Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Four Year B.Sc. Degree Program in Electronics

(Faculty of Science & Technology)

CBCS Syllabus

F.Y.B. Sc. (Electronics) Semester -II

For Department of Electronics

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

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

Preamble

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined 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 outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Electronics and related subjects, the Board of Studies in Electronics at Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the first semester of F.Y.B.Sc. Electronics, which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

BSc (Honours) 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 also provide 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: Acquire the knowledge in Electronic Devices and Circuits, Analog & Digital communication, Embedded systems, AI, WSN , MEMS and other core areas of Electronics.

PSO2: Understand the principles and working of both hardware and software aspects of Electronic systems.

PSO3: Gain theoretical and practical knowledge in developing areas of Electronics.

PSO4: To analyze, design and implement analog and digital electronic systems, information and communication systems

PSO5**:** Assess the impact of new technologies and solve complex problems.

PSO6: Develop research oriented skills and to inculcate laboratory skills in students so that they can take up independent 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.	Dr. Rupnawar P. D.,	Member
5.	Dr. Kothawale A. S,	Member
6.	Mrs. Gawade S. A.,	Member
7.	Mrs. Patil S. S.	Invitee
8.	Mrs. Shinde P. K.	Invitee
9.	Mrs. Walekar S. S.	Invitee
10.	Prof. Dr. S. R. Kumbhar	Expert from other University
11.	Dr. Sadistap Shashikant	Expert from other University
12.	Dr. Mudassar Shaikh	Expert from University
13.	Mr. Patil Sharad. V.	Industry Expert
14.	Miss. Salunkhe Yogita.	Meritorious Alumni
15.	Miss. Shivanjali Gawade	Student Representative
16.	Miss. Dhanashri Shedge	Student Representative
17.	Mr. Mayur Mahamuni	Student Representative

Credit Distribution Structure for F.Y.B.Sc.-2023-2024 (Electronics)

Level	Semester	Major		Minor	GE/OE	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC, RP	Cum. Cr./ Sem.	Degree/ Cum. Cr.
		Mandatory	Electives							
4.5	I	**ELE-101-MJM**: Basic Electronics and Network Theorems **ELE-102-MJM:** Fundamentals of Digital Electronics **ELE-103-MJM** Electronics Practical-I **Credits-2+2+2**		--	**ELE-116-OE:** Basic Electronics-I **ELE-117-OE:** Electronics Practical-I Credit- 2+2	**ELE-121-VSC:** Applied Electronics **ELE-126-SEC:** Introduction of Circuit Simulator-I Credit- 2+2	**ENG-131-AEC:** Functional English – I **ELE-137-IKS:** Evolution & Future Prospects of Electronics in India **ELE-135-VEC:** Environmental Science Credit- 2+2+2	**US--CC1:** NSS/NCC/Yoga /Cultural Activity/Sports Credit- 2	22	**UG** **Certificate 44**

II	**ELE-151-MJM** Semiconductor Devices & Circuits **ELE-152-MJM** Digital Electronic Circuits **ELE -153-MJM:** Electronics Practical-II Credits-2+2+2		**ELE -161-MN** Introduction to Electronic Devices Credits-2	**ELE -166-OE:** Fundamentals of Digital Electronics **ELE -167-OE:** Electronics Practical-II Credit- 2+2	**ELE -171-VSC:** Designing of Experimental Electronic Systems **ELE -176-SEC:** Introduction of Circuit Simulator-II Credit- 2+2	**ELE -181-AEC:** Functional English-II **ELE -185-VEC:** Digital and Technological Solutions Credit- 2+2	**US--CC2:** NSS/NCC/Yoga /Cultural Activity/Sports Credit- 2	22
Cum Cr.	**12**	**-**	**2**	**8**	**8**	**10**	**4**	**44**

Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

Course Structure for F. Y. B.Sc. Electronics (2023 Pattern)

Sem.	Course Type	Course Code	Course Title	Theory/ Practical	No. of credits
I	Major Mandatory	**ELE-101-MJM**	Basic Electronics and Network Theorems	Theory	02
	Major Mandatory	**ELE-102-MJM**	Fundamentals of Digital Electronics	Theory	02
	Major Mandatory	**ELE-103-MJM**	Electronics Practical-I	Practical	02
	Open Elective (OE)	**ELE-116-OE**	Basic Electronics-I	Theory	02
	Open Elective (OE)	**ELE-117-OE**	Electronics Practical-I	Practical	02
	Vocational Skill Course (VSC)	**ELE-121-VSC**	Applied Electronics	Theory	02
	Skill Enhancement Course (SEC)	**ELE-126-SEC**	Introduction of Circuit Simulator-I	Practical-	02
	Ability Enhancement Course (AEC)	**ENG-131-AEC**	Functional English – I	Theory	02
	Value Education Course (VEC)	**ELE-135-VEC**	Environmental Science	Theory	02
	Indian Knowledge System (IKS)	**ELE-137-IKS**	Evolution & Future Prospects of Electronics in India	Theory	02
	Co-curricular Course (CC)	**--**	To be selected from the basket	Theory	02
	Total credits Semester-I				**22**
II	Major Mandatory	**ELE-151-MJM**	Semiconductor Devices & Circuits	Theory	02
	Major Mandatory	**ELE-152-MJM**	Digital Electronic Circuits	Theory	02
	Major Mandatory	**ELE -153-MJM**	Electronics Practical-II	Practical	02
	Minor	**ELE -161-MN**	Introduction to Electronic Devices	Theory	02
	Open Elective (OE)	**ELE -166-OE**	Fundamentals of Digital Electronics	Theory	02
	Open Elective (OE)	**ELE -167-OE**	Electronics Practical-II	Practical	02
	Vocational Skill Course (VSC)	**ELE -171-VSC**	Designing of Experimental Electronic Systems	Practical	02
	Skill Enhancement Course (SEC)	**ELE -176-SEC**	Introduction of Circuit Simulator-II	Practical	02
	Ability Enhancement Course (AEC)	**ENG -181-AEC**	Functional English-II	Theory	02
	Value Education Course (VEC)	**ELE -185-VEC**	Digital and Technological Solutions	Theory	02
	Co-curricular Course (CC)	--	To be selected from the Basket	Theory	02
	Total Credits Semester-II				**22**
	Cumulative Credits Semester I + Semester II				**44**

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

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : F. Y. B.Sc.
Semester : II
Course Type : Major Mandatory (Theory)
Course Code : ELE-151-MJM
Course Title : Semiconductor Devices & Circuits
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. To study characteristic features of semiconductor devices
2. To introduce components such as diodes, BJTs and FETs.
3. To study elementary electronic circuits and applications
4. To introduce the fundamental concepts and working principle of BJT, JFET, MOSFET
5. To study applications of semiconductor devices.
6. To understand analysis and design of simple diode circuit.
7. To give understanding of various types of amplifier circuits.

Course Outcomes:

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

CO1: Getting the fundamental knowledge of electronics components & circuits.
CO2: Identify active and passive components and understand basic circuit theory
CO3: Solve & minimize complex electronic circuits.
CO4: Describe the properties of materials and Application of semiconductor electronics
CO5: Apply the knowledge of semiconductors to illustrate the functioning of basic electronic devices.
CO6: Implement circuit and test the performance.
CO7: Classify and Analyze the various circuit configurations of Transistor and MOSFETs

Topics and Learning Points

Unit 1: Semiconductor Diodes (10L)

Introduction to semiconductor materials, Energy level diagram, Intrinsic & Extrinsic semiconductors, n-type semiconductor, p-type semiconductor

Study of semiconductor active components-P-N junction diode, Zener diode, Light Emitting Diode (LED), Photo diode

Unit-2: Bipolar Junction Transistor and its applications (12L)

Bipolar Junction Transistor, configurations of transistors (CE, CB and CC), Biasing circuits, DC load line (CE), Q point, ,concept of class A, B, C and class AB amplifiers, transistor as a switch, transistor as amplifier.

