Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Structure and Curriculum of

Under Graduate Programme (II Year) of Electronics

B.Sc. in Electronics

Approved by

Board of Studies

in

Electronics

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

[UG II Year]

w.e.f. June, 2024

(In accordance with NEP-2020)

Review Statement

The NEP Cell reviewed the Curriculum of **B.Sc. (Honors/Research) in Electronics** Programme to be effective from the **Academic Year 2024-25.** It was found that, the structure is as per the NEP-2020 guidelines of Govt. of Maharashtra.

Date: 12/03/2024

Place: Latur

NEP Cell
Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

CERTIFICATE

I hereby certify that the documents attached are the Bonafide copies of the Curriculum of **B.Sc. (Honors/Research) in Electronics** Programme to be effective from the **Academic Year 2024-25.**

Date: 12/03/2024

Place: Latur

(Dr A. A. Yadav)
Chairperson
Board of Studies in Electronics
Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

From the Desk of the Chairperson…

"Creativity is intelligence having fun" – Albert Einstein

I welcome you all. We have immense pleasure to share that our department is one of the star departments with the state-of-the-art facilities and has highly qualified and dignified faculty. The department addresses the critical challenges to face the society, industry and the academia. I take great pride in sharing that from the academic year 2023-24, development of our Electronics curriculum is with the objectives and guidelines as per the National Education Policy 2020. National Education Policy 2020 is a comprehensive framework for education in India that aims to transform the existing education system. The NEP 2020 emphasizes a holistic and multidisciplinary approach to education, focusing on the overall development of students.

Our curriculum as per NEP 2020 reflects: A balanced mix of theoretical concepts, practical applications, and problem-solving skills. Incorporate interdisciplinary connections and encourage the integration of Electronics with other subjects where appropriate. Inclusion of emerging topics and advancements in Physics, such as Quantum mechanics, Astrophysics, Nuclear Physics, Renewable Energy, etc. Design learning outcomes that emphasize conceptual understanding, critical thinking, analytical skills, and practical applications. Encourage project-based learning, hands-on experiments, and inquiry-based activities to foster active student engagement and exploration. Explore the integration of technology tools and resources. Promotes inclusivity, gender sensitivity, and addresses the needs of students with diverse backgrounds and abilities.

Our department organizes workshops, training programs, and seminars to update physics teachers about the revised curriculum, instructional strategies, and assessment methods. Encourage teachers to engage in professional development activities, research, and collaboration to enhance their pedagogical skills. Provide support and resources for teachers to integrate technology effectively into their teaching practices.

Our assessment methods are innovative, such as project portfolios, oral presentations, demonstrations, and performance-based assessments in addition to traditional written exams. Facilitate collaborations with research institutions, industries, and organizations to provide students with real-world exposure and opportunities for internships or mentor-ship programs.

Let me take the opportunity to thank and wish you all a great success.

(Dr A.A. Yadav)
Chairperson
Board of Studies in Electronics

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Physics and Electronics

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Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science and Technology

Structure for Three Year Multidisciplinary Undergraduate Degree Programme in Electronics Multiple Entry and Exit (In accordance with NEP-2020)

Year & Level	Sem	Major		Minor	GE/ OE	VSC/ SEC (VSEC)	AEC/ VEC	OJT, FP, CEP, RP	Credit per Sem.	Cum./ Cr. per exit
		DSC	DSE							
1	**2**	**3**		**4**	**5**	**6**	**7**	**8**	**9**	**10**
II 5.0	III	DSC V: 04 Cr. DSC VI: 04 Cr.	NA	Minor I: 04 Cr.	GE-III: 02 Cr.	SEC-III: 02 Cr.	AEC-III Eng. : 02 Cr.	CC-I: 02 Cr. (SSC) Field Project: 02 Cr.	22	88 Cr. UG Diploma
	IV	DSC VII: 04 Cr. DSC VIII: 04 Cr.	NA	Minor II: 04 Cr.	GE-IV: 02 Cr.	SEC-IV: 02 Cr.	AEC-IV Eng. : 02 Cr.	CC-II: 02 Cr. (SSC) Field Project: 02 Cr.	22	
	Cum. Cr.	16	-	08	04	04	04	08	44	
Exit Option: Award of UG Diploma in Major with 88 Credits and Additional 04 Credits Core NSQF Course/Internship or continue with Major and Minor										

Note:

A) Co-Curricular Courses (CC) includes –

1. Health and Wellness
2. Yoga education
3. Sports and fitness
4. Cultural activities
5. NSS
6. NCC
7. Fine Applied Visual Performing Arts
8. Study Tour
9. Publication of articles in newspaper / magazine.

B) Field Project concerned with Major

Abbreviations:

1. DSC : Discipline Specific Core (Major)
2. DSE : Discipline Specific Elective (Major)
3. DSM : Discipline Specific Minor
4. OE : Open Elective
5. VSEC : Vocational Skill and Skill Enhancement Course
6. VSC : Vocational Skill Courses
7. SEC : Skill Enhancement Course
8. AEC : Ability Enhancement Course
9. MIL : Modern Indian Languages
10. IKS : Indian Knowledge System
11. VEC : Value Education Courses
12. OJT : On Job Training
13. FP : Field Projects
14. CEP : Fostering Social Responsibility & Community Engagement (FSRCE)
15. CC : Co-Curricular Courses
16. RP : Research Project/Dissertation
17. SES : Shahu Extension Services

Shiv Chhatrapati Shikshan Sanstha's

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Faculty of Science and Technology

Department of Physics and Electronics

B.Sc. Degree in Electronics

Year & Level	Semester	Course Code	Course Title	Credits	No. of Hrs.
I 4.5	I	201ELE3101 (DSC-V)	Oscillators, Multivibrators and Sweep Circuits	03	45
		201ELE3103	Lab Course-V	01	30
		201ELE3102 (DSC-VI)	Power Electronic Devices	03	45
		201ELE3104	Lab Course-VI	01	30
		(Minor-I)	From Basket	04	60
		OE-III	From Basket	04	60
		(SEC-III)	From Basket	02	45
		(AEC-III)	From Basket	02	30
		CC	CC-II	02	30
		AIPC/OJT-I	Field Project	02	60
	Total Credits			**22**	
	II	201ELE4101 (DSC-VII)	Fundamentals of Digital Electronics	03	45
		201ELE4103	Lab Course-VII	01	30
		201ELE4102 (DSC-VIII)	Power Electronic Device Applications and Microprocessors	03	45
		201ELE4104	Lab Course-VIII	01	30
		(Minor-II)	From Basket	04	60
		OE-II	From Basket	04	60
		(SEC-IV)	From Basket	02	45
		(AEC-IV)	From Basket	02	30
		CC	CC - III	02	30
		AIPC/OJT-III	CEP-I	02	30
	Total Credits			**22**	
Total Credits (Semester I & II)				**44**	

Programme Outcomes (POs) for B.Sc. Programme	
PO1	**Disciplinary Knowledge** Comprehensive knowledge of science subjects which constitute the graduate programme and execution of scientific knowledge in the specific area.
PO2	**Scientific Outlook** The qualities of a science graduate such as observation, precision, analytical mind, logical thinking, clarity of thought and expression and systematic approach.
PO3	**Self-Directed Life-long Learning** Ability to appear for various competitive examinations or choose the post graduate programme or other related programme of their choice.
PO4	**Research Skills** Functional knowledge and applications of instrumentation and laboratory techniques to do independent experiments, interpret the results and develop research ethos.
PO5	**Problem Solving Skills** Analytical and logical skills and critical thinking to extract information from qualitative and quantitative data, formulate and solve problems in a systematic and rational manner.
PO6	**Professional Competence and Ethics** Aptitude and skills to perform the jobs in diverse fields such as science, engineering, industries, survey , education, banking, development and planning, business, public service, self-business etc. with human rationale and moral values.

Programme Specific Outcomes (PSOs) for B.Sc. Electronics (Degree)	
PSO No.	Upon completion of this programme the students will be able to
PSO1	Build and test and debug oscillators using real word problems.
PSO2	Utilize circuit simulation software and lab equipment (e.g., CRO, signal generator, breadboard testing) to implement and verify the performance of oscillator and sweep circuits.
PSO3	Learn various concepts which help them in understanding the construction and working of electronic equipments.
PSO4	Develop problem solving skills and learn various concepts which help in developing logical tools and models used to solve various real-life problems.
PSO5	Analyze situations, search for truth and extract information, formulate and solve problems in a systematic and logical manner.
PSO6	Help formulate graduate attributes, qualification descriptors, program learning outcomes, and course learning outcomes that are expected to be demonstrated by the holders of qualification.
PSO7	Maintain national standards and international comparability of learning outcomes and academic standards to ensure global competitiveness, and to facilitate student/graduate mobility.
PSO8	Provide higher education institutions an important point of reference for designing teaching-learning strategies, assessing student learning level, and periodic review of programme and academic research.
PSO9	Attain a sound level of basic Electronics and lay a secure foundation for research and higher studies.

