the NEP are nationally accepted and internationally comparable.

The rapid changes in science and technology and new approaches in different areas ofElectronics and related subjects, Board of Studies in Electronics of Tuljaram Chaturchand College, Baramati - Pune has prepared the syllabus of F. Y. B. Sc.Electronics Semester – I& II under the Choice Based Credit System (CBCS) by following the guidelines of NEP 2020, NCrF, NHEQF, Prof. R.D. Kulkarni's Report, GR of Gov. of Maharashtra dated 20th April, 16th May 2023 and 13th March, 2024 and Circular of SPPU, Pune dated 31st May 2023 and 2nd May, 2024.

B.Sc. Electronics is a program, develops a specialized skill set among the graduates to cater the need of industries. The curriculum of B.Sc. Electronics is designed to help the learners to understand, appreciate, analyse and engage with learning of the subject and alsoprovide best learning experience to the graduates. The curriculum is aimed to equip the graduates with competencies like problem solving and analytical reasoning which provide them high professional competence apart from imparting disciplinary knowledge. The Electronics Department is encourage its faculty to make suitable pedagogical innovations, in addition to teaching/learning processes suggested in the model curriculum, so that the Course/Programme learning outcomes can be achieved.

Significance

In recent years, Electronics has made unprecedented growth in terms of new technologies, new ideas and principles. The research organizations and industries that work in this frontier area are in need of highly skilled and scientifically oriented manpower. This manpower can be available only with flexible, adaptive and progressive training programs and a cohesive interaction among the institutions, universities, and industries. The key areas of study within subject area of Electronics comprise of Semiconductor Devices, VLSI design, Microprocessors & Microcontroller Systems, Computer Coding/ Programming etc. and also modern applied fields such as Embedded Systems, IoT, Data Communication, Robotics, Control Systems, Artificial Intelligence, Nano Electronics and Nano Electronic Devices etc.

Overall, revising the Electronics syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Specific Outcomes (PSOs)

PSO1: AcquiretheknowledgeinElectronicDevicesandCircuits,Analog&Digitalcommunication, Embeddedsystems, AI, WSN ,MEMSandothercoreareasof Electronics.

PSO2: UnderstandtheprinciplesandworkingofbothhardwareandsoftwareaspectsofElectronicsystems.

PSO3: Gaintheoretical andpractical knowledgeindevelopingareasofElectronics.

PSO4: Toanalyze,designandimplementanaloganddigitalelectronicsystems,informationandcommunicationsystems

PSO5: Assesstheimpact ofnewtechnologiesandsolvecomplex problems.

PSO6: Developresearchorientedskillsandtoinculcatelaboratoryskillsinstudentssothattheycantakeupindependent projects

PSO7: Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.

PSO8: To acquire experimental skills, analysing the results and interpret data.

PSO9: Ability to design / develop/manage/ operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.

PSO10: Capacity to identify and implementation of formulate to solve the electronic related issues and analyse the problems in various sub disciplines of electronics.

PSO11: Capability to use the Modern Tools/Techniques.

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Board of Studies (BOS) in Electronics

From 2022-23 to 2024-25

Sr. No.	Name	Designation
1.	Dr. Deshpande J.D.	Chairman
2.	Dr. Mrs. Pawar A. M.	Member
3.	Dr. Patil S. N.,	Member
4.	Mrs.Rupnawar P. D.,	Member
5.	Dr. Kothawale A. S,	Member
6.	Mrs. Gawade S. A.,	Member
7.	Mrs. Patil S. S.	Member
8.	Mrs. Shinde P. K.	Member
9.	Mrs. Walekar S. S.	Member
10.	Miss. Pawar S. S.	Member
11.	Prof. Dr. Tilekar S. K	Expert from other University
12.	Dr. Lande Pankaj	Expert from other University
13.	Dr. Arun Patil	Expert from University
14.	Mr. Patil Sharad. V.	Industry Expert
15.	Mr. Sutar Ganesh	Meritorious Alumni
16.	Mr. Gaikwad Shubham R.	Student Representative
17.	Miss. Chavan Gauri M.	Student Representative

Course and Credit Distribution Structure for B.Sc. (Electronics)2024-2025

Level/Difficulty	Sem	Subject DSC-1	Subject DSC-2	Subject DSC-3	GE/OE	SEC	IKS	AEC	VEC	CC	Total
4.5/100	I	2(T)+2(P)	2(T)+2(P)	2(T)+2(P)	2(T)	2(T/P)	2(T) (Generic)	2(T)	2(T)	--	22
	II	2(T)+2(P)	2(T)+2(P)	2(T)+2(P)	2(P)	2(T/P)	--	2(T)	2(T)	2(T	22

Exitoption:AwardofUGCertificateinMajorwith44creditsandanadditional4creditscoreNSQFcourse/InternshipORContinuewithMajorandMinor
Continueoption:Studentwillselectonesubjectamongthe(subject1,subject2andsubject3)asmajorandotherasminorandthirdsubjectwillbedropped.

Level/Difficulty	Sem	CreditsRelatedtoMajor: MajorCore	MajorElective	VSC	FP/OJT/CEP/RP	Minor	--	GE/OE	SEC	IKS	AEC	VEC	CC	Total
5.0/200	III	4(T)+2(P)	--	2(T/P)	2(FP)	2(T)+2(P)	--	2(T)	--	2(T)	2(T)	--	2(T)	22
	IV	4(T)+2(P)	--	2(T/P)	2(CEP)	2(T)+2(P)	--	2(P)	2(T/P)	--	2(T)	--	2(T)	22
Exitoption:AwardofUGDiplomainMajorandMinorwith88creditsandanadditional4creditscoreNSQFcourse/InternshipORContinuewithMajorandMinor														
5.5/300	V	8(T)+4(P)	2(T)+2(P)	2(T/P)	2(FP/CEP)	2(T)	--	--	--	--	--	--	--	22
	VI	8(T)+4(P)	2(T)+2(P)	2(T/P)	4(OJT)	--	--	--	--	--	--	--	--	22
Total3Years		44	8	8	10	18	8	8	6	4	8	4	6	132
Exitoption:AwardofUGDegreeinMajorwith132creditsORContinuewithMajorandMinor														
6.0/400	VII	6(T)+4(P)	2(T)+2(T/P)	--	4(RP)	4(RM)(T)	--	--	--	--	--	--	--	22
	VIII	6(T)+4(P)	2(T)+2(T/P)	--	6(RP)	--	--	--	--	--	--	--	--	22
Total4Years		64	16	8	22	22	8	8	6	4	8	4	6	176
FourYearUGHonourswithResearchDegreeinMajorandMinorwith176credits														
6.0/400	VII	10(T)+4(P)	2(T)+2(T/P)	--	--	4(RM)(T)	--	--	--	--	--	--	--	22
	VIII	10(T)+4(P)	2(T)+2(T/P)	--	4(OJT)	--	--	--	--	--	--	--	--	22
Total4Years		72	16	8	14	22	8	8	6	4	8	4	6	176
FourYearUGHonoursDegreeinMajorandMinorwith176credits														

T=TheoryP=Practical **DSC**=DisciplineSpecificCourse **OE**=Open Elective **SEC**=SkillEnhancement Course
IKS=IndianKnowledge System **AEC**=AbilityEnhancementCourse **VEC**=ValueEducation Course**CC**= Co-curricularCourse **VSC**=VocationalSkillCourse
OJT=OnJobTraining **CEP**=CommunityEngagementProject **FP**=Field Project **RP**=ResearchProject

Course Structure for S.Y.B.Sc.Electronics (2024 Pattern)