Unit-3: Field Effect Transistor **(8L)**

Junction Field Effect Transitor (JFET), Metal Oxide Semiconductor Field Effect Transistor (MOSFET), DMOSFET, EMOSFET, JFET as voltage variable resistor.

Reference Books:

1. Basic Electronics: Bernard Grob, McGraw Hill Publication, 8th Revised Edition,2010
2. Electronic Principles: Albert Malvino, David J Bates, McGraw Hill 7th Edition. 2012
3. Principles of Electronics: V.K. Mehta, S.Chand and Co.
4. A text book of electrical technology: B.L.Theraja, S.Chand and Co.
5. Basic Electronics and Linear Circuits: Bhargava N.N., Kulshreshtha D.C., Gupta S.C., 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

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

Justification of Mapping

PO1-Disciplinary Knowledge:

CO1- Demonstrating and analyzing the behavior of semiconductor devices directly aligns with the comprehensive knowledge of the discipline and the theoretical understanding required in the graduate program.

CO2- Gaining insight into the operation of BJT, FET, UJT for designing basic circuits is a practical application of the theoretical understanding within the graduate program.

CO3- Understanding the basic material and properties of semiconductors is foundational knowledge for comprehending the behavior and characteristics of semiconductor devices.

CO4- Exploring the constructional features and I-V characteristics of basic semiconductor devices (diodes, transistors) directly aligns with the graduate program's emphasis on theoretical and practical understanding.

CO5- Applying basic concepts of P-N junction in developing simple application circuits demonstrates the integration of theoretical knowledge into practical applications within the discipline.

CO6- Attaining knowledge of various amplifiers and comparing them aligns with the graduate program's objective of comprehensive knowledge and theoretical understanding.

CO7- Understanding the operational amplifier and its applications directly relates to the theoretical and practical aspects of the graduate program.

PO2-Critical Thinking and Problem solving:

CO1- Analyzing the behavior of semiconductor devices requires critical thinking and problem-solving skills to understand and address complex electronic characteristics.

CO2- Designing basic circuits based on the operation of BJT, FET, UJT involves critical thinking and problem-solving, demonstrating the application of theoretical knowledge in practical situations.

CO3- Understanding the basic material and properties of semiconductors is crucial for problem-solving in the design and analysis of semiconductor devices.

CO4- Exploring constructional features and I-V characteristics of basic semiconductor devices (diodes, transistors) involves critical thinking in addressing circuit design challenges and troubleshooting.

CO5- Applying basic concepts of P-N junction in developing simple application circuits requires problem-solving skills to create effective solutions.

CO6- Comparing various amplifiers involves critical thinking to evaluate their characteristics and choose the most suitable one for a given application.

CO7- Understanding the operational amplifier and its applications demonstrates critical thinking in solving problems related to amplifier configurations and applications.

PO3-Social competence:

CO2- Gaining insight into the operation of BJT, FET, UJT for designing basic circuits may require collaborative work, contributing to group interactions and social competence.

CO3- Understanding the basic material and properties of semiconductors may have limited direct impact on social competence but could indirectly support effective communication within a team.

CO4- Exploring constructional features and I-V characteristics of basic semiconductor devices may involve collaboration and communication, enhancing social competence.

PO4-Research-related skills and Scientific temper:

CO7- Understanding the operational amplifier and its applications involves practical application and experimentation, fostering research-related skills and a scientific temper.

PO5-Trans-disciplinary knowledge:

CO3- Understanding the basic material and properties of semiconductors draws on principles from materials science and electronics, contributing to a trans-disciplinary understanding.

PO6-Personal and professional competence:

CO1- Demonstrating and analyzing the behavior of semiconductor devices involves teamwork and collaboration, contributing to personal and professional competence.

CO2- Gaining insight into the operation of BJT, FET, UJT for designing basic circuits may require collaboration within a team, fostering personal and professional competence.

CO3- Understanding the basic material and properties of semiconductors may involve collaborative efforts in a laboratory setting, contributing to personal and professional competence.

CO4- Exploring constructional features and I-V characteristics of basic semiconductor devices involves teamwork and collaboration, enhancing personal and professional competence.

CO5- Applying basic concepts of P-N junction in developing simple application circuits may involve collaborative efforts within a team, contributing to personal and professional competence.

CO6- Attaining knowledge of various amplifiers and their comparison may require collaborative discussions, fostering personal and professional competence.

CO7- Understanding the operational amplifier and its applications may involve teamwork and collaboration, contributing to personal and professional competence.

PO8-Environment and Sustainability:

CO3- Understanding the basic material and properties of semiconductors may have implications for sustainable material use in electronic components.

PO9- Self-directed and Life-long learning:

CO1- Demonstrating and analyzing the behavior of semiconductor devices encourages independent learning through research and experimentation, fostering a self-directed approach.

CO2- Gaining insight into the operation of BJT, FET, UJT for designing basic circuits promotes self-directed learning and the acquisition of knowledge necessary for lifelong learning.

CO3- Understanding the basic material and properties of semiconductors requires continuous learning to stay updated on advancements in materials science and semiconductor technology.

CO4- Exploring constructional features and I-V characteristics of basic semiconductor devices encourages ongoing learning and adaptation to new developments in device design.

CO5- Applying basic concepts of P-N junction in developing simple application circuits necessitates continuous learning to stay abreast of evolving applications and technologies.

CO6- Attaining knowledge of various amplifiers and their comparison encourages ongoing learning in the dynamic field of amplifier technology.

CO7- Understanding the operational amplifier and its applications promotes lifelong learning by staying informed about new applications and advancements in operational amplifier technology.

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

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : F. Y. B.Sc.
Semester : II
Course Type : Major Mandatory (Theory)
Course Code : ELE-152-MJM
Course Title : Digital Electronic Circuits
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. To get familiar with combinational and sequential circuits.
2. To understand the concepts of combinational circuits.
3. To study different encoders and decoders.
4. To understand the concepts of sequential circuits.
5. To study different flip-flops.
6. To study different shift registers.

Course Outcomes:

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

CO1. Realize combinational circuits for given application.
CO2. Design and analyses synchronous and asynchronous sequential circuits using flipflops
CO3. Implement combinational logic circuits using programmable logic devices.
CO4. Recognizes different types of flip flops that are falling edges, rising edges and surface trigger.
CO5. Prepares logical symbols and truth tables of RS, JK, D and T flip-flop
CO6. Explains how decoder, encoder and 7 segment decoder work.
CO7. Explains how logical problems can be solved by using multiplexer, demultiplexer, comparator.

Topics and Learning Points

Unit 1: Combinational Circuits **(15 L)**

Multiplexers (2:1, 4:1, 8:1) and their Applications.
Demultiplexer (1:2, 1:4, 1:8) and their applications
Encoders-Decimal to binary, Decimal to BCD, Priority encoder, Keyboard encoder.
Decoders- Binary to decimal , BCD to Decimal , BCD to seven segment.

Unit 2: Sequential Circuits **(15 L)**

Flip flops :RS ,clocked RS, JK, Master slave JK, D and T.
Counters: Asynchronous counter, Synchronous counter,up/ down counter.
Concept of modulus counters, Decade counter. Study of IC 7490.
Shift registers: SISO, SIPO, PISO, PIPO , Ring counter and Applications.

Reference Books:

1. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.
2. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education
3. Digital Electronics : Principles, Devices and Applications - Anil K. Maini (Wiley)
4. Digital system Design – M. Morris Mano(Pearson Education)

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
CO1	3	3	-	-	-	1	-	-	3
CO2	3	3	2	-	-	2	-	-	2
CO3	3	3	1	-	1	-	-	1	3
CO4	2	2	1	-	-	1	-	-	2
CO5	3	2	-	-	-	3	-	-	3
CO6	2	3	2	-	1	2	-	-	3
CO7	3	2	-	-	-	2	-	-	2

Justification of Mapping

PO1-Disciplinary Knowledge:

CO1- Combinatorial circuits form a fundamental aspect of the broader discipline, requiring a deep understanding of digital logic and logical operations, aligning with the comprehensive knowledge expected at the graduate level.