Curriculum

Major and VSC Courses

Semester - III

Shiv Chhatrapati Shikshan Sanstha's

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Faculty of Science and Technology

Department of Physics and Electronics

Course Type: DSC-V

Course Title: Oscillators, Multivibrators and Sweep Circuits-V

Course Code: 201ELE3101

Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning objectives:

LO 1. To familiarize students about types of oscillators, LC, and RC such as Hartley, Colpitts, Phase shift and Wiens bridge, determination of frequency and condition for oscillations,

LO 2. To develop understanding about frequency stability and crystal oscillator,

LO 3. To inculcate the concept of Radio (High Frequency) and Audio (Low frequency) oscillators,

LO 4. To develop problem solving ability among the students on oscillators i.e. to calculate frequency of oscillations and calculation of values of L or C or R also condition for oscillations,

LO 5. To create awareness about Multivibrators for the generation of square waves (timing waves) various states in respective types of Multivibrators such as (Monostable, Bistable and Astable Multivibrators). Generation of square wave with the help of Schmitt trigger without regenerative feedback.

Course outcomes:

After completion of course, the students will be able to-

CO 1. Understand generation of signal having desired frequency, low frequency and high frequency oscillators and their uses in communication,

CO 2. Understand need of frequency stability of signals in various day-to-day application or use such as electronic communication, Lab equipment's etc.

CO 3. Use multivibrators in generation of timing signals used in timing circuits as a timer,

CO 4. Use sweep circuits or time base generators in TV, CRO, ECG.

Unit No.	Title of Unit & Contents	Hrs.
I	**L-C Oscillators**	**12**
	1. Introduction, 2. Classification of an Oscillator, 3. Requirement of an Oscillator, and Feedback (Barkhausen) Condition for Oscillators, 4. Hartley Oscillator: Working/Action, Derivation of Frequency and Condition for Oscillations. 5. Colpitts Oscillator: Working/Action, Derivation of Frequency and Condition for Oscillations	

Unit No.	Title of Unit & Contents	Hrs.
	6. Crystal Oscillator: Working/Action, Derivation of Frequency and Condition for Oscillations 7. Numerical Problems.	
	Unit Outcomes: UO1. Learn about the Hartley and Colpitts oscillator for production of sinusoidal waves, UO2. State the Barkhausen criterion of oscillation.	
II	**R-C Oscillators**	**10**
	1. Introduction, 2. Basic Principle of R-C Oscillators, 3. R-C Ladder Network and its Analysis, 4. Transistor Phase-Shift Oscillator: Working/Action, Derivation of Frequency and Condition for Oscillations, 5. Transistor Wien-Bridge Oscillator: Working/Action, Derivation of Frequency and Condition for Oscillations. 6. Numerical Problems.	
	Unit Outcomes: UO1. Learn about frequency stability. UO2. Learn about generation of signal having desired frequency.	
III	**Multivibrators**	**12**
	1. Introduction, 2. Switching Characteristics of Transistor, 3. Switch ON and Switch OFF Transitions, 4. Transistor Switching Time for Input and Output Pulses: Delay Time, Rise Time, Turn ON Time, Storage Time, Fall Time and Turn OFF Time, Pulse Width, 5. Multivibrators: Types of Multivibrators, 6. Transistor Binary (Bistable Multi or Flip Flop), Circuit Action Using Double Source, 7. Transistor Monostable Multivibrator: Circuit Action/Working, Expression for Gate Width, Wave Forms 8. Astable Multivibrator: Circuit Action/Working, Expression for period Gate Width and Frequency, Wave Forms, Schmitt's Trigger Using Transistor 9. Numerical Problems.	
	Unit Outcomes: UO1. Learn about switching characteristics of Transistors, UO2. Learn about types of Multivibrators, Schmitt's trigger using transistor.	
IV	**Sweep Circuits (Time Base or Ramp Generators)**	**11**
	1. Introduction 2. General Features of Time Base Signal,	

Unit No.	Title of Unit & Contents	Hrs.
	3. Types of Time Base Circuits, Exponential Sweep Circuits, Sweep Circuit Using Transistor Switch, UJT Sweep Circuits, 4. Current Time Base Generator. 5. Numerical Problems.	
	Unit Outcomes: UO1. Use sweep circuits or time base generators in TV, CRO, ECG. UO2. Learn about ramp generators and different types of sweep circuits.	

Learning Resources:

1. Introduction to Electronics -K.J.M. Rao Oxford and IBH Publishing, Pvt. Ltd. (5th Printing.)
2. Text Book of Applied Electronics- R.S. Sedha, S. Chand and Comp. Ltd. Reprint 2012
3. Principle of Electronics- V. K. Mehta and Rohit Mehta S- Chand and Comp. Ltd., Edition-2005
4. Basic Electronics Solid State B.L. Theraja- S. Chand and Comp. Ltd.
5. Solid State Pulse Circuits -David A. Bell, PHI Ltd. 4th Edition
6. Pulse, Digital and Switching Wave Forms – Millman and Taub McGraw Hill Ltd.
7. Basic Electronics – Dr. J.P. Agrawal and Amit Agrawal, Pragati Prakashan Edition 2010
8. Principles of Electronics – A P Malvino (For Opto-Coupler).
9. Theory of Oscillators – A.A. Andronov, A.A. Vitt, Adiwes International Series in Physics.
10. Oscillations Theory – Kurt Kreith, Springer.

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Faculty of Science and Technology

Department of Physics and Electronics

Course Type: Laboratory Course-V

Course Title: Lab Course–V

Course Code: 201ELE3103

Credits: 01 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objectives:

LO 1. To design and built the circuits of Hartley, Colpitts, Phase shift and Wien-bridge oscillators and determine the frequency of oscillation in each case.

LO 2. To design and built the Multivibrators and calculate pulse width, space width, period and hence frequency of the generated pulse.

LO 3. To design and built the simple ramp generator and UJT ramp generator and hence study its waveforms also measure sweep voltage, sweep time, fall time, and output generated frequency,

LO 4. To design and built the Astable Multivibrator using IC 555 and study its waveforms and measure pulse width, space width, period and hence frequency,

LO 5. To understand the use of basic instruments such as: Voltmeter, Ammeter, Multimeters, Signal generator, CRO, etc.

Course Outcomes:

After completion of course, students will be able to-

CO 1. Analyze the working principles and frequency response of various oscillators such as Hartley, Colpitts, Crystal, and Wien Bridge oscillators.

CO 2. Study the operation of RC Phase Shift Oscillators and ramp generators using both transistor and UJT configurations.

CO 3. Design and investigate multivibrator circuits including astable and monostable configurations using transistors and IC-555.

CO 4. Demonstrate practical skills in constructing and testing analog waveform generation circuits and evaluating their performance.

List of Experiments:

Practical No.	Unit
1	Study of Hartley Oscillator
2	Study of Colpitts Oscillator
3	Study of Crystal Oscillator
4	Study of RC Phase Shift Oscillator
5	Study of Astable Multivibrator Using Transistor
6	Study of Monostable Multivibrator Using Transistor
7	Study of RC Ramp Generator
8	Study of UJT Ramp Generator

9	Study of Astable Multivibrator Using IC-555
10	Study of Wien Bridge Oscillator using Transistor

Learning Resources:

1. Introduction to Electronics -K.J.M. Rao Oxford and IBH Publishing, Pvt. Ltd. (5th Printing.)
2. Text Book of Applied Electronics- R.S. Sedha, S. Chand and Comp. Ltd. Reprint 2012
3. Principle of Electronics- V. K. Mehta and Rohit Mehta S- Chand and Comp. Ltd., Edition-2005
4. Basic Electronics Solid State B.L. Theraja- S. Chand and Comp. Ltd.
5. Solid State Pulse Circuits -David A. Bell, PHI Ltd. 4th Edition
6. Pulse, Digital and Switching Wave Forms – Millman and Taub McGraw Hill Ltd.
7. Basic Electronics – Dr. J.P. Agrawal and Amit Agrawal, Pragati Prakashan Edition 2010
8. Principles of Electronics – A P Malvino (For Opto-Coupler).
9. Theory of Oscillators – A.A. Andronov, A.A. Vitt, Adiwes International Series in Physics.
10. Oscillations Theory – Kurt Kreith, Springer.