Sem	Course Type	Course Code	Course Title	Theory/ Practical	Credits
III (5.0)	Major Mandatory	ELE-201-MRM	Integrated Circuits and Applications	Theory	02
	Major Mandatory	ELE -202-MRM	Digital Circuit Design	Theory	02
	Major Mandatory	ELE -203-MRM	Ele Pract. 2	Practical	02
	Vocational Skill Course (VSC)	ELE -204-VSC	Practicals on Circuit Building and Testing	Practical	02
	Field Project(FP)	ELE -205-FP	Field Project	Practical	02
	Minor	ELE -206-MN	Electronic Communication	Theory	02
	Minor	ELE -207-MN	Communication Practicals	Practical	02
	Open Elective (OE)	ELE -208-OE	Basics of Computer Hardware	Theory	02
	Subject Specific Indian Knowledge System (IKS)	ELE -209-IKS	Electronics IKS	Theory	02
	Ability Enhancement Course (AEC)	MAR-210-AEC/ HIN-210-AEC/ SAN-210-AEC		Theory (Any One)	02
	Co-curricular Course (CC)	YOG/PES/CUL/NSS /NCC-211-CC	To be continued from the Semester - II		02
	Total Credits Semester - III				**22**
IV (5.0)	Major Mandatory	ELE -251- MRM	C- Language	Theory	02
	Major Mandatory	ELE -252- MRM	Communication Systems	Theory	02
	Major Mandatory	ELE -253- MRM	Ele Pract. 3	Practical	02
	Vocational Skill Course (VSC)	ELE -254-VSC	Signal Conditioning of Electronic Circuits	Theory	02
	Community Engagement Project (CEP)	ELE -255-CEP	Community Engagement Project	Practical	02
	Minor	ELE -256-MN	Electronic Instrumentation	Theory	02
	Minor	ELE -257-MN	Instrumentation Practicals	Practical	02
	Open Elective (OE)	ELE -258-OE	Basics of Computer Hardware Lab.	Practical	02
	Skill Enhancement Course (SEC)	ELE -259-SEC	Circuit Simulator III	Practical	02
	Ability Enhancement Course (AEC)	MAR-260-AEC/ HIN-260-AEC/ SAN-260-AEC		Theory (Any One)	02
	Co-curricular Course (CC)	YOG/PES/CUL/NSS /NCC-261-CC	To be continued from the Semester - III		02
	Total Credits Semester - IV				**22**
	Total Credits Semester – III + IV				**44**

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc.Electronics (SEM III) (2024Pattern)

Name of the Programme : B.Sc.Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : III
Course Type : Major Mandatory (Theory)
Course Code : ELE-201-MRM
Course Title : Integrated Circuits and Applications
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives

1. To study basic principles of amplifiers and oscillators.
2. To understand the working of various analog circuits.
3. To develop analog circuit design skills.
4. To apply the knowledge of analog circuits in different applications.
5. To understand the basic concepts of operational amplifier and its various applications.
6. To understand the basics of Op-Amp and its practical applications
7. To know about Oscillator and its Application.

Course Outcomes

After completing the course student will able to

CO1: Understand basics of amplifiers, op-amp and oscillators.
CO2: Explain the concepts of oscillators, filters.
CO3: Design the circuits of different filters and oscillators.
CO4: Design and analyze the various non-linear application of op-amp
CO5: Design and analyze filter circuits using op-amp
CO6: Design and analyze oscillators circuits using op-amp.
CO7: Understand and Improve the Practical Skills and knowledge about Oscillators.

Topics and Learning Points

UNIT1: Basic Operational Amplifier& Applications **(10)**

Differential Amplifier, Block diagram of an operational amplifier, Op-Amp characteristics (Ideal and practical) Inverting and non-inverting amplifiers, Adder and subtractors, Voltage follower, Integrator, Differentiator, Comparators, Schmitt Trigger, Voltage to current converter, Current to voltage converter, Instrumentation amplifier, Active Filters: First order low pass, high pass, band pass and band reject filters.

UNIT2: Oscillators **(10)**

Concept of negative and positive feedback and Barkhausen criterion
Oscillators: Wien bridge, Phase Shift oscillator, Hartley, Colpitts, Crystal oscillator

UNIT3: Timing Circuits and Voltage regulators **(10)**

Concept of multivibrator, IC 555 – block diagram, multivibrator circuits,
Fixed and variable IC regulators: Block diagram of regulated power supply, series and shunt regulators, three terminal regulators 78xx and 79xx series, LM 317 regulator.

Reference Books:

1. Operational amplifiers and Linear Integrated Circuits by Gaykawad R. PHP
2. Operational amplifier by Clayton G. B. ELBS
3. Electronic devices and circuits by Millman, Halkias McGraw Hill
4. Operational amplifiers and Linear Integrated circuits, R. F. Coughlin and F. F. Driscoll, Pearson Education (2001)
5. Electronic Principals, A. P. Malvino, Tata McGraw-Hill, (2003)
6. OP-AMP and Linear Integrated Circuits, K. L. Kishore, Pearson (2011)
7. Basic Electronic Devices and Circuits: R.Y. Borse 1st Edition 2012 Adhayan Publishers and distributors, New Delhi.

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

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

Mapping Justification:-

PO1:-Comprehensive Knowledge and Understanding:

CO2:-How to analyze and design amplifier circuits. Similarly, comprehension of operational amplifiers (op-amps) includes knowledge of their ideal behavior, differentiating between inverting and non-inverting configurations, and applications in signal processing and control systems.

CO4:-Designing and analyzing non-linear op-amp circuits require knowledge of various non-linear devices and techniques such as diodes, transistors, and feedback configurations. Graduates must understand concepts like clipping, limiting, and distortion in op-amp circuits and how to mitigate or utilize them in practical applications.

CO7:-Designing op-amp characteristics also involves considering practical aspects such as power supply rejection ratio (PSRR), noise, and thermal stability to ensure reliable and robust circuit operation across different operating conditions.

PO2:-Practical, Professional, and Procedural Knowledge:

CO1:-The design process follows specific procedures, including problem definition, circuit analysis, component selection, simulation, and validation.

CO2:-Explaining the concepts of oscillators and filters requires graduates to have a deep understanding of the underlying principles, theories, and operational characteristics of these circuit elements.

CO5:-Designing and analyzing filter circuits using op-amps provides students with hands-on experience in circuit construction, testing, and validation.

CO7:- Students understanding the procedures involved in oscillator design, implementation, and optimization. This procedural knowledge encompasses aspects such as selecting appropriate components, configuring oscillator circuits, and analyzing performance characteristics.

PO3:-Entrepreneurial Mindset and Knowledge:

CO1:- Students we designing circuits for filters and oscillators, students gain procedural knowledge in circuit design, learning how to systematically approach design problems.

CO3:- Students will understand the basic Oscillators require knowledge of feedback theory, frequency stability, and circuit topologies to generate periodic waveforms reliably.

PO4:-Specialized Skills and Competencies:

CO1:- This practical experience enhances their understanding of filter behavior, fosters problem-solving skills, and prepares them for real-world engineering tasks where practical knowledge and skills are essential for success.

CO2:- Students will able to Facilitating the design and analysis of various filter and oscillator circuits.

CO4:-Students get the practical skills enhancement and knowledge improvement in oscillators.

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

CO1:-Students we are enables to comprehend oscillator and filter concepts.

CO3:-Students are exploring non-linear applications of op-amps.

CO5:- Students designing and analyzing filter circuits and oscillators using op-amps, students further develop their capacity for application and problem-solving.

CO7:-Students get Practical skills improvement and knowledge enhancement in oscillators and understanding and application capabilities, problem-solving.

PO6:-Communication Skills and Collaboration:

CO1:- understanding the basics of amplifiers, op-amps, and oscillators about students with foundational knowledge essential for effective communication.

CO5:- Analyzing various non-linear applications of op-amps as well as designing and analyzing filter circuits .