CO2 – Sequential circuits are an integral part of digital circuit design, and their analysis and design involve advanced concepts beyond combinatorial circuits, contributing significantly to the depth of understanding expected at the graduate level.

CO3- The ability to realize both combinational and sequential circuits for specific applications show cases a practical application of the theoretical knowledge acquired in the graduate program, aligning with the execution of strong theoretical and practical understanding.

CO4- While programmable logic devices are not exclusive to combinational circuits, the implementation of combinational logic circuits using these devices involves a degree of specialization, making it moderately related to the broader disciplinary knowledge.

CO5- Understanding various flip-flop types is relevant to sequential circuit design, contributing to the theoretical knowledge expected in the graduate program but not as directly tied to the broader disciplinary knowledge.

CO6- The preparation of logical symbols and truth tables for different flip-flop types demonstrates a strong theoretical understanding of these essential components in sequential circuits, aligning well with the expected graduate-level knowledge.

CO7- Solving logical problems using multiplexers, demultiplexers, and comparators requires a comprehensive understanding of their functionality, linking directly to the broader disciplinary knowledge and practical application in the given context.

PO2- Critical Thinking and Problem solving:

CO1- Analyzing and designing combinatorial circuits directly aligns with the critical thinking and problem-solving skills emphasized in PO2, requiring analysis and design in response to specific situations.

CO2- Analyzing and designing sequential circuits is closely tied to critical thinking and problem-solving, requiring the application of logical reasoning and problem-solving skills to design sequential circuits.

CO3- Realizing combinational and sequential circuits for given applications involves critical thinking and problem-solving skills, making it strongly related to the skills emphasized

CO4- Implementing combinational logic circuits using programmable logic devices requires problem-solving skills, making it strongly related to the critical thinking and problem-solving

CO5- Recognizing different types of flip-flops involves analysis and inference, contributing to a moderate relationship with critical thinking and problem-solving skills

CO6- Preparing logical symbols and truth tables of flip-flops involves analysis and interpretation, contributing to a moderate relationship with critical thinking and problem-solving skills

CO7- Understanding how logical problems can be solved by using multiplexers, demultiplexers, and comparators involves analysis and problem- solving, resulting in a moderate relationship with the skills.

PO3 – Social competence:

CO2- Analyzing and designing sequential circuits is more focused on technical aspects, with limited direct relevance to the behavioral skills needed for successful social adaptation and group work .

CO3- Realizing combinational and sequential circuits for given applications is primarily a technical skill, with limited direct relevance to the social competence

CO4- Implementing combinational logic circuits using programmable logic devices is a technical task and has limited direct relevance to the social competence

CO6**-** Preparing logical symbols and truth tables of flip-flops is primarily a technical skill, with limited direct relevance to the social competence.

PO5- Trans-disciplinary Knowledge:

CO3- Realizing combinational and sequential circuits for given applications is primarily a technical skill, with limited direct relevance to the integration of different disciplines.

CO6**-** Preparing logical symbols and truth tables of flip-flops is primarily a technical skill, with limited direct relevance to the integration of different disciplines.

PO6-Personal and Professional competence:

CO1- Analyzing and designing combinatorial circuits requires collaboration and interdisciplinary understanding, promoting personal and professional competence.

CO2- Analyzing and designing sequential circuits involves teamwork, meeting objectives, and adapting to diverse requirements, contributing to personal and professional competence.

CO4- Implementing combinational logic circuits using programmable logic devices involves teamwork and interdisciplinary work, contributing to personal and professional competence.

CO5- Recognizing different types of flip-flops involves self-motivation and adaptability skills, contributing to personal competence.

CO6- Preparing logical symbols and truth tables of RS, JK, and T flip-flops involves interpersonal relationships and a commitment to professional ethics, enhancing personal and professional competence.

CO7- Understanding how logical problems can be solved by using multiplexer, demultiplexer, comparator involves collaboration and interdisciplinary understanding, contributing to personal and professional competence.

PO8- Environment and Sustainability:

CO3- Realizing combinational and sequential circuits for given applications may not have immediate ties to environmental sustainability but could indirectly contribute through efficient circuit implementations.

PO9- Self-directed and Lifelong learning:

CO1- Analyzing and designing combinatorial circuits encourages independent learning through research and application, fostering a self-directed approach.

CO2- Analyzing and designing sequential circuits necessitates continuous learning and adaptation to evolving technologies, promoting a self-directed and lifelong learning approach.

CO3- Realizing combinational and sequential circuits for given applications requires ongoing learning to stay updated on advancements, contributing to a self-directed and lifelong learning attitude.

CO4- Implementing combinational logic circuits using programmable logic devices involves continuous learning and adaptation to new devices and technologies, supporting a self-directed approach.

CO5- Recognizing different types of flip-flops requires ongoing learning and adaptation to changes in technology, fostering a self-directed and lifelong learning mindset.

CO6- Preparing logical symbols and truth tables of RS, JK, and T flip-flops involves continuous learning, contributing to a self-directed and lifelong learning approach.

CO7- Understanding how logical problems can be solved by using multiplexer, demultiplexer, comparator requires continuous learning, supporting a self-directed and lifelong learning attitude.

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

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : F. Y. B.Sc.
Semester : II
Course Type : Major Mandatory (Practical)
Course Code : ELE-153-MJM
Course Title : Electronics Practical-II
No. of Credits : 02
No. of Teaching Hours : 60

Course Objectives:

1. To teach students how to draw symbols, timing diagrams, circuit diagrams.
2. To develop skill of Circuit Connections.
3. To train them to design and analyze circuits for specific purpose.
4. To motivate them to work on different mini projects.
5. To teach students how to know, identify, draw different symbols, logic diagrams and circuit diagrams.
6. To develop skill of circuit connections.
7. To train them to design and analyse circuits for specific purpose.
8. To motivate them to work on different mini projects.

Course Outcomes:

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

CO1. To identify different devices, ICs and their types.

CO2. To know working of different instruments used in the laboratory.

CO3. To connect circuit and do required performance analysis.

CO4. To understand basic parameters in electronics.

CO5. Capability to develop experimental skills, analyzing the results and interpret data.

CO6. Develop hobby projects.

List of Practicals

- The practical course consists of **15** experiments.
- Any two of the following activities with proper documentation will be considered as equivalent of 4 experiments weightage in term work.

Activities

i. Hobby projects
ii. Internet browsing

iii. Industrial visit / live work experience
iv. PCB Making
v. Study Tour and its report writing

These will be evaluated in an oral examination for 20% marks at internal and term end examination.

All the students are required to complete a minimum of 15 experiments from the following list.

Group A:

1. Study of forward and Reverse biased characteristics of PN Junction Diode
2. Study of breakdown characteristics and voltage regulation action of Zener diode.
3. Study of output characteristics of Bipolar Junction Transistor in CE mode.
4. Study of output and transfer characteristics of JFET/MOSFET
5. Study of I-V characteristics of UJT and Demonstration of UJT based relaxation oscillator.
6. Study of low voltage Half-wave, Full-wave and Bridge rectifier circuits.
7. Study of amplification action of BJT.
8. Diode matrix ROM.
9. Logic gate using diode and transistor.
10. Thumbwheel Interface

Group B:

1. Build and Test 8:1 Multiplexer using gates.
2. Build and Test 1:8 Demultiplexer using gates.
3. Build and Test 3X4 matrix Keyboard Encoder
4. Study of RS, JK, T and D flip flops using NAND gates
5. Study of Up/Down Counter
6. Study of decade counter IC 7490
7. Study of 4 bit Shift Register.
8. Study of Decoders
9. Keyboard Encoder

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

Justification of Mapping

PO1-Disciplinary Knowledge:

CO1- Identifying different components and devices aligns with comprehensive knowledge in the graduate program, demonstrating theoretical and practical understanding.