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(Autonomous)

Faculty of Science and Technology

Department of Physics and Electronics

Course Type: DSC-VI

Course Title: Power Electronic Devices-VI

Course Code: 201ELE3102

Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1. To make familiar students about power electronic devices like DIAC, TRIAC, UJT, SCR, and LASCR etc.

LO 2. To develop understanding about power control of DC as well AC using phase control of thyristors,

LO 3. To equip the students with knowledge about the series and parallel combination of Thyristors to reach the practical requirements of lab-work,

LO 4. To develop the understanding about the full wave-controlled rectifiers, half wave-controlled rectifiers, Bridge controlled rectifiers with various types of loads.

Course Outcomes:

After completion of course, the students will be able to-

CO 1. Learn the different characteristics, Construction and working of DIAC, TRIAC, UJT, SCR, LASCR etc.,

CO 2. Know the power requirements of different voltage and current ratings using series and parallel combinations of thyristors.

CO 3. Explain the phase control of thyristors using different triggering methods like RC triggering, UJT triggering to reach different power requirements.

CO 4. Analyze photoelectric effects and related components, and solve numerical problems related to light-based electronic devices and their characteristics.

Unit No.	Title of Unit & Contents	Hrs.
I	**Thyristors**	**12**
	1. Introduction, 2. Thyristors Family, Principle of Operations of SCR, 3. Static Anode-Cathode Characteristics of SCR, Two Transistor Analogy of SCR, 4. Thyristor Construction: Planer Diffused, Alloy Diffused, Methods of Triggering a Thyristor, 5. Commutation of Thyristor. 6. DIAC Construction & Working 7. TRIAC Construction and Working, 8. UJT Construction & Working, 9. UJT Relaxation Oscillator.	

Unit No.	Title of Unit & Contents	Hrs.
	10. Numerical Problems.	
	Unit Outcomes: UO1. Learn the different characteristics, Construction and working of DIAC, TRIAC, UJT, SCR, LASCR etc., UO2. Describe the characteristics of power semiconductors devices and identity suitable switch choices for a given application.	
II	**Series & Parallel Operation of Thyristors**	**10**
	1. Introduction, 2. Series Operations of Thyristors, 3. Need for Equalizing Network: Unequal Distribution of Voltage, Difference in Reverse Recovery Characteristics, 4. Equalizing Network Design: Static and Dynamic Equalizing Network, 5. Triggering of Series Connected Thyristors, 6. Parallel Operation of Thyristors, 7. Methods for Ensuring Proper Current Sharing: Triggering of Thyristors in Parallel, String Efficiency, Derating, 8. Numerical Problems	
	Unit Outcomes: UO1. Be able to know the power requirements of different voltage and current ratings using series and parallel combinations of thyristors easily available in market. UO2. To know about string efficiency and derating.	
III	**Phase Controlled Rectifiers**	**12**
	1. Introduction, 2. Phase Control Of SCR; Firing by UJT, One UJT Fires Two SCR Alternately, 3. Phase Control by Pedestal & Ramp, SCR Phase Control by Temperature or Light, Phase Angle Control, 4. Single Phase Half Wave Controlled Rectifier (One Quadrant): With Resistive Load, With Inductive Load, Effect of Freewheeling Diode, 5. Single Phase Full Wave Controlled Rectifier (Two Quadrants): With Resistive Load, With Inductive Load, Effect of Freewheeling Diode, 6. Bridge Configurations: Fully Controlled Bridge Circuit with Inductive Load (R-L Load). 7. Numerical Problems	
	Unit Outcomes: UO1. Analyze single phase-controlled rectifiers. UO2. be able to explain the phase control of thyristors using different triggering methods like RC triggering, UJT triggering to reach different power requirements	
IV	**Photoelectric Devices**	**11**

Unit No.	Title of Unit & Contents	Hrs.
	1. Introduction, 2. Light Dependent Resistor (LDR), 3. Light Emitting Diode (LED), 4. Photodiodes, 5. Phototransistor, 6. Photovoltaic Cell, 7. Photoconductive Cell, 8. Photoelectric Emission, 9. Photoelectric Relay, 10. Opto- Coupler, 11. Numerical Problems.	
	Unit Outcomes: UO1. To know the factors affecting photoelectric emission. UO2. Able to perform and describe simple experiments to illustrate the photoelectric effect.	

Learning Resources:

1. Power Electronics – M. D. Singh and K.B. Kahanchandani, Tata McGraw Hill Publishing Company Ltd, 10th Reprint 2003
2. Industrial Electronics & Control - S. K. Bhattacharya, S. Chatterjee. TTTI Chandigarh., Tata McGraw Hill Publishing (7th Reprint 2002)
3. Electronics in Industry- George, M. Chute, Robert, D. Chute, 5th Edition McGraw Hill Book Company
4. Industrial and Power Electronics –G. K. Mittal, Dr Manisha Gupta, Khanna Publishers.
5. Power Electronics -P.C. Sen. Tata McGraw Hill Publishing Comp.
6. Principles of Electronics – A P Malvino (For Opto-Coupler).
7. Power Electronics – P.S. Bimbhra, Khanna publication
8. Power electronics-Dr. J.S. Chitode, Technical Publications
9. Power Electronics circuits, devices, and Applications- Muhammad H. Rashid, PEARSON, always learning.
10. Power Electronics (Essentials & Applications) L UMANAND- Wiley Publications.

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Faculty of Science and Technology

Department of Physics and Electronics

Course Type: Laboratory Course- VI

Course Title: Lab Course–VI

Course Code: 201ELE3104

Credits: 01 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objectives:

LO 1. To provide practical experience with power electronics components, focusing on understanding and implementing various triggering techniques for SCRs, building half-wave and full-wave controlled rectifiers, and designing a photo relay using an LDR and transistor

Course Outcomes:

After completion of course, students will be able to-

CO 1. Explain the characteristics of power electronic semiconductor devices such as UJT, SCR, DIAC, TRIAC.

CO 2. Discuss how SCR is fired with the help of UJT relaxation oscillators.

CO 3. Know the different types of triggering of SCR using resistor and RC circuits.

CO4. Discuss how rectification is achieved and how it can be controlled (phase and hence power).

Practical No.	Unit
1	UJT characteristics.
2	SCR characteristics.
3	DIAC characteristics.
4	TRIAC characteristics.
5	Resistance Triggering of SCR.
6	R-C Triggering of SCR.
7	Half Wave Controlled Rectifier.
8	Full Wave Controlled Rectifier.
9	Photo relay using LDR and transistor.

Learning Resources:

1. Power Electronics – M. D. Singh and K.B. Kahanchandani, Tata McGraw Hill Publishing Company Ltd, 10th Reprint 2003
2. Industrial Electronics & Control - S. K. Bhattacharya, S. Chatterjee. TTTI Chandigarh., Tata McGraw Hill Publishing (7th Reprint 2002)
3. Electronics in Industry- George, M. Chute, Robert, D. Chute, 5th Edition McGraw Hill Book Company

4. Industrial and Power Electronics –G. K. Mittal, Dr Manisha Gupta, Khanna Publishers.
5. Power Electronics -P.C. Sen. Tata McGraw Hill Publishing Comp.
6. Principles of Electronics – A P Malvino (For Opto-Coupler).
7. Power Electronics – P.S. Bimbhra, Khanna publication
8. Power electronics-Dr. J.S. Chitode, Technical Publications
9. Power Electronics circuits, devices, and Applications- Muhammad H. Rashid, PEARSON, always learning.
10. Power Electronics (Essentials & Applications) L UMANAND- Wiley Publications.

Semester - IV

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Faculty of Science and Technology

Department of Physics and Electronics

Course Type: DSC-VII

Course Title: Fundamentals of Digital Electronics-VII

Course Code: 201ELE4101

Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1. To acquire the basic knowledge of digital logic levels and application of this to understand digital electronic circuits.

LO 2. To prepare students to perform the analysis and design of various digital electronic circuits.

LO 3. To demonstrate the concept of number system, reduction of logic expressions using K-map and Boolean's algebra.

Course Outcomes:

After completion of course, students will be able to-

CO 1. Represent numerical values using various binary codes and perform conversions between number systems.

CO 2. Understand and apply basic logic gates, Boolean algebra, and simplification techniques like Karnaugh maps in digital circuit design.

CO 3. Design, build, and troubleshoot basic digital circuits using logic ICs for various applications.

CO 4. Develop practical skills through hands-on experiments involving digital electronics concepts and components.