PO7:- Research-related Skills:

CO2:- students to engage in research activities related to electrical engineering. By explaining oscillator and filter concepts.

CO4:- Designing and analyzing filter circuits and oscillator using op-amps provide students with practical research experience in applying theoretical knowledge to real-world problems.

CO5:- Improving practical skills and knowledge in oscillators enhances students' ability to conduct experiments and gather data for research purposes.

PO8:- Learning How to Learn Skills:

CO1:- Students are the foundation for students to develop learning how to learn skills.

CO4:- Designing and analyzing filter circuits and oscillators using op-amps provide students with opportunities.

CO5:- students' ability to learn through hands-on experimentation and application.

PO9:-Digital and Technological Skills:-

CO1:- fundamental for developing digital and technological skills among students in the field of electrical engineering.

CO2:- We are explaining oscillator and filter concepts and designing various filter and oscillator circuits.

CO4:- students gain practical experience with analog electronic components, which are essential for understanding digital systems.

CO5:- Op-amps provide students with a strong foundation in signal processing and control, which are crucial aspects of digital and technological skills.

CO7:- Improving practical skills and knowledge in oscillators further enhances students' ability to apply analog and digital concepts.

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

PO1:- Students the basics of amplifiers, op-amps, and oscillators and explaining the concepts of oscillators and filters provide a foundational understanding of electronic circuits.

PO2:- Designing and analyzing filter circuits using op-amps involves problem-solving and critical thinking skills, as well as hands-on experimentation.

P05:- the process of designing filter circuits, students may encounter diverse perspectives and approaches, fostering multicultural competence and empathy as they appreciate different ways of approaching and solving engineering challenges.

PO11:- Value Inculcation and Environmental Awareness

CO1:- Understanding the basics of amplifiers, op-amps, oscillators (CO1), and explaining the concepts of oscillators and filters.

CO2:- the optimization of electronic circuits, including amplifiers, op-amps, oscillators, and filters, often involves considerations such as power efficiency, minimizing energy consumption etc.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc.Electronics (SEM III) (2024 Pattern)

Name of the Programme : B.Sc.Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : III
Course Type : Major Mandatory (Theory)
Course Code : ELE-202-MRM
Course Title : Digital Circuit Design
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives

1. To utilize k-maps in the design of combinational circuits.
2. To understand the design principles of sequential circuits.
3. To study the design and working of various DACs.
4. To study the design and working of various ADCs.
5. To be familiar with different counters.
6. To understand the basic software tools for the design of circuits.
7. To understand and analyze the operation of counters .

Course Outcomes

Student should able to:

1. Design combinational circuits using logic gates.
2. Design various counters and determine its outputs.
3. Work with different types of counters and design its applications.
4. Understand sequential circuits.
5. Understand the fundamental concepts and techniques used in digital electronics.
6. To prepare students to analyze and design various digital electronic circuits.
7. To facilitate students in designing a logic circuit.

Topics and Learning Points

UNIT -1: Combinational Circuits: **(10)**

Revision of K maps, Design of code converters: BCD to Seven segments, Binary to Gray, Gray to binary, Half adder, Full adder, Half subtractor and full subtractor, One bit and Two bit Magnitude comparator.

UNIT -2: Sequential Circuits: **(10)**

State table, State diagram, excitation table and transition table. Design of counters using state machines: Synchronous, asynchronous, modulo-N and up-down counter.

UNIT -3: Data Converters : (10)

Digital to analog converters : Weighted resistive DAC, R-2R ladder DAC, DAC accuracy and resolution.

Analog to Digital converters: Simultaneous ADC, Counter type ADC, Tracking ADC, Successive approximation ADC, Single slope ADC, Dual slope ADC, ADC accuracy and resolution.

Reference Books:

1. Digital Fundamentals by Floyd Thomas (Pearson)
2. Digital Circuit design by Morris Mano (PHP)
3. Digital Principles and applications by Malvino Leach (TMH)
4. Modern digital Electronics by R.P.Jain (TMH)

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

Mapping Justification :-

PO1: Comprehensive Knowledge and Understanding:

CO2:- To provide students with comprehensive knowledge and understanding in digital electronics.

C04: focuses on designing various counters and determining their outputs.

CO7:- understanding digital system interfacing and logic families. This ensures that students acquire a holistic understanding of digital circuits, enabling them to design and analyze complex systems effectively.

PO2:- Practical, Professional, and Procedural Knowledge:

CO1:- Students we are designing combinational circuits using logic gates creating various counters and determining outputs.

CO2:- Students are understanding fundamental concepts and techniques in digital electronics.
CO5:- Students will able to facilitating students in designing logic circuits.
CO7:- This comprehensive approach equips students with hands-on skills and theoretical understanding essential for professional application in digital electronics.

PO3:- Entrepreneurial Mindset and Knowledge:

CO1:- Involves designing combinational circuits using logic gates, which encourages creative problem-solving and innovation.

CO3:- Includes designing various counters and determining outputs, which enhances students' ability to develop novel solutions and applications.

PO4:- Specialized Skills and Competencies

CO1:-Students designing combinational circuits using logic gates, which lays the groundwork for understanding digital circuitry.

CO2:- Designing various counters and determining outputs, honing students' ability to work with sequential logic.

CO4:- students' understanding of digital system interfacing and logic families, providing them with specialized knowledge essential for advanced circuit design and integration. **PO5:- Capacity for Application, Problem-Solving, and Analytical Reasoning**

CO2:- Designing various counters and determining outputs, which requires problem-solving skills to ensure correct functionality and efficiency.

CO3:- students develop the capacity to apply their knowledge effectively, solve complex problems, and employ analytical reasoning in the design and application of digital circuits.

PO6:- Communication Skills and Collaboration

CO2:- To enhance communication skills and collaboration in the context of digital electronics.

CO5:- Involves designing various counters and determining outputs, which may require students to effectively communicate their design ideas.

PO7:- Research-related Skills

CO2:- Designing various counters and determining outputs, which requires students to conduct research to understand different counter designs and their applications in various Circuits.

CO4:- understanding digital system interfacing and logic families, also contributes to research-related skills by necessitating students to explore literature and resources to grasp advanced concepts and their applications.

CO5:- understanding the fundamental concepts and techniques in digital electronics, fostering the ability to critically analyze existing research and integrate new findings into digital circuit design.

PO8:- Learning How to Learn Skills:

CO1:- Students weare designing combinational circuits using logic gates, requiring students to engage in active learning processes to understand the principles behind circuit design and operation.

CO4:- Designing combinational circuits using logic gates, reinforcing the importance of iterative learning and practice in mastering this skill.

CO5:-Students to understanding the fundamental concepts and techniques used in digital electronics.

PO9:- Digital and Technological Skills

CO1:- designing combinational circuits using logic gates And practical skills in electronic circuit design and implementation

CO4:- Designing combinational circuits using logic gates, emphasizing the importance of mastering this foundational skill in digital electronics.

PO10:- Multicultural Competence, Inclusive Spirit, and Empathy

CO1:-Involves designing combinational circuits using logic gates, which can provide a platform for diverse perspectives to be expressed and integrated into circuit design projects.

CO3:- It requires working with different types of counters and designing their applications, which may involve digital circuits.

CO6:- Students will prepares students to analyze and design various digital electronic circuits, which may require understanding and empathizing with different circuits.

PO11:- Value Inculcation and Environmental Awareness

CO1:- To designing combinational circuits using logic gates, which can encourage students to consider efficiency and optimization in circuit design,

CO2:- Designing various counters and determining outputs, which can foster a mindset of resource optimization and sustainability as students work to maximize efficiency and minimize waste in circuit design.

CO3:- Students able to working with different types of counters and designing their applications, which may involve considering environmentally friendly applications or solutions in circuit design.

CO6:- students to analyze and design various digital electronic circuits, which may include design techniques for digital circuits and considering the environmental impact of electronic devices.