CO2- Understanding basic parameters associated with each device contributes to strong theoretical knowledge in the graduate program.

CO4- Connecting circuits and performing required performance analysis demonstrates a strong blend of theoretical and practical skills in the graduate program.

PO2- Critical Thinking and Problem solving:

CO2- Understanding basic parameters associated with each device involves analysis and inference, fostering critical thinking in problem-solving scenarios.

CO3- Knowing the operation of different instruments used in the laboratory requires problem-solving skills and interpretation of data, aligning with critical thinking.

CO5- Comparing simulated and actual results of experiments necessitates critical analysis and problem-solving to reconcile differences and draw meaningful conclusions.

PO3-Social competence:

CO1- Identifying different components and devices may involve collaboration, enhancing social competence in group work.

PO5-Trans-disciplinary knowledge:

CO1- Identifying different components and devices involves integrating knowledge from various disciplines, contributing to a trans-disciplinary approach.

CO2- Understanding basic parameters associated with each device requires the integration of knowledge from different disciplines, supporting a trans-disciplinary perspective.

CO3- Knowing the operation of different instruments used in the laboratory involves integrating knowledge from various disciplines, fostering a trans-disciplinary understanding.

CO4- Connecting circuits and performing required performance analysis integrates knowledge from electronics and other disciplines, supporting a trans-disciplinary approach.

PO6-Personal and professional competence:

CO4- Connecting circuits and performing required performance analysis requires interpersonal relationships and collaboration, contributing to personal and professional competence.

CO5- Comparing simulated and actual results of experiments involves teamwork and collaboration, enhancing personal and professional competence.

PO8-Environment and Sustainability:

CO3- Knowing the operation of different instruments used in the laboratory may have limited direct ties to environmental sustainability but could indirectly contribute through efficient laboratory practices.

PO9- Self-directed and Life-long learning:

CO3- Knowing the operation of different instruments used in the laboratory fosters a self-directed approach to learning and staying abreast of technological advancements.

CO4- Connecting circuits and performing required performance analysis requires ongoing learning to adapt to changes in technology, supporting a self-directed and lifelong learning attitude.

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

Name of the Programme : B.Sc. Electronics
Programme Code : USEL
Class : F. Y. B.Sc.
Semester : II
Course Type : Minor (Theory)
Course Code : ELE -161-MN
Course Title : Introduction to Electronic Devices
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. To get familiar with basic circuit elements and passive components.
2. To understand network theorems and their use in circuit analysis.
3. To study elementary electronic circuits and applications.
4. To understand various number systems and their conversions.
5. To develop skill to build digital circuits.
6. To develop analog circuit design skills.
7. To learn basic techniques to design digital circuits and fundamental concepts used in design of digital system.

Course Outcomes:

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

CO1: To study basic electronic components and their applications in different areas.
CO2: Capability to understand the working principles of the electronic devices and their applications.
CO3: To develop an understanding of the fundamental laws and elements of electronic circuits.
CO4: Apply the knowledge of network theorems and simplify the network using reduction techniques.
CO5: To perform the conversions among different number systems.
CO6: Identify different types of logic gates along with their ICs and also verify their truth tables.
CO7: Derive basic logic gates, adder and subtractor using universal gates.

Topics and Learning Points

Unit 1: Study of Basic Components: (10L)

Study of basic circuit elements and passive components (with special reference to working principle, circuit symbols, types, specifications and applications): Resistor, Capacitor, Inductor, Transformer, Cables, Connectors, Switches, Fuses, Relays, Batteries. Series and parallel circuit of resistor, capacitor and inductor.

Unit 2: Circuits Analysis and Network Theorems: (10L)

Concept of Ideal voltage and current with AC and DC sources, Internal resistance, DC source and AC source (amplitude, frequency, peak value, peak to peak value, RMS value). Network terminology, Ohms law, voltage and current dividers, Kirchhoff's Laws (KCL, KVL), Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem,

Unit 3: Number Systems and Logic Gates: (10L)

Introduction to decimal, Octal, Binary and hexadecimal number systems, interconversions of number systems, BCD, Excess-3 and Gray codes and their inter conversions, Alphanumeric representation using ASCII code. Positive and Negative Logic, Basic Logic gates (NOT, OR, AND) & derived gates (NAND, NOR), EX-OR, EX-NOR gates (Symbol and truth table), Study of Gate ICs (7408, 7432, 7404,7400,7402,7486). Rules of binary addition and subtraction, subtraction using 1's and 2's complements.

Reference Books:

1. Basic Electronics: Bernard Grob, McGraw Hill Publication, 8th Revised Edition,2010.
2. Electronic Principles: Albert Malvino, David J Bates, McGraw Hill 7th Edition. 2012.
3. Digital Electronics: Jain R.P., Tata McGraw Hill.
4. Digital Principles and Applications: Malvino Leach, 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

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

Justification of Mapping

PO1: Disciplinary Knowledge

CO1: Students acquire a foundational understanding of electronic components, which is essential for their overall grasp of electronic engineering concepts.

CO3: Students have disciplinary knowledge by emphasizing the understanding of fundamental laws and elements of electronic circuits, which is crucial for an electronics engineer.

CO4: Applying knowledge of network theorems and reduction techniques is a specific skill within the discipline of electronics. Students can practically apply their knowledge in analyzing and simplifying electronic networks.

CO6: Identification of logic gates, their associated Integrated Circuits (ICs), and the verification of truth tables are specific skills within electronic engineering. This ensures students have a comprehensive understanding of logic gates.

PO2: Critical Thinking and Problem Solving:

CO1: Studying basic electronic components and their applications requires critical thinking to understand the principles and problem-solving skills to apply this knowledge in various contexts.

CO2: Understanding the working principles of electronic devices involves critical thinking to analyze complex concepts and problem-solving skills to apply these principles in practical scenarios.

CO4: Applying network theorems and simplifying networks demand critical thinking to choose appropriate theorems and problem-solving skills to simplify complex circuits effectively.

CO5: Performing conversions among different number systems involves critical thinking to understand the relationships between systems and problem-solving skills to execute accurate conversions.

CO7:Deriving basic logic gates, adders, and subtractors using universal gates demands critical thinking to apply theoretical knowledge and problem-solving skills to create functional circuits.

PO3: Social competence:

CO3: A deep understanding of fundamental laws and elements in electronic circuits enables graduates to contribute to the development of technologies that can benefit society, showcasing their social competence.

CO5:Performing conversions among different number systems is a fundamental skill that can be applied in various technological and societal contexts, showcasing the graduate's ability to contribute to society.

CO7: Deriving basic logic gates, adders, and subtractors using universal gates demonstrates a high level of understanding that can be applied to design efficient electronic systems, contributing to societal needs and showcasing social competence.

PO4: Research-related skills and Scientific temper:

CO1: Studying basic electronic components and their applications involves applying scientific methods and developing research-related skills to understand and explore the principles underlying these components.

CO2: Developing the capability to understand electronic devices requires a scientific temper, and this involves research-related skills as students delve into the scientific principles governing these devices.

CO3: Developing an understanding of fundamental laws and elements in electronic circuits involves scientific inquiry, and students acquire research-related skills as they explore and analyze these foundational concepts.

CO6: Identifying logic gates and their ICs involves scientific inquiry, and verifying truth tables requires a systematic approach, reflecting research-related skills and a scientific temper.

CO7: Deriving basic logic gates, adders, and subtractors using universal gates demands research-related skills and a scientific temper, as students engage in systematic analysis and problem-solving.