Unit No.	Title of Unit & Contents	Hrs.
I	**Binary Codes**	**10**
	1. Introduction, 2. Straight Binary Code, 3. Binary Coded Decimal (Natural BCD, 8421) and its Conversions, 4. Excess-3 Code and its Conversions, Gray Code, Binary to Gray Code Conversion and Vice Versa 5. Code Comparison, Error Detecting Parity Codes. 6. Condition for Maximum Efficiency, Auto Transformer 7. Alphanumeric (Alphanumeric) Code, 8-bit EBCDIC Code, ASCII Code.	
	Unit Outcomes: UO1. Able to perform binary to decimal conversion and vice versa. UO2. Be familiar with different types of binary codes.	
II	**Logic Gates**	**12**

Unit No.	Title of Unit & Contents	Hrs.
	1. Introduction 2. Basic Gates, AND Gate: Symbol, Truth Table, Diode and Transistor AND Gate Circuits 3. OR Gate: Symbol, Truth Table, Diode and Transistor OR Gate Circuits, Disadvantage of Diode OR Gates, Multi-Inputs (FAN-IN), 4. NOT Gate (Inverter): Symbol, Truth Table and Single, Transistor NOT Gate Circuit, Loading Effect (FAN-OUT) 5. Positive and Negative logic, NAND Gate: Symbol, Truth Table, NOR Gate: Symbol, Truth Table, 6. Bubble Gates: NAND and NOR as Universal Gates. 7. XOR and XNOR Gates: Symbols and Truth Table.	
	Unit Outcomes: UO1. Able to recognize basic, universal, and algebraic gates, UO2. Able to construct truth tables of gate.	
III	**Boolean Algebra**	**12**
	1. Introduction, 2. Basic Concept of Boolean Algebra, 3. Boolean Operations, Laws and Theorems of Boolean Algebra, Proof of Boolean Laws, 4. Demorgan's Theorems: Proof of Demorgan's Theorems, Physical Significance of Demorgan's Theorems, 5. Duality of Boolean Algebra, Evaluation (Solving) of Boolean Expressions, Sequence of Operations, 6. Synthesis of Boolean Expressions–SOP and POS Standard Products and Sums, Physical Significance of SOP and POS.	
	Unit Outcomes: UO1. State Boolean theorem and Demorgan's theorem to solve Boolean expressions. UO2. Understands the concepts of SOP and POS.	
IV	**Simplification of Boolean Expressions**	**11**
	1. Introduction 2. Simplification by Algebraic Method, 3. Simplification by Karnaugh Map: 2- Variable, 3- Variable, 4- Variable K-Maps, 4. Karnaugh Map to Obtain Simplification SOP and POS Solutions, Don't Care Conditions. 5. Implementation of Boolean Expressions, NAND and NOR Implementation.	
	Unit Outcomes: UO1. Able to solve K-map. UO2. Able to simplify Boolean expressions.	

Learning Resources:

1. Digital Principles and Circuits- Dr. C.B. Agarwal. (Himalaya Publishing House)
2. Digital Principles and Applications- Donald P. Leach, A.P. Malvino and Goutam (Tata McGraw Hill Education Pvt. Ltd. Saha)
3. Digital Electronics – William H. Goutman (Prentice- Hall of India)
4. Digital Electronics with Practical Approach- Dr. G.N. Shinde (Shivani Publications, Nanded)
5. Digital Fundamentals – Floyd and Jain (Pearson Edition)
6. Modern Digital Electronics- R.P. Jain (Tata McGraw Hill Education Pvt Ltd)
7. Digital Fundamentals by Morris and Mano, PHI Publication
8. Fundamental of digital circuits by A. ANANDKUMAR, PHI Publication
9. Digital Fundamentals by FLOYD & JAIN, Pearsons Pub
10. Fundamentals of Logic Design by Charles H. Roth Thomson

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science and Technology

Department of Physics and Electronics

Course Type: Laboratory Course- VII

Course Title: Lab Course–VII

Course Code: 201ELE4103

Credits: 01 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objectives:

LO 1. The laboratory course aims to equip you with hands-on experience in understanding and implementing various digital electronics concepts.

Course outcomes:

After completion of the course, students will be able to-

CO 1. Perform basic mathematical operation such as addition, multiplication, and complementation, also verified its truth table,

CO 2. Built and verify truth table basic gates obtained from universal gates (NAND and NOR),

CO 3. Built and verify truth tables of NAND and NOR gates,

CO 4. Built and verify X-OR and X-NOR gate,

Practical No.	Unit
1	Implementation of Boolean Expression Using K-Map
2	Study of X-OR gate using NAND gates
3	Study of X-NOR C gate using NAND gates.
4	Construction of Basic gates using transistor and its study
5	Construction of Basic gates using PN junction diode and its study
6	Conversion of binary to gray code
7	Conversion of Gray code to 8421 code
8	Verification of Demorgan's first theorem using IC74XX
9	Verification of Demorgan's second theorem using IC74XX

Learning Resources:

1. Digital Principles and Circuits- Dr. C.B. Agarwal. (Himalaya Publishing House)
2. Digital Principles and Applications- Donald P. Leach, A.P. Malvino and Goutam (TataMcGraw Hill Education Pvt. Ltd. Saha)
3. Digital Electronics – William H. Goutman (Prentice- Hall of India)
4. Digital Electronics with Practical Approach- Dr. G.N. Shinde (Shivani Publications, Nanded)
5. Digital Fundamentals – Floyd and Jain (Pearson Edition)

6. Modern Digital Electronics- R.P. Jain (Tata McGraw Hill Education Pvt Ltd)
7. Digital Fundamentals by Morris and Mano, PHI Publication
8. Fundamental of digital circuits by A. ANANDKUMAR, PHI Publication
9. Digital Fundamentals by FLOYD & JAIN, Pearsons Pub
10. Fundamentals of Logic Design by Charles H. Roth Thomson

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science and Technology

Department of Physics and Electronics

Course Type: DSC-VIII

Course Title: Power Electronic Device Applications and Microprocessors-VIII

Course Code: 201ELE4102

Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1. To know the phase control for regulating temperature illumination control, light activated turn off, using DIAC and TRIAC off at dark water level indicator, battery charger automatic street lighting, SCR alarms, Timer circuits using thyristors,

LO 2. To know the construction and working of inverters, choppers, and voltage commutation process,

Course Outcomes:

After completion of the course, students will be able to-

CO 1. Apply thyristors to temperature control, illumination control, light activated turn-Off at dark water level indicator, battery charger, SCR alarms, Timers etc.,

CO 2. Explain resistance welding control and its applications,

CO 3. Discuss different types of choppers and inverters.

CO 4. Know the architecture of 8085 and Write programs over 8085 microprocessors.

Unit No.	Title of Unit & Contents	Hrs.
I	**Thyristor Control Circuits**	**11**
	1. Introduction, 2. Temperature Control: Phase Control Circuit for Regulating 3. Temperature, Remote Temperature Controller, 4. Illumination Control: Illumination Control Using SCR, DIAC and TRAIC, 5. Light Activated Turn OFF Circuit Using DIAC, TRIAC, & LDR, 6. Light Activated Turn OFF at Dark, Automatic Street Light Circuit Using SCR and LDR, 7. Automatic Water Level Indictor Using SCR, Light Operated SCR Alarm, 8. SCR-UJT operated Timer Circuit,	
	Unit Outcome: UO1. Understand the working principles and applications of SCR, DIAC, TRIAC, UJT, and LDR in temperature, illumination, and automation control circuits.	

	UO2. Design and analyze electronic control systems such as automatic street lights, water level indicators, and timer circuits using power electronic components.	
II	**Inverters and Choppers**	**11**
	1. Introduction, 2. Working Principle of Inverter, 3. Thyristor Inverter: Series Inverters and Parallel Inverters, Current Commutation Process, Voltage Commutation Process 4. Choppers: D.C. Chopper, Single Thyristor Chopper and Two Thyristor Chopper, Step Up Chopper, AC Choppers, Morgan Chopper Circuit, 5. Numerical Problems.	
	Unit Outcomes: UO1. Prepare students to design & analyze different power converter circuits. UO2. Know working of home inverter unit.	
III	**High Frequency Heating**	**11**
	1. Introduction, 2. Induction Heating: Eddy Current Heating, Merits of Induction Heating, Applications of Induction Heating, High Frequency Power Sources for Induction Heating, 3. Dielectric Properties of Few Typical Materials, Electrodes Used in Dielectric Heating, 4. Methods of Coupling of Electrodes to RF Generator, 5. Applications of Dielectric Heating: Preheating of Plastic Preformed, Wood Gluing, Food Processing and Electronic Sewing.	
	Unit Outcomes: UO1. Know the industrial applications of different types of heating methods. UO2. Compare the Induction and dielectric heating.	
IV	**Introduction to 8085 Microprocessors**	**12**
	1. CPU Architecture 2. Register Organization, 8085 Instruction Set 3. Addressing modes. Stack &Subroutines, Instruction Cycle, Interrupts of 8085 4. Memory interfacing, I/O interfacing 5. Memory mapped I/O; I/O mapped I/O 6. Peripheral Interfacing – Programmable I/O-8255 Interface 7. DC – 0809, DAC – 0808, Seven segment LED, 4 x 4 Matrix Keyboard, stepper motor.	
	Unit Outcomes: UO1. Know the architecture of 8085. UO2. Write programs over 8085 microprocessors.	