PO12:- Autonomy, Responsibility, and Accountability:

CO1:- students to take ownership of their design decisions and take responsibility for the functionality and performance of their circuits.and get develop skill in electronics .

CO3:-Students to perform the analysis and design of various digital electronic circuits,

CO6:- Students to understanding the various gets improve skills.

PO13: Community Engagement and Service

CO1:-Students can collaborate with local organizations to design circuits for educational purposes, such as creating interactive learning tools .

CO3:- Requires working with different types of counters and designing their applications, which can also be utilized in community service projects. For instance, students can design counting circuits for community events.

CO5:-To understanding the fundamental concepts and techniques used in digital electronics, which is essential for students to effectively contribute to community service projects.

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

Name of the Programme	: B.Sc. Electronics
Programme Code	: USEL
Class	: S. Y. B.Sc.
Semester	: III
Course Type	: Major Mandatory (Practical)
Course Code	: ELE-203-MRM
Course Title	: Electronics Practical III
No. of Credits	: 02
No. of Teaching Hours	: 60

Course Objectives:

1. To make use 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. To Design and test combinational circuits.
6. This course gives students deep knowledge in digital communication systems
7. To Understand Basic knowledge of Digital electronics.

Course Outcomes

After achieving the above objectives, students should be able to

1. Design any operational amp. based application circuit and test it.
2. Design any instrumentation based application circuit and test it.
3. To understand basic parameters in electronics.
4. Students should know operation of different instruments used in the laboratory.
5. Students should connect circuit and required to do performance analysis.
6. The course will help in design and analysis of the digital circuit and system.
7. At the end of the course, the students will be able to.

The practical course consists of 10 experiments.

List of Practicals

Total 15 practicals are compulsory including activities.

List of experiments (Any 11)

ListofPracticals(AnalogElectronics):

1. Weinbridgeoscillator/Phaseshiftoscillator
2. Designandbuildtwostageamplifierusingtransistor
3. DesignandbuildVtoI converterusingOPAMPIC-741
4. DesignofLowPassFilterandHighPassFilterusingOPAMPIC-741
5. Pushpullamplifier
6. Effectofnegativefeedbackonamplifierparameters.
7. Astable multivibrator

8. Adder and subtractors
9. Voltage follower
10. Integrator and Differentiator,

ListofPracticals(DigitalElectronics):

1. Code conversion using logic gates–binary to gray, gray to binary
2. DACusingR-2Rladder network
3. ADCusingIC0808/IC7109/IC741/IC324
4. Sequencegeneratorforsteppermotor
5. 3bitsynchronouscounterusingflipflops
6. DecimaltoBCDencoderusinglogic gates

Activity: (Any one Activity equivalent to two experiments)
Total Laboratory work with additional activities should be equivalent to fifteen experiments.

List of Activities:

1. Internet Browsing of latest Electronic Technologies.
2. Market Survey of components/devices/equipment's.
3. Hobby Project
4. Industrial Visit/ Study Tour / Field visit

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

Mapping Justification:-

PO1:- Comprehensive Knowledge and Understanding:

CO2:- Students acquire practical skills in designing and testing instrumentation-based circuits. Through this, students get understanding of the theoretical concepts and practical applications of instrumentation, thereby enhancing their overall knowledge and understanding.
CO4:- Understanding the operation of various instruments in a laboratory setting is fundamental

to gaining comprehensive knowledge in the field of instrumentation.

CO7: It enables students to demonstrate their ability to apply theoretical knowledge to practical scenarios by designing and testing instrumentation-based circuits.

PO2:- Practical, Professional, and Procedural Knowledge:

CO1:- Students practical knowledge and skills in designing operational amplifier-based circuits.

CO2:- Design and testing process, students acquire professional-level competence in applying instrumentation principles to real-world applications.

CO5:- Connecting circuits and performing performance analysis are essential procedural skills. And students develop the ability to effectively connect circuits and analyze their performance, which is crucial for professional practice in the field of instrumentation.

CO7:- Students to demonstrate their ability to apply practical knowledge and skills in designing and testing operational amplifier-based circuits

PO3:- Entrepreneurial Mindset and Knowledge:

CO1:- Designing and testing operational amplifier-based circuits, students not only gain technical skills but also learn to innovate and create solutions to real-world problems.

CO3:- Understanding basic parameters in electronics is essential for developing an as it provides students with foundational knowledge about electronic components and systems.

PO4:-Specialized Skills and Competencies:

CO1:- To design and testing process, students acquire specific competencies relevant to their field of study.

CO2:- Design and testing of such circuits equips students with specialized competencies required for working with instrumentation systems.

CO4:- Understanding the operation of various instruments used in laboratory settings is a fundamental specialized skill.

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

CO1:- Students to apply their theoretical knowledge of operational amplifiers and circuit design principles to real-world applications. By designing and testing circuits.

CO3:- Understanding basic parameters in electronics is crucial for applying theoretical knowledge to practical Skill.

CO5:-Students get performing performance analysis requires students to apply their knowledge of circuit theory and measurement techniques.

CO7:- Developing students' capacity for application, problem-solving, and analytical reasoning throughout the course.

PO6:-Communication Skills and Collaboration:

CO2:-Students will get the communication skills through group projects or lab work. In many cases, students may need to work in teams to design and test instrumentation-based circuits.

CO5:-In the process of designing circuits, students encounter various challenges that require them to analyze problems and develop the own skill in electronics projects.

PO7:-Research-related Skills:

CO2:- When designing and testing instrumentation-based circuits, students may need to conduct research to explore new techniques, components.

CO4:- students develop their capacity for application, problem-solving, and analytical reasoning in the field of electronics.

CO5:- To Understanding the operation of various instruments used in the various circuits.

PO8:-Learning How to Learn Skills:

CO1:- students are encouraged to engage in research, seek out resources, and apply critical thinking to solve problems.

CO4:- Understanding the operation of various instruments in the laboratory requires students to engage in active learning processes

CO5:- The design and testing process, students encounter challenges that require them to analyze problems, develop solutions, and evaluate the performance of their designs.

PO9:-Digital and Technological Skills:

CO1:- Electronic circuit design, digital components and technologies are often integrated with analog circuits.

CO4:- Understanding the operation of various instruments in the laboratory, including digital instruments.

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

CO2:- Collaborating on projects such as designing and testing instrumentation-based circuits encourages interaction and mutual respect among students, fostering an inclusive atmosphere where different viewpoints are valued.

CO3:- Understanding basic parameters in electronics is essential for effective communication and collaboration, specially in multicultural settings.

CO6:- When working on digital circuit and system design, students may encounter diverse requirements and constraints that require them to consider the needs this circuits .

PO11:-Value Inculcation and Environmental Awareness:

CO1:- The importance of designing operational amplifier-based circuits with optimal performance and minimal waste, students learn to value efficiency and environmental consciousness in their practical.

CO2:- students to design instrumentation-based circuits that are energy-efficient and environmentally sustainable.

CO3:- Understanding basic parameters in electronics, such as power consumption, voltage levels, and signal etc.

CO6:- Students develop a deeper understanding of the importance of environmental awareness in electronic Project practices.

PO13: Community Engagement and Service:

CO1:- Students to independently design operational amplifier-based circuits and test them. By taking ownership of their design projects, students learn to make decisions, solve problems, and manage tasks autonomously.

CO3:- Understanding basic parameters in electronics is essential for students to take responsibility for their designs and ensure their effectiveness

CO7:- Students develop autonomy in problem-solving and decision-making, take responsibility for their design choices, and are held accountable for the performance of their digital circuits and systems.