PO5: Trans-disciplinary Knowledge:

CO1: Studying basic electronic components involves gaining knowledge that can be applied across various disciplines, as electronic components find applications in diverse fields such as healthcare, communication, and energy.

CO4: Applying network theorems and simplifying networks is a skill that can be utilized in various disciplines, as electronic networks are prevalent in fields like telecommunications, control systems, and computer engineering.

PO6: Personal and professional competence:

CO2: The capability to understand electronic devices and their applications contributes to personal and professional competence by ensuring that graduates are well-equipped to analyze, design, and implement electronic systems in a professional setting.

CO3: Developing an understanding of fundamental laws and elements in electronic circuits is crucial for personal and professional competence, enabling graduates to make informed decisions and contribute effectively to the field.

CO6: Identifying logic gates and their applications contributes to personal and professional competence by ensuring graduates can work effectively with digital systems, a critical aspect of modern engineering.

CO7: Deriving logic gates, adders, and subtractors using universal gates showcases a high level of personal and professional competence, demonstrating an advanced understanding and application of foundational principles.

PO7: Effecive Citizenship and Ethics:

CO3: Developing an understanding of electronic circuits involves recognizing the ethical considerations in circuit design and operation. This knowledge contributes to effective citizenship by promoting responsible engineering practices.

CO6: Identifying logic gates and their applications involves ethical considerations, especially in fields like digital communication and security. Graduates need to be effective citizens by considering the ethical implications of the systems they design and implement.

PO9: Self-directed and Life-long learning:

CO1: Students have ability to independently research and understand new components is crucial for staying updated throughout one's career.

CO3: Understanding fundamental laws and elements empowers students to continue learning and applying their knowledge to complex electronic circuitry as they encounter new challenges.

CO5: Proficiency in number system conversions is a foundational skill that can be applied across various electronic disciplines, fostering a self-directed approach to learning related concepts.

CO6: The identification of logic gates and their applications requires ongoing self-directed learning especially as digital technology continues to advance.

CO7: Students have ability to derive complex circuits using universal gates demonstrates a mastery of fundamental concepts and encourages a mindset of continuous exploration and learning.

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

Name of the Programme : B.Sc. Electronics

Programme Code : USEL

Class : F. Y. B.Sc.

Semester : II

Course Type : Open Elective (OE) (Theory)

Course Code : ELE -166-OE

Course Title : Fundamentals of Digital Electronics

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To get familiar with concepts of digital electronics
2. To know about different number systems and codes.
3. To learn number systems and their representation.
4. To study the interconversions using number systems.
5. To understand basic logic gates and truth tables.
6. To understand Boolean Laws.
7. To understand DeMorgan's Theorems.
8. To study arithmetic operations and circuits in digital electronics.

Course Outcomes:

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

CO1: Understand Binary arithmetic, different number systems interconversions and codes.
CO2: Solve problems based on interconversion of number systems.
CO3: Understand concepts of Logic Gates and Boolean algebra.
CO4: Understand universal gates and their applications.
CO5: Reduce expressions using Boolean Laws.
CO6: Reduce expressions using DeMorgan's Theorems.
CO7: Perform different arithmetic operations and circuits.

Topics and Learning Points

Unit I: Number Systems (10 L)

Number Systems - Introduction to decimal, Octal, Binary and hexadecimal number systems, Inter conversions – Decimal to Binary, Octal, Hexadecimal; Binary to Decimal, Octal, Hexadecimal; Octal to Binary, Decimal, Hexadecimal; Hexadecimal to Binary, Octal to Decimal

BCD code , Excess-3 code and Gray code.

Interconversion- Binary to Gray and Gray to Binary, Decimal to BCD, Decimal toExcess-3

Unit II: Logic Gates (10 L)

Concept of Logic Gates (NOT, OR, AND), Universal Gates(NOR, NAND) and Derived gates(EX-OR, EX-NOR) – Statement, Circuit Symbol, Expression, Truth table. Pinout diagrams - IC 7400, IC 7402, IC 7432, IC 7408, IC 7486

Unit III: Boolean algebra and Arithmetical Operations (10 L)

Boolean Laws – Insertion, union, Tautology, Complement, Double Negation, Commutation, Association, Distribution, Absorption. Boolean Expressions in SOP and POS Form, Conversion of SOP and POS into their standard form, Minimization of Complex Boolean Expression using Boolean Algebraic Techniques. DeMorgan's Theorems, Basic Binary Rules for addition and subtraction, 1's and 2's complement of binary numbers, Subtraction of binary numbers using 1's and 2's complement. Adder- Haff and Full adder. Subtractor- Half and Full subtractor.

Reference Books:

1. Digital Fundamentals - Floyd T.N. and Jain R.P. (Pearson Educations)
2. Digital system Design – M. Morris Mano(Pearson Education)
3. Digital Principles and Applications –Leach, Malvino, Saha (TMH)
4. Digital Electronics : Principles, Devices and Applications - Anil K. Maini (Wiley)

Mapping of Program Outcomes with Course Outcomes

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

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

PO1: Disciplinary Knowledge:

CO1: Students will develop a understanding of binary arithmetic, different number systems interconversions and codes which is essential for fundamental understanding of computers, memory management, data storage.
CO2: Students will develop a deep understanding of various bases such as binary, octal, decimal, and hexadecimal. This knowledge is foundational in the field of computer science and related disciplines also enhances a programmer's ability to work with these fundamental operations.
CO3: Understanding these concepts is crucial for students pursuing disciplines related to computer science, electrical engineering, and information technology. This knowledge provides a basis for more advanced topics in these fields. It finds applications in various fields such as telecommunications, control systems, robotics, and artificial intelligence. Students with a strong foundation in these concepts are better equipped to apply their knowledge across diverse domains.
CO4: Students who understand universal gates can effectively design and analyze complex digital circuits, contributing to their disciplinary knowledge in the field of digital electronics. Understanding of this serves as a foundation for more advanced topics in digital electronics, such as sequential logic circuits, microprocessor design, and embedded systems..
CO5: The ability to reduce expressions using Boolean laws is a practical skill that directly translates into real-world applications and enhance a fundamental skill in designing efficient digital circuits.
CO6: It involves step-by-step transformations, requiring algorithmic thinking. This skill is valuable in various aspects of computer science, including algorithm design, optimization, and complexity analysis also students pursuing disciplines related to computer science and electrical engineering.
CO7**:** Students learn how to analyze problems, design solutions, and evaluate the efficiency of different circuit implementations. Essential for students to grasp more advanced topics within the discipline.

PO2: Critical Thinking and Problem solving

CO1: It require students to apply logical reasoning and critical thinking skills. It often involves the application of algorithms, this encourages algorithmic thinking.
CO2: Students must analyze the structure and properties of these systems to successfully convert between them. This process requires logical thinking to identify patterns and relationships among different number systems, fostering analytical skills that are crucial for critical thinking.
CO3: Students can apply these concepts in interdisciplinary problem-solving scenarios, fostering a holistic approach to critical thinking. It enable students to critically analyze the functionality of digital circuits and learn to evaluate the impact of different logic configurations on circuit behavior. Students can design, analyze, and troubleshoot digital systems.
CO4: Provide a solid foundation in digital circuitry, encourage creative circuit design, and fostering logical reasoning abilities for students.

CO5: Promote logical reasoning, algorithmic thinking, decision-making, and real-world problem-solving skills. These skills are essential for students to navigate complex problems, particularly in fields where digital logic plays a significant role.
CO6: Students learn to approach complex problems systematically, breaking them down into manageable components and applying appropriate techniques. Encourage analytical thinking, problem-solving skills,cognitive flexibility, and the application of abstract concepts. These skills are essential for professionals in various fields, particularly in technology and engineering.
CO7**:** Students must use critical thinking to identify the most efficient and effective methods for solving mathematical and circuit-related problems.