Learning Resources:

1. Industrial Electronics and Control - S. K. Bhattacharya, S. Chatterjee, TTTI Chandigarh. TATA.
2. Electronics in Industry- George, M. Chute, Robert, D. Chute, 5th Edition McGraw Hill Publishing Company
3. Power Electronics -P.C. Sen. TATA McGraw Hill Publishing Company
4. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar – Wiley Eastern Limited- IV Edition
5. Muhammad Ali Mazidi, "Microprocessors and Microcontrollers", Pearson, 2006.
6. Industrial & Power Electronics –G. K. Mittal, Dr Manisha Gupta, Khanna Publisher, 19th Edition.
7. Industrial and Power Electronics –G. K. Mittal, Dr Manisha Gupta, Khanna Publishers.
8. Power Electronics -P.C. Sen. Tata McGraw Hill Publishing Comp.
9. Principles of Electronics – A P Malvino (For Opto-Coupler).
10. Power Electronics – P.S. Bimbhra, Khanna publication

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science and Technology

Department of Physics and Electronics

Course Type: Laboratory Course- VIII

Course Title: Lab Course –VIII

Course Code: 201ELE3104

Credits: 01 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objectives:

LO 1. Students should draw and assemble the circuits of power electronics like illumination control, Light activated turn off, automatic water level indicator, inverter, chopper etc.

LO 2. Students should tabulate the observations, predict the results, and plot necessary graphs.

LO 3. To practice a program on 8085 simulator and hardware kit.

LO 4. To use the knowledge to interfacing of LED, LCD to 8085.

Course Outcomes:

After completion of course, students will be able to-

CO 1. Analyze and implement power electronic circuits such as illumination controllers, inverters, and choppers using SCR, DIAC, TRIAC, and LDR.

CO 2. Design and test automation circuits including automatic street lighting and water level indicators using semiconductor devices.

CO 3. Perform interfacing of stepper motors and LCD displays with microprocessors for control applications.

CO 4. Execute arithmetic and logical operations using 8085 microprocessor and apply it in embedded system applications.

Practical No.	Unit
1	Illumination Control Using DIAC and TRIAC
2	Light Activated Turn OFF Using DIAC, TRIAC & LDR
3	Automatic Water Level Indicator Using SCR
4	Series Inverter Using SCR and TRIAC
5	Automatic Street Light Circuit Using SCR and LDR
6	Study of Step Up/Down Chopper
7	Conversion of DC to AC Using Chopper
8	Interface Stepper motor using 8085.
9	Interfacing of LCD (2X16).
10	Arithmetic & Logical operations using 8085.

Learning Resources:

1. Industrial Electronics and Control - S. K. Bhattacharya, S. Chatterjee, TTTI Chandigarh. TATA.
2. Electronics in Industry- George, M. Chute, Robert, D. Chute, 5th Edition McGraw Hill Publishing Company
3. Power Electronics -P.C. Sen. TATA McGraw Hill Publishing Company
4. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar – Wiley Eastern Limited- IV Edition
5. Muhammad Ali Mazidi, "Microprocessors and Microcontrollers", Pearson, 2006.
6. Industrial & Power Electronics –G. K. Mittal, Dr Manisha Gupta, Khanna Publisher, 19th Edition.
7. Industrial and Power Electronics –G. K. Mittal, Dr Manisha Gupta, Khanna Publishers.
8. Power Electronics -P.C. Sen. Tata McGraw Hill Publishing Comp.
9. Principles of Electronics – A P Malvino (For Opto-Coupler).
10. Power Electronics – P.S. Bimbhra, Khanna publication

Minor course offered by the Department

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science & Technology

Department of Physics and Electronics

Course Type: Minor-I
Course Title: Principles of Electronics
Course Code: 201ELE3301
Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1. To impart knowledge of basic concepts in Electronics.

LO 2. To provide the knowledge and methodology necessary for building electronics circuits.

LO 3. To introduce to basic electronics laws.

LO 4. To introduce to basic semiconductor devices and its applications.

Course Outcomes:

After completion of course, the students will be able to-

CO 1. Develop a comprehensive understanding of resistive circuits, including series circuits, their characteristics, and the application of Ohm's Law,

CO 2. Develop a thorough understanding of fundamental electrical laws, including Ohm's Law, Kirchhoff's Current Law (KCL), and Kirchhoff's Voltage Law (KVL),

CO 3. Develop a comprehensive understanding of semiconductor materials, including intrinsic and extrinsic semiconductors,

CO 4. Develop a comprehensive understanding of the block diagram of a power supply,

Unit No.	Title of Unit & Contents	Hrs.
I	**Basic Circuit Concepts**	**11**
	1. Resistive circuits: Series circuit, characteristics of series circuit, 2. Series aiding and series opposing voltages, 3. Series voltage divider, 4. Opens and shorts in series circuit 5. Parallel circuit, laws of parallel circuit, 6. Opens and shorts in parallel circuit. 7. Inductors: Inductance in series and parallel, 8. Capacitors: Principles of capacitance, capacitors in series and parallel 9. Numerical Problems	
	Unit Outcomes: UO1. Gain proficiency in analyzing series and parallel circuits, and the voltage division principle in parallel circuits,	

Unit No.	Title of Unit & Contents	Hrs.
	UO2. Acquire knowledge and skills in understanding the behavior of inductors and capacitors in series and parallel configurations,	
II	**Network Theorems**	**11**
	1. Ohm's law, Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL) 2. Determination of algebraic sign, 3. Ideal constant-voltage source, ideal constant-current source, 4. Superposition theorem, 5. Thevenin theorem, 6. Norton theorem, 7. Maximum Power Transfer Theorem, 8. Numerical Problems	
	Unit Outcomes: UO1. Acquire proficiency in determining algebraic signs in circuit analysis, distinguishing between ideal constant-voltage sources and ideal constant-current sources, UO2. Gain competency in applying circuit analysis theorems such as the Superposition Theorem, Thevenin's Theorem, and Norton's Theorem	
III	**Semiconductor Devices**	**12**
	1. Semiconductor, Intrinsic and Extrinsic Semiconductor, 2. P and N Type semiconductor 3. PN junction formation, Formation of depletion layer, 4. Junction or Barrier Voltage, 5. Effect of temperature on Barrier voltage 6. Forward and Reverse bias PN junction and its V-I characteristics 7. Construction, working and characteristics of Zener diode, 8. LED and photodiode 9. Numerical Problems	
	Unit Outcomes: UO1. Acquire proficiency in the formation of PN junctions, including the formation of depletion layers under forward and reverse bias conditions, and understanding the voltage-current (V-I) characteristics of PN junction diodes, UO2. Gain knowledge and skills in the construction, working principles, and characteristics of specialized semiconductor devices,	

Unit No.	Title of Unit & Contents	Hrs.
IV	**Rectifiers and Voltage Regulators**	**11**
	1. Block diagram of a power supply 2. Half wave rectifier, Output frequency of Half wave rectifier, Efficiency of Half wave rectifier 3. Full wave rectifier, Centre Tap Full Wave rectifier, 4. Full Wave Bridge rectifier, Output frequency of Full wave rectifier, Efficiency of full wave rectifier 5. Shunt capacitor filter, voltage regulation, 6. Zener shunt regulator.	
	Unit Outcomes: UO1. Acquire proficiency in the principles and operation of half-wave, full-wave, and bridge rectifiers, including their circuit configurations, waveforms, and rectification efficiency, UO2. Gain knowledge and skills in the design and analysis of shunt capacitor filters for smoothing rectified AC voltage,	

Learning Resources:

1) Basic Electronics Solid State (Multicolor illustrative edition), by B. L. Theraja, S. Chand & Company Ltd, New Delhi
2) A Textbook of Electrical Technology, by B.L. Theraja, Vol.1, Nirja Construction & Development Company.
3) A Text book of Applied Electronics by R. S. Sedha, New reprint of Revised Edition 2013, S. Chand & Company Ltd, New Delhi
4) Principles of Electronics (Multicolour revised edition), by V.K. Mehta, Rohit Mehta, S. Chand & Company, Ram Nagar, New Delhi.
5) Basic Electronics (eighth edition), by Bernard Grob, Pub.: Glencoe Mc Graw Hill, Pub. Company.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science and Technology

Department of Physics and Electronics

Course Type: Minor Laboratory Course- I
Course Title: Minor Lab Course –I
Course Code: 201ELE3302
Credit: 01 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objectives:

LO 1. To handle and make use of simple equipment's in electricity for making error free measurements and to determine some unknown quantities

LO 2. To understand the use of basic Laws such as: Ohm's law, Kirchhoff's Law, etc.