PO8 - Learning How to Learn Skills

CO1 - Students are encouraged to engage in research, seek out resources, and apply critical thinking to solve problems

CO4 - Understanding the operation of various instruments in the laboratory requires students to engage in active learning processes

CO5 - The design and testing process, students encounter challenges that require them to analyze problems, develop solutions, and evaluate the performance of their designs

PO9 - Digital and Technological Skills

CO3- Electronic circuit design, digital components and technologies are often integrated with analog circuits

CO4- Understanding the operation of various instruments in the laboratory, including digital instruments

PO10-Multicultural Competence, Inclusive Spirit, and Empathy

CO2- Collaborating on projects such as designing and testing instrumentation-based circuits encourages interaction and mutual respect among students, fostering an inclusive atmosphere where different viewpoints are valued

CO3- Understanding basic parameters in electronics is essential for effective communication and collaboration, especially in multicultural settings

CO6- When working on digital circuit and system design, students may encounter diverse requirements and constraints that require them to consider the needs and choices

PO11-Value Inculcation and Environmental Awareness

CO1 - The importance of designing operational amplifier-based circuits with optimal performance and minimal waste, students learn to value efficiency and environmental consciousness in their practices

CO2 - students to design instrumentation-based circuits that are energy-efficient and environmentally sustainable

CO3 - Understanding basic parameters in electronics, such as power consumption, voltage levels, and signal use

CO6 - Students develop a deeper understanding of the importance of environmental awareness in electronic Design practices

PO12-Autonomy, Responsibility and Accountability

CO1 - Students to independently design operational amplifier-based circuits and test them. By taking ownership of their design projects students learn to make decisions, solve problems, and manage tasks autonomously

CO3 - Understanding basic parameters in electronics is essential for students to take responsibility for their designs and ensure their effectiveness

CO7 - students, develop autonomy in problem-solving and decision-making, take responsibility for their design choices, and are held accountable for the performance of their digital circuits and systems

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics

(2024 Pattern)

Name of the Programme:	**B.Sc. Electronics**
Programme Code:	**ELE**
Class:	**S. Y. B.Sc.**
Semester:	**III**
Course Type:	**Vocational Skill Course (VSC)**
Course Code:	**ELE -204-VSC**
Course Title:	**Practicals on Circuit Building and Testing**
No. of Credits:	**02**
No. of Teaching Hours:	**30**

Course Objectives:

1.To measure the amplitude and frequency of any waveform.

2. To learn various applications using active and passive components.

3. To design a power supply circuit.

4. To study and apply IC 555 for waveform generation.

5. To study different sensors or detectors.

6. To simulate basic circuits.

7. To study switches.

Course Outcomes:

CO1. Measurement of different frequencies, amplitudes, voltages.

CO2. Know the concept of filter.

CO3. Get familiar with sensors.

CO4. Generate various frequencies.

CO5. Calculate the voltages across the resistors.

CO6. Simulate some basic circuits.

CO7. Design applications using active and passive components.

List of experiments (Any 11)

Total 15 practicals are compulsory including activities.

1. Study of CRO/DSO & Measurement of Voltage Amplitude & Frequency.
2. Testing of Diode and Transistor.
3. Transistor as a Switch.
4. Frequency Response of CR circuit.
5. Positive Power Supply using Regulator IC.
6. Negative Power Supply using Regulator IC.
7. Study of LM 35 temperature sensor.
8. Astable Multivibrator using IC 555.
9. Inverting Amplifier using IC741.
10. Non inverting amplifier using IC 741.
11. Study of Relay.
12. Build and test LDR circuit.
13. Charging and discharging of capacitor.
14. Voltage divider rule analysis.
15. Study of Varactor Diode.
16. 4 bit adder using IC 7483
17. Study of Multiplexer using IC 74153.
18. Study of Demultiplexer using IC 74LS138/139.

Activities

(Any 2 activities): 1 activity is equivalent to two experiments.

1. Internet survey on comparison of recent trends in Electronics.
2. Study of Circuit Simulators.
3. Study of PCB designing software/ hardware.
4. Industrial visit.

Mapping of Program Outcomes with Course Outcomes
Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

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

PO1: Comprehensive Knowledge and Understanding:

CO1: Involves fundamental concepts essential to understanding electronics.

CO2: Filters are key components in signal processing and electronics, contributing to core knowledge.

PO2: Practical, Professional, and Procedural Knowledge:

CO1: Direct hands-on measurement develops essential procedural and professional lab skills.

CO3: Understanding filters is foundational but the application improves procedural knowledge.

CO7: Involves end-to-end application of procedural and professional design practices.

PO3: Entrepreneurial Mindset and Knowledge:

CO3: Understanding sensors can inspire product-based solutions in startups.

CO7: Designing applications lays a foundation for product innovation and startup creation.

PO4: Specialized Skills and Competencies:

CO1: These measurements are foundational skills required for precise and specialized circuit testing.

CO3: Sensor knowledge is essential for specialized embedded and automation systems.

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

CO6: Simulation requires logical reasoning to predict behavior and debug issues.

CO7: Designing complete circuits demonstrates a strong application and analytical reasoning ability.

PO6: Communication Skills and Collaboration:

CO4: Frequency generation is typically an individual task with minimal communication needed.

CO6: Circuit simulation may involve sharing insights and results, encouraging basic collaboration.

PO7: Research-related Skills:

CO2: Sensor data collection is critical in experimental research and data analysis.

CO3: Signal generation is part of experimental setups in electronic research.

PO8: Learning How to Learn Skills:

CO1: Measurement is foundational for experimental research and data analysis.

CO3: Sensors are vital in experimental setups and data acquisition for research projects.

PO9: Digital and Technological Skills:

CO3: Sensors are fundamental to modern digital systems and IoT-based technologies.

CO7: Application design integrates both hardware and digital development environments.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy:

CO3: Sensors can be used in applications that involve community-based projects, providing data for more inclusive solutions.

CO5: Voltage calculations are theoretical, with minimal impact on multicultural skills or empathy.

PO11: Value Inculcation and Environmental Awareness:

CO7: Designing applications could directly relate to environmental consciousness, such as creating energy-efficient solutions or eco-friendly technologies.

PO12: Autonomy, Responsibility, and Accountability:

CO2: Understanding filters aids in developing responsible solutions, such as reducing noise or optimizing systems, which requires accountability.

CO6: Simulation is an essential part of developing autonomous problem-solving skills, where responsibility is crucial for testing and validating designs.

PO13: Community Engagement and Service:

CO6: Simulating circuits can indirectly support community service by creating low-cost or innovative solutions, but its connection is moderate.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM V) (2024 Pattern)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : III
Course Type : Minor
Course Code : ELE-206-MN
Course Title : Electronic Communication
No. of Credits : 02
No. of Teaching Hours : 60

Course Objectives:

1. **To understand the basics of electronic communication systems and their components.**
2. **To explore the electromagnetic spectrum and frequency allocation for radio communication in India.**
3. **To learn about noise, signal-to-noise ratio, and their impact on communication.**
4. **To comprehend the need for modulation and demodulation in communication systems.**
5. **To study continuous-wave modulation techniques like AM and FM, including their power distribution.**
6. **To understand pulse modulation techniques and their role in multiplexing.**
7. **To gain knowledge of digital communication, including keying techniques and error detection using Hamming code.**

Course Outcomes:

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

CO1:Understand the basic concepts of electronic communication systems and their components.

CO2:Learn about the electromagnetic spectrum and frequency allocation for radio communication in India.

CO3:Analyze the impact of noise and signal-to-noise ratio on communication system performance.

CO4:Recognize the necessity of modulation and demodulation in communication systems.

CO5:Explain AM and FM modulation techniques and their power distribution.

CO6: Explore pulse modulation techniques and their role in multiplexing.

CO7:Apply digital communication techniques, including keying methods and error detection using Hamming code.