PO3: Social competence

CO1: Programmers with a strong foundation in these areas are better equipped to communicate effectively, collaborate in team settings, and consider ethical implications in their work.
CO2: Understanding various number systems and codes promotes social competence by fostering effective communication and collaboration in diverse technological environments.
CO5: Enhancing social competence through the application of Boolean Laws in program development, fostering effective collaboration and communication skills within a technical context.
CO6: Mastering DeMorgan's Theorems for expression reduction enhances social competence in programming by promoting concise and efficient code, fostering collaborative communication within development teams, and facilitating better understanding and maintenance of codebases.
CO7: Developing the ability to perform various arithmetic operations and circuits fosters social competence by enhancing problem-solving skills and collaborative teamwork in addressing complex challenges.

PO4: Research related skills and Scientific temper

CO1: Equipping students with the ability to comprehend binary arithmetic, execute diverse number system conversions, and apply coding techniques, fostering research-related skills and cultivating a scientific temper in problem-solving.
CO3: Enabling students to grasp the fundamentals of Logic Gates and Boolean algebra fosters a solid foundation for effective problem-solving in digital systems, while also nurturing research-related skills and cultivating a scientific temper essential for innovation and inquiry.
CO4: Mastering universal gates enhances programming proficiency by enabling efficient logical circuit design, fostering research-related skills and cultivating a scientific temper for innovative problem-solving in diverse domains.
CO5: Enhances logical reasoning and programming efficiency by mastering Boolean Laws for expression simplification, while cultivating research-related skills and fostering a scientific temper for robust problem-solving in diverse contexts.
CO6: Enhances programming proficiency by mastering DeMorgan’s Theorems to systematically simplify logical expressions, enhancing research-related skills and a scientific temper in algorithmic problem-solving.

CO7: Demonstrate proficiency in executing diverse arithmetic operations and circuit designs, while cultivating research-related skills and fostering a scientific temper for informed problem-solving.

PO6: Personal and professional competence

CO1: Binary arithmetic, number system interconversions, and codes enhances personal and professional competence by promoting a solid foundation in fundamental computing concepts, crucial for effective problem-solving and communication in diverse technological environments.

CO2: Proficiently navigating and manipulating diverse number systems enriches a foundational skill set, enhancing personal and professional competence in problem-solving within the realm of computer science.

CO3: Logic Gates and Boolean algebra providing a fundamental understanding of digital logic, enabling efficient problem-solving and logical reasoning in programming and related fields..

CO4: Comprehensive knowledge of universal gates and their applications enhances advanced problem-solving abilities and enabling the efficient design and optimization of complex digital circuits in programming and related fields.

CO5: Proficiency in reducing expressions using Boolean Laws promotes analytical skills, facilitating concise and optimized logic design, and enhancing problem-solving capabilities in programming and related domains.

CO6: Mastery of reducing expressions using De Morgan's Theorems enhances personal and professional competence by refining logical reasoning skills, enabling streamlined logic design, and fostering effective problem-solving in programming and related domains.

CO7: Acquiring the ability to perform diverse arithmetic operations and design circuits enhances personal and professional competence, fostering advanced problem-solving skills and ensuring proficiency in algorithmic development within programming and related professional domains.

PO9: Self-directed and life-long learning

CO1: Gaining proficiency in binary arithmetic, number systems interconversions, and codes enabling adaptability to diverse computational challenges.

CO2: Proficiently solving problems through interconversion of number systems fostering adaptability to diverse computational scenarios.

CO3: Grasping the concepts of Logic Gates and Boolean algebra facilitating continuous growth and adaptability in tackling complex logical and computational challenges.

CO4: Comprehending universal gates and their applications empowering individuals to adapt and innovate in diverse computational contexts.

CO5: Mastering expression reduction with Boolean Laws promotes self-directed and life-long learning in programming, fostering continuous skill development for efficient and optimized code implementation.

CO6: Proficiency in expression reduction using De Morgan's Theorems encourages adaptability to diverse logical challenges and promoting continuous skill enhancement.

CO7: Empowers students to independently apply and continually enhance their skills in performing diverse arithmetic operations and designing circuits.

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

Name of the Programme : B.Sc. Electronics

Programme Code : USEL

Class : F. Y. B.Sc.

Semester : II

Course Type : Open Elective (OE) (Practical)

Course Code : ELE -167-OE

Course Title : Electronics Practical II

No. of Credits : 02

No. of Teaching Hours : 60

Course Objectives:

1. To get familiar with concepts of digital electronics
2. To know about different number systems and codes.
3. To learn number systems and their representation.
4. To study the interconversions using number systems.
5. To understand basic logic gates and truth tables.
6. To understand Boolean Laws.
7. To understand DeMorgan's Theorems.

Course Outcomes:

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

CO1: Understand Interconversion codes

CO2: Understand Concept of digital Electronics.

CO3: Understand concepts of Logic Gates and Boolean algebra

CO4: Understand universal gates and their applications

CO5: Reduce expressions using Boolean Laws.

CO6: Concept of DeMorgan's Theorems.

CO7: Perform different arithmetic operations.

List of Practical

1. Study of Inter conversion System.

2. Study of digital system vs Analog System.

3. Study of basic Logic Gate

4. Study of Half adder

5. Study of Full adder

6. Study of Half Subtractor.

7. Code converter: Binary to Gray

8. Study of Universal logic Gate.

9. Verification of DE Morgan's theorem

10. Gray to Binary Converter

11. Study of 1's Compliment.

12. Study of Digital online payment system.

13. Study of Seven segment Display.

14. Study of Full Subtractor.

15. Study of 2's Compliment.

16.Market Survey.

17. Activity.

Mapping of Program Outcomes with Course Outcomes

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

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

Justification for OE(Practical)

PO1: Disciplinary Knowledge

CO1: Understanding interconversion codes contributes to disciplinary knowledge in the field of digital electronics and coding schemes**.**

CO2: Grasping the concepts of digital electronics aligns with disciplinary knowledge in digital systems and electronics.

CO3: Grasping the concepts of logic gates and Boolean algebra contributes to disciplinary knowledge in digital logic design.
CO4: Understanding universal gates and their applications contributes to disciplinary knowledge in digital circuit design.
CO5: Reducing expressions using Boolean laws aligns with disciplinary knowledge in digital logic optimization.
CO6: Understanding DeMorgan's Theorems contributes to disciplinary knowledge in digital logic design and optimization.
CO7:Performing arithmetic operations aligns with disciplinary knowledge in digital arithmetic and circuit design.

PO2: Critical Thinking and Problem Solving

CO1: Interconverting codes may involve critical thinking and problem-solving skills.
CO2: Grasping the concepts of digital electronics aligns Critical Thinking and Problem Solving in digital systems and electronics.
CO3: Grasping the concepts of logic gates and Boolean algebra contributes to Critical Thinking and Problem Solving in digital logic design.
CO4: Understanding universal gates and their applications contributes to Critical Thinking and Problem Solving.
CO5: Reducing expressions using Boolean laws aligns with Critical Thinking and Problem Solving in digital logic optimization.
CO6: Understanding DeMorgan's Theorems contributes to Critical Thinking and Problem Solving in digital logic design and optimization.
CO7:Performing arithmetic operations aligns with Critical Thinking and Problem Solving in digital arithmetic and circuit design.

PO2: Critical Thinking and Problem Solving

CO1: Interconverting codes may involve critical thinking and problem-solving skills.
CO2: Grasping the concepts of digital electronics aligns Critical Thinking and Problem Solving in digital systems and electronics.
CO3: Grasping the concepts of logic gates and Boolean algebra contributes to Critical Thinking and Problem Solving in digital logic design.
CO4: Understanding universal gates and their applications contributes to Critical Thinking and Problem Solving.
CO5: Reducing expressions using Boolean laws aligns with Critical Thinking and Problem Solving in digital logic optimization.
CO6: Understanding DeMorgan's Theorems contributes to Critical Thinking and Problem Solving in digital logic design and optimization.
CO7:Performing arithmetic operations aligns with Critical Thinking and Problem Solving in digital arithmetic and circuit design.