LO 3. To verify some network theorems such as maximum power transfer Theorem.

Course Outcomes:

After completion of the course, students will be able to-

CO 1. Identify resistor values using color codes and verify them using a multimeter; determine equivalent resistance in series and parallel combinations.

CO 2. Apply and verify basic electrical circuit theorems, including Kirchhoff's laws and the maximum power transfer theorem.

CO 3. Analyze the characteristics and behavior of semiconductor devices such as PN junction diodes, photodiodes, and Zener diodes.

CO 4. Construct and study rectifier circuits and voltage regulation using diodes and IC voltage regulators (74XX and 79XX series).

List of Experiments:

Practical No.	Practical
1	Determination of values of given resistors by colour code and verification of them by multimeter.
2	Determination of total resistance in series and parallel combination of resistances.
3	Verification of Kirchhoff's laws
4	Verification of maximum power transfer theorem.
5	Study of PN junction diode Characteristics.
6	Study of Photodiode Characteristics.
7	Study of Half wave rectifier using diode.
8	Study of Full wave rectifier using diode.

9	Study of Zener shunt regulator.
10	Study of voltage regulation using IC 74xx and 79XX.

Learning Resources:

1) Basic Electronics Solid State (Multicolor illustrative edition), by B. L. Theraja, S. Chand & Company Ltd, New Delhi
2) A Textbook of Electrical Technology, by B.L. Theraja, Vol.1, Nirja Construction & Development Company.
3) A Text book of Applied Electronics by R. S. Sedha, New reprint of Revised Edition 2013, S. Chand & Company Ltd, New Delhi
4) Principles of Electronics (Multicolour revised edition), by V.K. Mehta, Rohit Mehta, S. Chand & Company, Ram Nagar, New Delhi.
5) Basic Electronics (eighth edition), by Bernard Grob, Pub.: Glencoe Mc Graw Hill, Pub. Company.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science & Technology

Department of Physics and Electronics

Course Type: Minor-II
Course Title: Basic Digital Electronics
Course Code: 201ELE4301
Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.

LO 2. To prepare students to perform the analysis and design of various digital electronic circuits.

Course Outcomes:

After completion of the course, the students will be able to-

CO 1. Understand the principles, symbols, and truth tables of basic logic gates and digital circuits.

CO 2. Apply Boolean algebra and De Morgan's theorems to analyze and design digital logic circuits.

CO 3. Simplify complex digital expressions and circuits using Karnaugh maps (K-maps) and Boolean rules.

CO 4. Interpret and differentiate between various types of digital logic circuits based on their structure and functionality.

Unit No.	Title of Unit & Contents	Hrs.
I	**Logic Gates**	**11**
	1. Introduction to analog signals and digital signals, 2. Positive and Negative logic, 3. Logic gates: definition, symbols, truth tables, 4. Boolean expressions, pulsed operation of NOT, OR, AND, NAND, NOR, EX-OR, EX-NOR gates	
	Unit Outcomes: UO1. Develop a comprehensive understanding of analog signals and digital signals, UO2. Acquire proficiency in positive and negative logic representations in digital systems,	
II	**Number System and Codes**	**11**
	1. Introduction to Decimal, binary, octal, hexadecimal number systems,	

Unit No.	Title of Unit & Contents	Hrs.
	2. Conversion of numbers from one number system to another including decimal / binary points, 3. Binary addition, subtraction, multiplication, division, 4. 1's and 2's complement method of subtraction BCD code numbers and their limitations, 5. Gray code, 6. ASCII code	
	Unit Outcomes: UO1. Develop a comprehensive understanding of various number systems, UO2. Gain knowledge and skills in performing arithmetic operations in the binary number system,	
III	**Boolean Algebra**	**12**
	1. Rules and laws of Boolean algebra, 2. Logic expression, 3. De Morgan's theorems, their proof, 4. Sum of products form (min. terms), 5. Product of sum form (max. terms), 6. Simplification of Boolean expressions using Boolean algebra and Karnaugh Map up to 4 variables.	
	Unit Outcomes: UO1. Develop a thorough understanding of the rules and laws of Boolean algebra, UO2. Gain knowledge and skills in De Morgan's theorems, including their proofs and applications,	
IV	**Arithmetic and Logical Circuits**	**11**
	1. Half adder, 2. Full adder circuit and its operation, 3. Parallel binary adder, 4. Half Subtractor, 5. Full Subtractor	
	Unit Outcomes: UO1. Develop a comprehensive understanding of half adder circuits, UO2. Develop competency in designing and analyzing half subtractor circuits,	

Learning Resources:

1) Modern Digital Electronics: Jain R.P., Tata McGraw Hill
2) Digital Electronics with Practical Approach - G. N. Shinde, Shivani Pub., Nanded
3) Digital Computer Electronics, Malvino
4) Digital System Design, Morris Mano, Pearson Education (2014)
5) Fundamentals of Logic Design, Charles H. Roth, Jr. and Larry L. Kinney
6) Digital Principals, Schaum's outline series, Tata McGraw Hill (2006)
7) Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education
8) Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science and Technology

Department of Physics and Electronics

Course Type: Minor Laboratory Course-II
Course Title: Minor Lab Course–II
Course Code: 201ELE4302
Credits: 01 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objective:

LO 1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.

LO 2. To prepare students to perform the analysis and design of various digital electronic circuits.

Course Outcomes:

After completion of course, students will be able to-

CO 1. Develop an understanding of basic logic gates such as AND, OR, NOT, NAND, NOR, XOR, and XNOR.

CO 2. Understand the principles and algorithms for converting binary numbers to Gray code and vice versa.

CO 3. Design and implement logic circuits to verify the validity of De Morgan's theorems.

CO 4. Explore the universal property of the NAND gate.

List of Experiments:

Practical No.	Experiment
1	Study of logic gates
2	Study of Binary to gray code and gray to binary code conversion
3	Verification of De-Morgan's Theorems
4	Interconversion of logic gates using NAND gate
5	Interconversion of logic gates using NOR gate
6	Study of Half adder and full adder
7	Study of Half Subtractor and full subtractor
8	Study of multiplexer and demultiplexer
9	Simplification of Boolean expressions using Boolean algebra and Karnaugh map and its implementation using logic gates
10	Study of 4-bit Parallel Adder
11	Study of BCD to seven segment decoders

Learning Resources:

1) Modern Digital Electronics: Jain R.P., Tata McGraw Hill
2) Digital Electronics with Practical Approach - G. N. Shinde, Shivani Pub., Nanded
3) Digital Computer Electronics, Malvino
4) Digital System Design, Morris Mano, Pearson Education (2014)
5) Fundamentals of Logic Design, Charles H. Roth, Jr. and Larry L. Kinney
6) Digital Principals, Schaum's outline series, Tata McGraw Hill (2006)
7) Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education
8) Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.

Open Elective Courses Offered by the Department

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science & Technology

Department of Physics and Electronics

Course Type: OE-III

Course Title: Electronic components

Course Code: 201ELE3401

Credits: 02 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objectives:

LO 1. To impart basic knowledge of electronic components to the students from other faculty.

LO 2. To familiarize students with the concepts of active and passive components and terminology in electronics.

LO 3. To help the students to understand the role of components in simple electronic circuits.

Course Outcomes:

After completion of course, the student will be able to-

CO 1. Understand the significance and application of electronic components in various aspects of daily life, elucidating their role in modern technology and innovation.

CO 2. Demonstrate comprehensive knowledge of resistors, including the ability to identify different types, interpret color coding schemes, and calculate resistance values, while elucidating their significance in electronic systems and applications.

CO 3. Explore and analyze the operational modes of transistors, including cutoff, saturation, and active region operation, facilitating a deeper understanding of transistor behavior and its implications in circuit design and functionality.