Unit 1:- Introduction to Electronic Communication: (8L)

Introduction to communication- means and modes, Block diagram of an electronic communication system, Electromagnetic spectrum , Brief idea of frequency allocation for radio communication system in India (TRAI) concept of Noise, signal-to-noise (S/N) ratio, Noise figure and noise temperature Need of modulation and demodulation

Amplitude modulation: AM waveform, mathematical expression of AM, concept of sideband, Definition and problems: modulation index, power distribution.
Frequency modulation: FM waveform, mathematical representation, frequency spectrum, bandwidth and modulation index. frequency deviation, average power. Comparison of AM and FM

Unit 3:-Pulse modulation techniques: **(6L)**

Types of analog pulse modulation: concept and generation of PAM, PWM, PPM, Spectra of pulse modulation, concept of time division multiplexing and frequency division multiplexing.

Unit 4:- Introduction to digital communication **(8L)**

Block diagram of digital communication system, advantages of digital communication system, bit rate, baud rate and bandwidth. Serial and parallel communication, concept of sampling, Sampling theorem, PCM concept of keying techniques: ASK, FSK, PSK. Introduction to Hamming code, error finding, advantage and disadvantages.

References Books:

1. Communication Electronics :Principles and applications by Louis E Frenzel 3rd edition TMH Publications
2. Electronics Communication Systems by Denis Roddy, John Coolen, PHI publication.
3. Kennedy, George & Davis, Bernard / "Electronic Communication Systems" / Tata McGraw-Hill / 4th Ed.
4. Singh, R.P. & Sapre, S.D. / "Communication Systems: Analog & Digital" / Tata McGraw- Hill

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

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

PO1: Comprehensive Knowledge and Understanding

CO1: Builds foundational knowledge of communication systems and components.

CO2: Enhances understanding of radio frequency spectrum and regulatory policies.

CO3: Promotes in-depth comprehension of system performance factors like noise.
CO4: Strengthens conceptual clarity of modulation fundamentals.
CO5: Deepens understanding of analog modulation techniques.
CO6: Provides theoretical base for pulse-based transmission.
CO7: Covers key concepts in digital communication.

PO2: Practical, Professional, and Procedural Knowledge
CO1: Prepares students for real-world communication system design.
CO2: Introduces national radio frequency allocation standards.
CO3: Applies knowledge in evaluating system performance.
CO4: Develops procedural skills in communication techniques.
CO5: Links theory with power and bandwidth considerations.
CO6: Enables procedural understanding of time-division transmission.
CO7: Builds hands-on skills in digital communication error detection.

PO4: Specialized Skills and Competencies
CO1: Equips students with skills in basic communication system design.
CO2: Supports allocation strategy understanding.
CO3: Cultivates competency in performance analysis.
CO4: Encourages skill development in system-level thinking.
CO5: Builds technical ability in evaluating AM/FM systems.
CO6: Promotes mastery of advanced pulse techniques.
CO7: Develops core competency in digital transmission methods.

PO5: Application, Problem-Solving, and Analytical Reasoning
CO1: Enhances logical thinking through block diagram analysis.
CO2: Builds reasoning about frequency usage.
CO3: Strengthens ability to solve SNR-related issues.
CO4: Promotes reasoning in modulation choices.
CO5: Involves critical thinking in power computation.
CO6: Applies analytical thought in multiplexing scenarios.
CO7: Encourages algorithmic reasoning in Hamming code application.

PO7: Research-related Skills
CO3: Encourages signal quality research through SNR analysis.
CO6: Opens inquiry into hybrid pulse systems.
CO7: Fosters interest in digital communication improvements.

PO8: Learning How to Learn Skills
CO7: Encourages self-directed learning through error detection techniques.

PO9: Digital and Technological Skills
CO2: Connects with use of licensed and unlicensed digital bands.
CO3: Applies technology in improving system fidelity.
CO5: Uses simulation tools for AM/FM studies.
CO6: Enables understanding of ADC techniques.
CO7: Strengthens skills in digital communication platforms.

PO11: Value Inculcation and Environmental Awareness
CO2: Creates awareness about spectrum management as a national resource.

PO12: Autonomy, Responsibility, and Accountability
CO3: Reinforces accountability through proper noise management.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (SEM V) (2024 Pattern)

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : S. Y. B.Sc.
Semester : III
Course Type : **Minor**
Course Code : ELE-207-MN
Course Title : **Communication Practicals**
No. of Credits : 02
No. of Teaching Hours : 60

Course Objectives:

1. To understand and implement amplitude and frequency modulation techniques using transistors, ICs, and varactor diodes.
2. To explore various digital modulation techniques such as Frequency Shift Keying (FSK), Phase Shift Keying (PSK), and Amplitude Shift Keying (ASK).
3. To analyze multiplexing techniques, including time-division multiplexing (TDM) and pulse modulation methods like PAM, PWM, and PPM.
4. To study and implement delta modulation and Pulse Code Modulation (PCM) techniques for digital communication.
5. To design, build, and test an FM receiver to understand real-world communication system implementation.
6. To use MATLAB for simulating and verifying key digital communication techniques, including PSK, BPSK, QPSK, and the Sampling Theorem.
7. To develop hands-on skills in software tools like Proteus and PCB design software for circuit simulation and hardware design.

Course Outcomes:

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

CO1: Demonstrate the working of amplitude and frequency modulation techniques using various components.
CO2: Implement and analyze digital modulation techniques such as FSK, PSK, and ASK.
CO3:Explain and apply multiplexing techniques, including TDM and pulse modulation methods.
CO4: Construct and test PCM and delta modulation systems for efficient digital communication.
CO5: Design and evaluate an FM receiver for practical communication system applications.
CO6: Utilize MATLAB to simulate and verify digital communication principles.
CO7:Develop proficiency in using Proteus and PCB design software for circuit simulation and fabrication.

List of Practicals

1. Amplitude Modulator using transistor
2. FM generation using VCO/IC 8038/varactor diode
3. Frequency Shift Keying (FSK) using XR 2206
4. Time division multiplexing circuit.
5. Study of Balance modulator and demodulator.
6. Study of PPM/PWM /PAM
7. Demonstration of PCM/delta modulation
8. Design build and test FM Receiver
9. Delta modulation.
10. Hamming code generation and error detection.

Experiments using MATLAB

1. Phase shift keying (PSK)
2. Generation and reception of BPSK
3. Generation and reception of FSK
4. Generation and reception of QPSK.
5. Verification of Sampling theorem.
6. Amplitude shift keying ASK

Activities

1. To learn Proteus software.
2. To learn PCB Software.
3. Study tour
4. Internet survey on Electronics.

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

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

PO1: Comprehensive Knowledge and Understanding

CO1: Builds understanding of analog modulation principles and components.

CO2: Strengthens theoretical knowledge of digital modulation schemes.

PO1: Comprehensive Knowledge and Understanding

CO1: Builds understanding of analog modulation principles and components.
CO2: Strengthens theoretical knowledge of digital modulation schemes.
CO3: Enhances clarity on multiplexing concepts and applications.
CO4: Provides understanding of PCM and delta modulation structures.
CO5: Encourages application of knowledge in FM receiver design.
CO6: Reinforces communication concepts through MATLAB simulation.
CO7: Supports theoretical learning through simulation and PCB design.

PO2: Practical, Professional, and Procedural Knowledge

CO1: Involves practical setup and observation of AM/FM systems.
CO2: Requires hands-on implementation of digital modulation.
CO3: Application-based learning of TDM and pulse techniques.
CO4: Hands-on experience in constructing digital mod systems.
CO5: Real-time testing of FM communication receivers.
CO6: Procedural skills in MATLAB communication modeling.
CO7: Application of PCB/proteus tools for hardware simulation.

PO3: Entrepreneurial Mindset and Knowledge

CO7: Encourages design thinking and fabrication awareness for startup/project execution.