PO3:Social competence

CO2 to CO7: All provide Social competence.

PO4: Research-related Skills and Scientific Temper:

CO1 to CO7(Except CO3): All provide Research-related Skills and Scientific Temper

PO5:Trans-disciplinary knowledge

CO1: Reducing expressions using Boolean laws aligns with disciplinary knowledge in digital logic optimization.
CO2: Applying Boolean laws for expression reduction requires critical thinking skills.
CO4: Understanding universal gates and their applications contributes to Trans-disciplinary knowledge Solving.

PO6: Personal and professional competence

CO1:Understanding interconversion codes contributes to disciplinary knowledge in the field of digital electronics and coding schemes**.**

CO2: Understanding digital electronics enhances personal and professional competence in the field.
CO4: Knowledge of universal gates enhances personal and professional competence in circuit design
CO5: Applying Boolean laws for expression reduction requires Personal and professional competence.

P07: Effective Citizenship and Ethics

CO2: Understanding digital electronics enhances personal and professional competence in the field.

P08: Environment and Sustainability

CO2: Grasping the concepts of digital electronics aligns with Environment and Sustainability in digital systems and electronics.
CO3: Applying logic gates and Boolean algebra involves Environment and Sustainability.
CO4: Knowledge of universal gates enhances Environment and Sustainability in circuit design.
CO6: Studying theorems involves Environment and Sustainability.

P09: Self-directed and Life-long learning

CO2: Acquiring knowledge about the concepts of digital electronics encourages students to engage in continuous learning, adapting to advancements in the field throughout their careers.
CO4: Understanding universal gates and their applications requires the ability to explore diverse applications independently, fostering a mindset of lifelong learning
CO6: Understanding DeMorgan's Theorems necessitates the ability to explore theorems independently, contributing to a culture of self-directed learning and adaptability.

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

Name of the Programme : B.Sc. Electronics

Programme Code : USEL

Class : F. Y. B.Sc.

Semester : II

Course Type : Vocational Skill Course (VSC) (Practical)

Course Code : ELE -171-VSC

Course Title : Designing of Experimental Electronic Systems

No. of Credits : 02

No. of Teaching Hours : 60

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:

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

1. Measurement of different frequencies, amplitudes, voltages.
2. Know the concept of filter.
3. Get familiar with sensors.
4. Generate various frequencies.
5. Calculate the voltages across the resistors.
6. Simulate some basic cicrcuits.
7. Design applications using active and passive components.

List of Practical

- The practical course consists of **15** experiments.
- Any two of the following activities with proper documentation will be considered as equivalent of 4 experiments weightage in term work.

1. Study of CRO & Measurement of Voltage Amplitude & Frequency.
2. Frequency Response of CR circuit.
3. Touch switch circuit using transistor.
4. Positive Power Supply using Regulator IC.

5. Negative Power Supply using Regulator IC.
6. Study of LM 35 temperature sensor.
7. Astable Multivibrator using IC 555.
8. Study of Multiplexer using IC.
9. Study of Varactor Diode.
10. Amplifier using IC741.
11. Water level indicator circuit using only transistors and resistors.
12. Study of Relay.
13. Build and test LDR circuit.
14. Light Sensor Circuit using Photodiode as photodiode.
15. Study of CircuitMod Simulator.
16. Voltage divider rule analysis.
17. Charging and discharging of capacitor
18. 4 bit full adder using IC 7483
19. Testing of Diode and Transistor
20. Transistor As A Switch

List of Activities:

1. Internet Browsing of latest Electronic Technologies.
2. Market Survey of components/devices/equipment's.
3. Hobby Project
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
CO1	1	1	-	1	-	3	-	-	2
CO2	1	1	-	2	-	-	-	-	1
CO3	1	2	2	1	-	-	-	2	1
CO4	1	1	-	-	-	-	-	-	-
CO5	1	1	-	-	-	-	-	-	-
CO6	2	2	2	2	-	1	-	-	1
CO7	1	1	-	-	-	-	-	-	1

Justification for Mapping

PO1: Disciplinary Knowledge

CO1: Students will be able to take measurements of different frequencies, amplitudes, voltages.
CO2: Students will get to know the concepts of the different filter circuits and their designs.
CO3: Students will get familiar with various types of sensors.
CO4: Students will generate various different frequencies using the given components.
CO5: Students will be able to calculate voltages across the registers.
CO6: Students will be able to simulate some basic circuits in the particular simulator.

CO7: Students will be capable of designing the applications using active and passive components.

PO2: Critical Thinking and Problem solving

CO1: Students will be able to measure the frequencies, amplitudes and voltages of the given circuit at the output by measuring again the time and wavelength manually and then by observations.

CO2: Students will get to know the various filters by examining and designing different circuits and modifying the active passive components.

CO3: Students will be familiar with the sensors, types of sensor, working of sensors, pin connections of sensors and applications of sensors.

CO4: Students will be capable of generating different frequencies by designing circuits as well as by modifying the values of the basic components and observe them for further calculations.

CO5: Students will be able to calculate the values of voltages drop across the resistor in the circuit.

CO6: By designing, measuring and modifying the basic circuits, students will be able to do simulation for the respective circuits after learning the simulator.

CO7: Students will be able to design the more and more application by getting familiar with the designing, measurements techniques and simulations.

PO3: Social competence

CO3: Students will get familiar with the sensors and they can apply the particular sensor to the real life societal applications.

CO6: Students will get the knowledge about the Circuit Mod Simulator and can be aware of the output responses in voltage as well as in waveforms.

PO4: Research-related skills and Scientific temper

CO1: Students will know various measurement techniques for frequency measurement, amplitude measurement, voltage measurement etc. as requirement of basic knowledge in any research work.

CO2: Students will know what is the concept of filter and where to apply them as a part of any research related skill in scientific approach.

CO3: Students will get to know the importance of sensor and their working in the research related skills and scientific approaches.

CO6: Students will get knowledge of using simulators before going to the actual component soldering and its importance in research in electronics topics.

PO6: Personal and professional competence

CO1: Students will measure the frequency of the given circuit, amplitudes of given circuit and also voltages at different points in the circuit which belongs to their personal as well as professional competence.

CO6: Students will simulate numerous basic electronic circuits using the Circuit Mod simulator.

PO8: Environment and Sustainability

CO3:

PO9: Self-directed and Life-long learning

CO1: Students will get to know about the measurements of the frequencies, amplitude as well as voltages in the circuit which will again useful for the rest of the time further in future work.

CO2: Student will be clear about the concept of filter and its circuitry of different types of filters.

CO3: Students will get the basic knowledge about the sensors and further they can study advance sensors in future.

CO6: Students will get the basic knowledge about the simulators and further they can study advance and various simulators in future.

CO7: Students will be able to design various circuits using the basic active and passive components.

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

Name of the Programme : B.Sc. Electronics

Programme Code : USEL

Class : F. Y. B. Sc.

Semester : II

Course Type : Skill Enhancement Course (SEC)

Course Code : ELE -176-SEC

Course Title : Introduction of Circuit Simulator-II

No. of Credits : 02

No. of Teaching Hours : 60

Course Objectives:

1. To develop hands-on skills of students
2. To promote entrepreneurship among the students
3. To enhance technical knowledge
4. To increase employment opportunities of students
5. To develop hands on working experience with reference to Solve, Simulate and Analyses Electrical & Electronics Circuits using TINA.TI. Software.
6. To develop in various Hardware Description Languages, VHDL, Verilog, Verilog A, Verilog AMS and System C and for designing their PCB layouts.
7. TINA Standard includes circuit simulation TINA Design Suite also includes the advanced PCB designer.