CO 4. Develop a comprehensive understanding of integrated circuits (ICs)

Unit No.	Title of Unit & Contents	Hrs.
I	**Introduction to Electronic Components**	**08**
	1. Overview the use of electronics components and their importance in everyday life. 2. Concepts of active and passive components and terminology in electronics 3. Introduction to common electronic components: resistors, capacitors, inductor, diodes, and transistors 4. Understanding the role of components in simple electronic circuits	
	Unit Outcomes: UO1. Distinguish between active and passive electronic components,	

	demonstrating comprehension of fundamental terminologies essential in electronics engineering and design. UO2. Identify and describe the characteristics, functions, and applications of essential electronic components, including resistors, capacitors, inductors, diodes, and transistors, highlighting their individual contributions to electronic systems.	
II	**Resistors, Inductors and Capacitors**	**09**
	1. Detailed exploration of resistors: types, color coding, resistance values, and applications. 2. Understanding the behavior of resistors in circuits: Ohm's law, series, and parallel connection 3. Introduction to inductor, types and values and applications of inductor 4. Introduction to capacitors: types, capacitance values, and applications	
	Unit Outcomes: UO1. Understand the principles governing inductors, including their various types, characteristics, and values, and discern their applications across different domains of electronics engineering. UO2. Gain proficiency in the understanding of capacitors, encompassing identification of types, interpretation of capacitance values, and exploration of diverse applications, enabling effective integration into electronic circuit design and implementation.	
III	**Diodes and Transistors**	**07**
	1. Study of diodes: types (semiconductor diode, light-emitting diodes), characteristics, and applications 2. Understanding diode behavior: forward bias, reverse bias, and rectification 3. Introduction to transistors: types (e.g., bipolar junction transistors, field-effect transistors), configurations, and applications 4. Exploring transistor operation modes: cutoff, saturation, and active region	
	Unit Outcomes: UO1. Gain comprehensive knowledge of diodes, encompassing various types such as semiconductor diodes and light-emitting diodes (LEDs), understanding their characteristics and applications in electronic circuits. UO2. Develop proficiency in understanding transistors, including their different types (e.g., bipolar junction transistors, field-effect transistors), configurations, and applications across different electronic devices and systems.	
IV	**Integrated Circuits**	**06**
	1. Overview of integrated circuits (ICs): types (e.g., logic gates, OP AMP), functionality, and applications, 2. Introduction to IC packaging and pin configurations	
	Unit Outcomes:	

	UO1. Develop a comprehensive understanding of integrated circuits (ICs) UO2. Gain proficiency in identifying different types of IC packaging and interpreting pin configurations	

Learning Resources:

1) Electronics Circuit Design: S. N. Talbar & Dr. T. R. Sontake
2) Basic Electronics (Eight Edition) by Bernard Grob: Glance Mc Graw Hill, Pub. Company.
3) Principal of Electronics (Multicolor revised edition) by V. K. Mehta, Rohit Mehta, S. Chand Pub.
4) Op-Amp and Linear Integrated Circuits by Ramakant Gaikwad, Prentice Hall of India Pvt Ltd
5) Handbook of Electronics by Gupta, Kumar, 44thEdn, 2017, Pragati Prakashan, Meerut.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science & Technology

Department of Physics and Electronics

Course Type: OE-IV

Course Title: Electronics for Everyone

Course Code: 201ELE4401

Credits: 02 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objective:

LO 1. Inculcate the importance of safety and precautions to be taken by the students coming across electric and electronic devices.

Course Outcomes:

After completion of course, the student will be able to-

CO 1. Understand the critical importance of safety in industrial environments and shop floors, including the recognition of potential hazards and the implementation of precautionary measures to ensure a safe working environment for oneself and others.

CO 2. Develop a comprehensive understanding of fundamental electrical terms, including the concepts of conductors and insulators,

CO 3. Develop proficiency in understanding secondary batteries, encompassing the types of charge and discharge processes, as well as maintenance practices.

CO 4. Demonstrate comprehensive knowledge of computer parts and their functions.

Unit No.	Title of Unit & Contents	Hrs.
I	**Basic Workshop Practice**	**08**
	1. Importance of safety and Precautions to be taken in the industry/shop floor 2. Personal Protective Equipment (PPE), First Aid, Fire extinguishers. 3. Basic hand tools	
	Unit Outcomes: UO1. Demonstrate knowledge of personal protective equipment (PPE). UO2. Acquire proficiency in the identification, handling, and safe use of basic hand tools commonly used in industrial and workshop settings.	
II	**Basics of AC and Electrical Cables**	**07**
	1. Electrical Terms, Conductor, and Insulator 2. Single Range Meters 3. Measuring Instrument Meters	
	Unit Outcomes: UO1. Gain proficiency in the operation and application of single-range meters for measuring basic electrical quantities. UO2. Acquire knowledge and skills in the operation and utilization of	

	measuring instrument meters.	
III	**Cells and Batteries**	**07**
	1. Power Sources 2. Cells and Batteries, The Cell: Primary and Secondary Cells, Dry and Wet Cells, Dry Cells, and Batteries, Weak, Dead Cell, 3. Secondary Batteries, 4. Lead-acid, wet type cells: Principle of chemical action, discharging of lead-acid cells, Charging of lead-acid cells, Construction of lead-acid batteries, Current rating of Lead acid batteries, Effect of temperature on AH capacity of Lead-acid batteries, 5. Hydrometer, Instrument for testing condition of cells - High rate discharge tester, Topping up of lead-acid battery cells, 6. Types of Charge, Discharge, and Maintenance.	
	Unit Outcomes: UO1. Gain comprehensive knowledge of cells and batteries, including their principles of operation, construction, and various types, UO2. Develop proficiency in understanding secondary batteries, encompassing the types of charge and discharge processes, as well as maintenance practices.	
IV	**Computer Hardware**	**08**
	1. Computer parts and their working, CMOS setup and install the windows OS, 2. Switch Mode Power Supply for PC, Hard Disk Drives, Different types of printers, 3. Computer networking, Network Cable Components, and Servers, 4. Wi-Fi Network.	
	Unit Outcomes: UO1. Gain proficiency in the principles and operation of switch mode power supplies for PCs, UO2. Develop competency in computer networking principles, including understanding network cable components and configurations	

Learning Resources:

1) Electronics Mechanics NSQF Level – 5 1st Year (Volume I of II) Trade Theory Sector: Electronics & Hardware.
2) Fundamentals of Electrical Engineering and Electronics by B.L. Theraja and A.K. Theraja.
3) Basic Electronics: Solid State by B.L. Theraja and S. Chand
4) Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky (Adapted by Suresh K. Sharma).
5) Integrated Electronics: Analog and Digital Circuits and Systems by Jacob Millman and Christos C. Halkias (Adapted by A.P. Godse and U.A. Bakshi)
6) Electronics Engineering" by U.A. Bakshi and A.P. Godse

Skill Enhancement Courses Offered by the Department

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science & Technology

Department of Physics and Electronics

Course Type: SEC-III

Course Title: Internet of Things (IoT)

Course Code: 201ELE3601

Credits: 02 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objectives:

LO 1. The foundational understanding of Arduino programming, including syntax, control structures, and functions, enabling students to write and debug simple programs for Arduino microcontrollers.

Course Outcomes:

After completion of course, the student will be able to-

CO 1. Describe the operation principles IoT

CO 2. Familiarize with Applications of IoT

CO 3. Design an Application of IoT in the daily life

CO 4. Demonstrate competency in addressing interoperability challenges in IoT ecosystems

Unit No.	Title of Unit & Contents	Hrs.
I	**Introduction to IoT**	**08**
	1. Introduction to IoT: Sensing, Actuation, 2. Basics of Networking: Communication Protocols, 3. Sensor Networks, Sensor Networks, 4. Machine-to-Machine Communications, 5. Interoperability in IoT,	
	Unit Outcomes: UO1. Develop a comprehensive understanding of the Internet of Things (IoT) UO2. Gain proficiency in the basics of networking relevant to IoT	
II	**Introduction to Arduino Programming**	**07**
	1. Introduction to Arduino Programming 2. Integration of Sensors and Actuators with Arduino 3. Introduction to Python programming, 4. Introduction to Raspberry Pi, 5. Implementation of IoT with Raspberry Pi,	
	Unit Outcomes: UO1. Acquire proficiency in integrating sensors and actuators with Arduino boards, including understanding sensor interfacing techniques, UO2. Understand the basics of Raspberry Pi, including its hardware components, operating system, and programming environment,	

III	Practical	15
	1. Understanding Arduino UNO Board and Components 2. Installing and work with Arduino IDE 3. Working with Adafruit Libraries in Arduino 4. Blinking LED sketch with Arduino 5. Simulation of 4-Way Traffic Light with Arduino 6. LED Fade Sketch and Button Sketch 7. Spinning a DC Motor and Motor Speed Control Sketch 8. To interface Digital sensor (LDR) with Arduino and Write a program for detection of sensor. 9. To interface a Bluetooth with Arduino and Write a program to send sensor data to smartphone using Bluetooth. 10. Write a program on Arduino to retrieve temperature and humidity data to think peaks cloud.	