PO4: Specialized Skills and Competencies

CO1–CO7: All outcomes involve specialized skills in communication system design, simulation, and testing.

PO5: Application, Problem-Solving, and Analytical Reasoning

CO1–CO7: Each CO develops reasoning through circuit analysis, system performance, and design evaluation.

PO6: Communication Skills and Collaboration

Not directly mapped, but team-based activities and documentation promote communication skills.

PO7: Research-related Skills

CO4: Involves analysis and testing of modern modulation techniques.
CO6: Encourages research and validation using simulation tools.

PO8: Learning How to Learn Skills

CO6 & CO7: Promote independent learning via software tools like MATLAB, Proteus, and PCB design.

PO9: Digital and Technological Skills

CO1: Involves basic use of lab instruments.
CO2, CO4, CO6, CO7: Strongly linked to digital tool proficiency (simulation, analysis, design).

CBCS Syllabus as per NEP 2020 for S.Y.OE

(2024 Pattern)

Name of the Programme : B.Sc. Electronic Science
Programme Code :USEL
Class : S.Y.OE.
Semester : III
Course Type : Major Mandatory [Theory]
Course Code : ELE -208-OE
Course Title : Basics of Computer Hardware
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. Understand the computers system and its operation.
2. To learn the Organization of basic computers.
3. To understand architecture and functioning of computer system.
4. Understand the use of system software and application software.
5. To understand the concept of memory organization.
6. To learn different devices used in the computer with respect to their application.
7. To train troubleshoot the computer hardware or software problem.

Course Outcomes:

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

CO1: Understand computer system and its operations.
CO2: Enhance the knowledge of different devices used in the computer with respect to their application.
CO3: Understand the use of system software and application software.
CO4: Identify computer hardware parts and connect peripherals.
CO5: Understand the use of different types of storage devices.
CO6: Understand the use of system software and applications software.
CO7: Able to troubleshoot the computer hardware or software problems.

Topics and Learning Points

UNIT-I **8**

Fundamental of Computers:

Definition, block diagram of computer system, need, features, characteristics; Generation of computers; Classifications of computer systems: main-frames, microcomputer, minicomputers, supercomputer; Types of computer: desktop, laptop, server, tablet; Application areas of computers minicomputers, supercomputer; Types of computer: desktop, laptop, server, tablet; Application areas of computers

UNIT-II 12

Components of Computer:

Block diagram, working, features, classification of microprocessor, generation of microprocessor, packaging of microprocessor, types of processor. Motherboard: block diagram, working, features, components, connectors, slots, ports, classification of motherboard, concept of PCB, types of motherboard. Memory: definition, features, types of memory, memory hierarchy; Primary memory: RAM, ROM; Concept of cache memory; Secondary memory: floppy disk, hard disk, CD, DVD, pen drive, memory card, external memory.

UNIT-III

Computer Peripherals: 10

Definition, characteristics, classification; Keyboard: features, types; Mouse: features, types; Scanning devices: scanner, O.M.R., touch screen; Microphone; Webcam. Output devices: definition, characteristics, classification; Monitor: features, types; Printer: features, classification, types; Projector; Speaker; Concept of computer assembling and disassembling.

Reference Books:

1. Computer Fundamentals, P. K. Sinha, BPB Publications, Sixth Edition.
2. Introduction to Information Technology, V. Rajaraman, PHI, Second Edition.
3. Fundamental of Information Technology, Chetan Shrivastava, Kalyani Publishers.
4. Computers Today, Suresh K Basandra, Galgotia Publications.

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

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

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding:
CO1: Understanding computer systems and their operations forms the foundational knowledge essential to the field of computer science.
CO2: Knowing various devices and their applications deepens conceptual clarity and links theory with practical use in computing.
CO3: Differentiating system and application software reflects a comprehensive understanding of computer systems and software structure.
CO4: Identifying hardware and connecting peripherals enhances understanding, though more focused on practical than theoretical knowledge.
CO5: Knowing various storage devices supports foundational learning but is more limited in scope than broader theoretical concepts.
CO6: Reiterating understanding of software types reinforces key concepts crucial for a well-rounded theoretical base.
CO7: Troubleshooting involves applied knowledge, contributing to overall understanding but not as deeply theoretical as other outcomes.
PO2: Practical, Professional, and Procedural Knowledge:
CO1: Understanding computer systems supports foundational knowledge for practical application but is more theoretical in nature.
CO2: Knowledge of computer devices and their applications directly aligns with industry practices and real-world use cases.
CO3: Differentiating between system and application software is essential for professional competence in software environments.
CO4: Identifying and connecting hardware parts is a core practical skill in IT and hardware support roles.
CO5: Understanding storage devices supports procedural knowledge, though more about component understanding than full professional application.
CO6: Knowledge of software systems directly contributes to professional readiness and real-world usage.

CO7: Troubleshooting is a crucial practical and professional skill, especially in IT support and systems maintenance roles.

PO3: Entrepreneurial Mind set and Knowledge:

CO2: Knowledge of device applications can inspire innovative tech solutions or products, contributing moderately to entrepreneurial thinking.

CO3: Understanding different software types can help identify digital service opportunities or tech-based ventures.

CO4: Hardware knowledge may enable entrepreneurial initiatives like system assembly, repair services, or tech startups.

CO6: System and application software knowledge provides a base for software solution development or digital entrepreneurship.

CO7: Troubleshooting skills can support service-oriented ventures, such as IT support businesses or tech consultancy.

PO4: Specialized Skills and Competencies:

CO1: Understanding system operations supports technical competence but is more foundational than specialized.

CO2: Knowing various devices and their applications helps build specialized technical skills applicable to multiple roles.

CO3: Understanding system and application software enhances analytical thinking and supports software-specific competencies.

CO4: Identifying and connecting hardware is a hands-on technical skill relevant in IT and engineering domains.

CO5: Understanding storage devices contributes to technical knowledge, though it's more supportive than core.

CO6: Deep understanding of software use develops strong, field-specific competencies and adaptability.

CO7: Troubleshooting issues requires problem-solving and analytical skills, aligning strongly with PO4's objectives.

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

CO1: Understanding system operations contributes moderately to applying concepts in real-world contexts.

CO2: Application knowledge of computer devices enhances practical problem-solving and adaptability.

CO3: Knowledge of software types supports analytical reasoning, though not deeply focused on problem-solving alone.

CO4: Hands-on ability to connect peripherals fosters direct application of concepts and problem-solving in hardware-related issues.

CO5: Understanding storage options supports decision-making but has limited analytical depth.

CO6: Repetition of software understanding helps with application but adds moderate value to analytical reasoning.

CO7: Troubleshooting is a direct application of problem-solving and analytical thinking in real-world scenarios.

PO6: Communication Skills and Collaboration:

CO1: Basic system understanding contributes little to communication or collaboration unless applied in group settings.

CO2: Knowledge of devices can be shared or discussed in teams, offering some collaborative value.

CO3: Understanding software supports documentation and discussion, aiding communication in tech contexts.