Course Outcomes:

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

CO1.Create, design and develop problem solving ability

CO2. Understand state of the art, technology and development

CO3. Develop soft skills needed.

CO4. Get knowledge of self-employability.

CO5. Identify Electronic components and understand simulating tool.

CO6. Design Suite also includes the advanced PCB designer.

CO7. TINA Design Suite is a powerful yet affordable software package for analyzing, designing and real time testing of circuits with analog, digital & microcontroller components

List of Practical

- ❖ The practical course consists of **15** experiments.
- ❖ Any two of the following activities with proper documentation will be considered as equivalent of 4 experiments weightage in term work.

1.Study of TINA environment.

2. Study of Simulation and Circuit Schematic using TINA.

3. Study Transistor Amplifier circuit.
4. Creating and analyzing an Op-Amp circuit
5. Analyzing an RLC circuit (DC, AC, Transient and Fourier analysis).
6. Calculating DC Transfer characteristic
7. Analysis of SMPS circuits.
8. Power dissipation and efficiency calculations
9. Network Analysis
10. Stress Analysis
11. Testing Logic gate.
12. Half Adder
13. Full Adder
14. Analyzing a Digital Circuit with TINA's Digital Engine
15. Analyzing Circuits using HDL models
16. Analyzing a Digital Circuit Using Digital VHDL Simulation
17. Analyzing a Digital Circuit Using Digital Verilog Simulation
18. Testing your Circuit in Interactive mode
19. Using the Flowchart Editor and Debugger in TINA
20. Creating printing circuit Board (PCB)

Activity:

- Industrial Visit / Study Tour / Field visit/Designing/Internet Serve/Seminar

Reference Books:

1. Texa tool and software
2. Tina_V12_Lab_Manual
3. Printed circuit Board – Design & Technology by Walter C. Bosshart, TMH.
4. Printed Circuit Board –Design, Fabrication, Assembly & Testing, R.S. Khandpur, TMH,3rd Edition,2017.
5. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky, PHI, 10th Edition, 2009

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
CO1	2	3	-	1	-	3	-	-	3
CO2	2	3	-	2	-	2	-	-	3
CO3	3	2	2	3	-	-	-	2	3
CO4	3	3	-	1	-	-	-	-	3
CO5	3	2	2	-	-	-	-	-	-
CO6	3	2	-	2	-	3	-	-	3
CO7	3	3	2	-	-	-	-	-	3

Justification of Mapping

PO1-Disciplinary Knowledge:

CO1- Creating, designing, and developing problem-solving ability aligns closely with the comprehensive knowledge of disciplines expected in a graduate program, demonstrating strong theoretical and practical understanding.

CO2- Understanding the state of the art, technology, and development requires comprehensive knowledge of the disciplines within the graduate program, indicating a strong relationship with the theoretical and practical understanding

CO3- Developing soft skills is moderately related to the comprehensive knowledge of disciplines within a graduate program, as it complements the theoretical and practical understanding

CO4- Gaining knowledge of self-employability to the comprehensive knowledge of disciplines within a graduate program, indicating a connection to the theoretical and practical understanding

CO5- Identifying electronic components and understanding simulating tools directly aligns with the comprehensive knowledge of disciplines in a graduate program, demonstrating strong theoretical and practical understanding.

CO6- Designing Suite, including advanced PCB design, is strongly related to the comprehensive knowledge of disciplines within a graduate program, indicating a clear connection to the theoretical and practical understanding

CO7- TINA Design Suite for analyzing, designing, and real-time testing of circuits aligns strongly with the comprehensive knowledge of disciplines within a graduate program, indicating a clear connection to the theoretical and practical understanding

PO2- Critical Thinking and Problem solving:

CO1- The creation, design, and development of problem-solving ability directly align with the critical thinking and problem-solving skills expected at the graduate level, reflecting a strong connection to the overarching program outcome.

CO2- A solid understanding of the state-of-the-art technology and development is crucial for effective problem-solving and critical thinking, showcasing a strong relationship with the expected graduate-level skills.

CO3- While soft skills contribute to effective communication and collaboration in problem-solving scenarios, their direct connection to critical thinking is moderately related, as the emphasis is on cognitive abilities.

CO4- The knowledge of self-employability involves a mix of entrepreneurial and problem-solving skills, making it moderately related to critical thinking and problem-solving skills expected at the graduate level.

CO5- The identification of electronic components and understanding simulation tools directly contributes to the problem-solving process in electronics, demonstrating a strong connection to critical thinking skills in the context of the graduate program.

CO6- The inclusion of advanced PCB design in the design suite underscores the application of critical thinking and problem-solving skills in designing complex electronic circuits, aligning strongly with the expected outcomes of the graduate program.

CO7- The use of TINA Design Suite for real-time testing of circuits encompasses critical thinking and problem-solving skills, demonstrating a strong connection to the overall program outcome of exhibiting these skills in a practical context.

PO3-Social competence:

CO3- Soft skills, including effective communication and collaboration, are directly tied to social competence, aligning strongly with the expected outcomes of understanding and exhibiting behavioral skills in social settings.

CO5- While technical skills in identifying electronic components are important, their direct relationship to social competence is limited, resulting in a partial connection to the broader social adaptability skills.

CO7- While the use of TINA Design Suite involves technical skills, its connection to social competence is limited, resulting in a partial relationship with the broader outcomes of successful social adaptation and effective communication.

PO4-Research-related skills and Scientific temper :

CO1- While problem-solving ability is crucial for conducting experiments, its direct connection to the broader research-related skills and scientific temper is moderate, as research involves a specific set of skills beyond general problem-solving.

CO2- Understanding technology contributes to the application of instrumentation and laboratory techniques, linking moderately with research-related skills, but the direct impact on scientific temper is limited.

CO3- Soft skills, while important in a broader context, have limited direct relevance to the specific research-related skills and scientific temper targeted in the graduate program.

CO4- Knowledge of self-employability has limited direct relevance to the specific skills needed for laboratory work and research, resulting in a partial relationship with research-related outcomes.

CO6- The inclusion of advanced PCB design, while significant in a technical context, has limited direct relevance to the broader research-related skills and scientific temper targeted in the graduate program.

PO6-Personal and professional competence:

CO1- Problem-solving ability is integral to personal and professional competence, emphasizing the capability to contribute effectively to team objectives and interdisciplinary work while demonstrating a commitment to professional ethics.

CO2- Understanding technology contributes to professional competence, but the direct link to interpersonal relationships and commitment to professional ethics is moderate, as these aspects involve a broader set of skills.

CO6- The inclusion of advanced PCB design, while significant in a technical context, has limited direct relevance to interpersonal relationships, adaptability, and commitment to professional ethics

PO8-Environment and Sustainability:

CO2- While understanding technology contributes to addressing environmental impacts, the direct link to sustainability and societal context is moderate, as it requires additional considerations beyond technological advancement.

PO9-Self-directed and Life-long learning:

CO1- Developing problem-solving ability is crucial for fostering a mindset of continuous learning, aligning strongly with the goal of self-directed and life-long learning.

CO2- Staying updated with the state-of-the-art technology and development requires ongoing learning, making it strongly related to the objective of self-directed and life-long learning.

CO3- While soft skills contribute to lifelong learning, the direct relationship to self-directed learning is moderate, as it involves a broader scope beyond interpersonal skills.

CO4- Knowledge of self-employability has limited direct relevance to self-directed and life-long learning, resulting in a partial relationship with the overarching goal.

CO6- The inclusion of advanced PCB design in the design suite requires continuous learning, moderately linking with the objective of self-directed and life-long learning.

CO7- Utilizing TINA Design Suite for real-time testing aligns strongly with the need for ongoing learning in the field of circuit analysis and design, supporting the objective of self-directed and life-long learning.