CO4: Working with hardware may involve teamwork, offering opportunities to develop collaborative and explanatory skills.
CO6: System and application software understanding may support effective reporting or explanation in team environments.
CO7: Troubleshooting often requires teamwork and clear communication, especially when collaborating with users or peers.
PO7: Research-related Skills:
CO2: Awareness of various devices can support observational skills and help frame practical inquiry.
CO3: Understanding software lays the groundwork for exploring tools used in research methodologies.
CO6: Familiarity with software tools may assist in data analysis and reporting of research outcomes.
CO7: Troubleshooting involves observation, inquiry, and methodical analysis—skills directly related to research.
PO8: Learning How to Learn Skills:
CO1: Understanding computer systems forms the foundation for continuous learning in tech-related fields.
CO2: Knowing device applications supports independent exploration of emerging technologies.
CO3: Recognizing the role of software enables learners to explore and utilize new tools.
CO4: Identifying and connecting hardware encourages hands-on, self-guided experimentation.
CO5: Understanding storage devices fosters awareness of evolving digital storage solutions.
CO6: Familiarity with system/application software builds confidence for learning advanced software independently.
CO7: Troubleshooting skills empower learners to solve problems autonomously and adapt to tech issues independently.
PO9: Digital and Technological Skills:
CO1: Understanding computer systems is foundational to all digital and technological competencies.
CO2: Knowing device functions enhances capability to operate and troubleshoot ICT tools.
CO3: Software knowledge directly contributes to using ICT tools effectively.
CO4: Identifying and connecting hardware is essential for functional use of digital systems.
CO5: Understanding storage devices supports data management and technology usage.
CO6: Proficiency in both system and application software is key to digital literacy.
CO7: Troubleshooting skills demonstrate hands-on technological ability and ICT problem-solving.
PO10: Multicultural Competence, Inclusive Spirit, and Empathy:
CO3: Knowledge of widely used software supports working in diverse, possibly multicultural teams.
CO4: Hardware collaboration may occur in diverse teams; sharing knowledge requires empathy and inclusiveness.
CO6: Application of software may occur in collaborative environments, requiring communication across diverse groups.
CO7: Troubleshooting in teams supports collaboration and the ability to help others, which ties to empathy and inclusiveness
PO11: Value Inculcation and Environmental Awareness:
CO2: Knowledge of hardware helps in making informed, sustainable decisions regarding device use and e-waste.

CO4: Identifying and connecting peripherals contributes to decisions that support sustainable practices (e.g., reducing hardware redundancy).

CO5: Understanding storage devices encourages data efficiency and proper disposal practices, promoting environmental consciousness.

CO7: Troubleshooting helps reduce hardware waste and promotes responsible, repair-oriented behavior.

PO12: Autonomy, Responsibility, and Accountability:

CO1: Understanding system operations enables independent handling of basic computing tasks.

CO2: Knowledge of hardware components supports responsible usage and device management.

CO3: Understanding software equips students to manage and install software responsibly without supervision.

CO4: Identifying and connecting peripherals fosters hands-on accountability in assembling and maintaining systems.

CO5: Awareness of storage options supports responsible data organization and management.

CO6: Learning to use both system and application software enhances self-sufficiency in digital environments.

CO7: Troubleshooting skills promote independence and responsibility in resolving technical issues.

PO13: Community Engagement and Service:

CO1: Basic understanding of computer systems can be applied in community digital literacy programs.

CO2: Knowledge of devices enables learners to assist in community ICT setups and awareness drives.

CO3: Knowing system and application software helps in supporting community education and training.

CO4: Ability to connect peripherals can support setting up public computer labs or digital centers.

CO6: Skills in using software can be applied in training others in community service contexts.

CO7: Troubleshooting skills are highly useful when volunteering in local ICT infrastructure maintenance.

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. Electronics (2024 Pattern)

Name of the Programme : B.Sc. Electronics

Programme Code : USEL

Class : S. Y. B.Sc.

Semester : III

Course Type : Indian Knowledge System (IKS)

Course Code : **ELE-209-IKS**

Course Title : Electronics IKS

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. Study traditional Indian knowledge system.
2. To study history of Electronic industry development in India.
3. To study evolution of Science and technology in India
4. To Study development of new technology and its applications.
5. To introduce students to the concept and value of Traditional Knowledge (TK) and its role in modern society.
6. To develop an understanding of India's achievements in science and technology, both ancient and modern.
7. To create awareness about the evolution and contribution of the electronics industry in India.

Course Outcomes:

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

CO1. Describe the traditional Indian knowledge system.

CO2. Analyse the need to protect traditional Indian knowledge system.

CO3. Understand the history and development of Electronics technology in India.

CO4. To learn today's electronics technology in India.

CO5. Define and explain the nature, scope, and importance of traditional knowledge and its relevance in today's global context.

CO6. Understand the historical and present-day development of the electronics industry in India.

CO7. Analyze the influence of modern technologies (like AI, IoT, social media) on personal and societal communication.

Topics and Learning Points

1. Introduction to Electronics Knowledge System:

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge. The need for protecting traditional knowledge, the value of traditional knowledge in the global economy, Role of Government to harness traditional knowledge.

2. Science and Technology in India:

Milestones of India in Science and Technology, IKS in ancient India and in modern India, History of Electronic industry development in India, Achievements of Indians in Science and Technology in Ancient and medieval India, Nobel laureates of India in Science, Achievements of Indians in Science & Technology in the modern era.

3. Future Prospects:

Impact of New Technologies and Applications, social networking sites- Facebook, LinkedIn, Instagram, myspace, X.com, Online chat, video chatting, Internet telephony- voice, video, blogs, ChatGPT, IoT, Artificial Intelligence.

Reference Books:

1. A.K. Maini and J. Ramamurthy, Making sense of electronics: Understanding discreet components and their applications, , Tata McGraw-Hill Education, 2008.
2. Charles Harrell, Designing Electronics for Manufacturing and Testability: A Guide to Designing Automated, Cost-Effective Manufacturing and Test Systems, by Wiley, 2015.
3. Hamid R. Arabnia, Embedded Systems Design Challenges in the Electronic InTech, 2013.
4. Asok Kumar Das and Chandra Shekhar Bose , Artificial Intelligence in Electronics and Communication, , Cambridge University Press, 2004.
5. NitinGautam , Handbook of Electronics Manufacturing Engineering– CRC Press, 2016
6. Electronic Communication - Dennis Roddy, John Coolen, Pearson Education
7. Communication Electronics: Principles and Applications, Louis Frenzel , McGraw Hill Education

Mapping

Justification

CO1: as it involves understanding and describing a specific field of knowledge, in this

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	-	-	3	3	-	-	1	3
CO2	-	2	-	-	-	-	-	-	3
CO3	-	-	2	-	-	-	3	-	2
CO4	-	-	-	-	1	3	-	-	1
CO5	-	-	-	3	-	-	-	3	1
CO6	-	-	-	-	-	-	-	-	3
CO7	2	1	-	3	-	-	-	-	3

case, the traditional Indian knowledge system.

CO7:different electronics tools include Disciplinary Knowledge.

PO2 Critical Thinking and Problem Solving

CO2: It requires analyzing and critically evaluating the importance of protecting traditional Indian knowledge.

CO7 :Different tools required critical thinking and problem solving.

PO3: Social Competence

CO3: Provide social Competence

PO4: Research-related Skills and Scientific Temper

CO1: it involves understanding and describing a specific field of Research , in this case, the traditional Indian knowledge system.

CO5: it involves Research related skills and scientific temper to the contributions of Indians in the field of science.

CO7: as it involves understanding and utilizing tools in the field of electronics for research purposes.

PO5: Trans-disciplinary Knowledge

CO1: it involves understanding and describing a specific field Trans-disciplinary Knowledge, in this case, the traditional Indian knowledge system.

CO4: The necessary knowledge and skills to navigate and work with current electronics technology.

PO6: Personal and Professional Competence

CO4: as it implies acquiring the necessary knowledge and skills to navigate and work with current electronics technology.

PO7: Effective Citizenship and Ethics

CO3: As it involves understanding Effective Citizenship and Ethics of Electronics technology in the Indian context.

PO8: Environment and Sustainability

CO1: it involves understanding and describing a specific field Environment and Sustainability, in case of the traditional Indian knowledge system

CO5: it involves Environment and Sustainability to the contributions of Indians in the field of science.

PO9: Self-directed and Life-long Learning

CO1 to CO7: all Course Outcomes, as learning about traditional knowledge, historical development, current technology, and advancements requires ongoing learning.