Learning Resources:

1) The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2) Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN: 978-1-84821-140-7, Wiley Publications
3) Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", Wiley Publications
4) Vijay Madisetti and Arshdeep Bahga, — "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014.
5) J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016. Design and Test", Application Note, 2016.
6) Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
7) Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
8) https://onlinecourses.nptel.ac.in/noc17_cs22/course
9) http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science & Technology

Department of Physics and Electronics

Course Type: SEC-IV
Course Title: PCB Designing
Course Code: 201ELE3602
Credits: 02 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objective:

LO 1. The course aims to understand development of Printed Circuit Boards for various electronic experiments.

Course Outcomes:

After completion of course, the students will be able to-

CO 1. Acquire the experimental skill about preparation of Printed circuit boards.
CO 2. Enhance the skills related to Soldering of electronic components on PCBs.
CO 3. Demonstrate skills in basic electronic workshop practices including drilling, soldering, and layout printing on copper-clad boards.
CO 4. Design, develop, and prepare printed circuit boards (PCBs) for rectifier circuits and logic gate configurations using standard fabrication techniques.

Unit No.	Title of Unit & Contents	Hrs.
I	**PCB Designing**	**07**
	1. Introduction to PCB: Evolution & Classification, 2. Manufacturing of PCB: Single sided and double sided, 3. Layout planning and design: Reading drawings and diagrams, 4. General PCB design considerations, Conductor patterns, 5. Component placement Rules.	
	Unit Outcomes: UO1. Develop proficiency in the manufacturing processes of PCBs, including single-sided and double-sided board fabrication techniques, UO2. Acquire skills in layout planning and design for PCBs, including the interpretation of technical drawings and diagrams,	
II	**Soldering Methods**	**08**
	1. What is soldering, theory of soldering, 2. Soldering variables, soldering material, Soldering and Brazing, 3. Soldering tools, other hand soldering tools, 4. Hand soldering: Requirements & steps, Health, and safety Aspects, 5. De-soldering techniques, Etching techniques: Immersion etching, drilling: drill bit geometry and its importance	
	Unit Outcomes: UO1. Understand the requirements and steps involved in hand soldering processes, including component preparation, solder application, and joint inspection,	

	UO2. Demonstrate competency in de-soldering techniques for component removal and rework, as well as understanding etching techniques such as immersion etching for PCB fabrication.	
III	**Practical**	**15**
	1. Drilling and Soldering Practice. 2. Layout printing on copper clad. 3. Designing of PCB through etching. 4. Preparing PCB for Half Wave Rectifier 5. Preparing PCB for Full wave Rectifier 6. Preparing PCB for Capacitor filter 7. Preparing PCB for Basic logic gates 8. Preparing PCB for NAND gate using 74XX 9. Preparing PCB for NOR gate using 74XX 10. Preparing PCB for Basic gates using NAND gate	

Learning Resources: -

1) Printed circuit boards: design, fabrication, assembly, and testing- R.S. Khandpur
2) Electronic Product Design- Er. S. D. Mehta, Volume I, S. Chand Publications.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science and Technology

Department of Physics and Electronics

UG Second Year (Semester III / IV)

Basket I: Open Elective (OE)

(GEs offered to the Science and Technology students in Sem.-III/IV)

Sr. No.	BoS Proposing OE	Course Title	Credits	Hrs.
1.	Commerce	Digital Marketing	2	30
2	Commerce	Introduction to Personal Taxation	2	30
3	Commerce	Fundamentals of Accounting	2	30
4	Hindi	Rojgar Abhimulak Hindi	2	30
5	English	English Proficiency Course	2	30
6	Geography	Fundamentals of GIS & RS	2	30

Note: Student can choose any one OE from the basket.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science and Technology

Department of Physics and Electronics

UG Second Year (Semester III / IV)

Basket II: Skill Enhancement Courses (SEC)

(SEC offered to the Commerce and Management students in Sem.-III/IV)

Sr. No.	BoS Proposing SEC	Course Title	Credits	Hrs.
1	Commerce	Financial Management	2	30
2	Analytical Chemistry	Skills In Chemistry	2	30
3	Commerce	Wealth Management	2	30
4	Biotechnology	Good Laboratory Practices	2	30
5	Biotechnology	Dairy Technology	2	30
6	Botany	Herbal Technology	2	30
7	Information technology	Software Development Techniques	2	30
8	Information technology	Information Security	2	30
9	Computer Science	Web Development using WordPress	2	30
10	Electronics	Internet of Things	2	30
11	English	English for Careers	2	30
12	Geography	Disaster Management	2	30
13	Commerce	Business Law	2	30
14	Microbiology	Production of Bio fertilizers	2	30
15	Physics	Applied Optics	2	30
16	Political Science	Political Journalism	2	30
17	Chemistry	Chemistry of Biomolecules	2	30
18	Mathematics	Essential Statistics for Data Science	2	30
19	Information Technology	Android Aap Development	2	30
20	English	English for Competitive Examinations	2	30

Note: Student can choose any one SEC from the basket.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science and Technology

Department of Physics and Electronics

UG Second Year

Basket III: Ability Enhancement Courses (AEC)

(AEC offered to the Science & Technology students in Sem.-III/IV)

Sr. No.	BoS Proposing AEC	Course Title	Credits	Hrs.
1.	English	English Communication	2	30
2.	English	English for Professionals	2	30

Note: Student can choose any one AEC from the basket.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Extra Credit Activities

Sr. No.	Course Title	Credits	Hours T/P
1	MOOCs	Min. of 02 credits	Min. of 30 Hrs.
2	Certificate Courses	Min. of 02 credits	Min. of 30 Hrs.
3	IIT Spoken English Courses	Min. of 02 credits	Min. of 30 Hrs.

Guidelines:

Extra -academic activities

1. All extra credits claimed under this heading will require sufficient academic input/ contribution from the students concerned.
2. Maximum 04 extra credits in each academic year will be allotted.
3. These extra academic activity credits will not be considered for calculation of SGPA/CGPA but will be indicated on the grade card.

Additional Credits for Online Courses:

1. Courses only from SWAYAM and NPTEL platform are eligible for claiming credits.
2. Students should get the consent from the concerned subject Teacher/Mentor/Vice Principal and Principal prior to starting of the course.
3. Students who complete such online courses for additional credits will be examined/verified by the concerned mentor/internal faculty member before awarding credits.
4. Credit allotted to the course by SWAYAM and NPTEL platform will be considered as it is.

Additional Credits for Other Academic Activities:

1. One credit for presentation and publication of paper in International/National/State level seminars/workshops.
2. One credit for measurable research work undertaken and field trips amounting to 30 hours of recorded work.
3. One credit for creating models in sponsored exhibitions/other exhibits, which are approved by the concerned department.
4. One credit for any voluntary social service/Nation building exercise which is in collaboration with the outreach center, equivalent to 30 hours
5. All these credits must be approved by the College Committee.

Additional Credits for Certificate Courses:

1. Students can get additional credits (number of credits will depend on the course duration) from certificate courses offered by the college.
2. The student must successfully complete the course. These credits must be approved by the Course Coordinators.
3. Students who undertake summer projects/ internships/ training in institutions of repute through a national selection process, will get 2 credits for each such activity. This must be done under the supervision of the concerned faculty/mentor.

Note:

1. The respective documents should be submitted within 10 days after completion of Semester End Examination.
2. No credits can be granted for organizing or for serving as office bearers/ volunteers for Inter-Class / Associations / Sports / Social Service activities.
3. The office bearers and volunteers may be given a letter of appreciation by the respective staff coordinators. Besides, no credits can be claimed for any services/ activities conducted or attended within the college.
4. All claims for the credits by the students should be made and approved by the mentor in the same academic year of completing the activity.
5. Any grievances of denial/rejection of credits should be addressed to Additional Credits Coordinator in the same academic year.
6. Students having a shortage of additional credits at the end of the third year can meet the Additional Credits Coordinator, who will provide the right advice on the activities that can help them earn credits required for graduation.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

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Examination Framework

Theory:

40% Continuous Assessment Tests (CATs) and 60% Semester End Examination (SEE)

Practical:

50% Continuous Assessment Tests (CATs) and 50% Semester End Examination (SEE)

Course	Marks	CAT & Mid Term Theory				CAT Practical		Best Scored CAT & Mid Term	SEE	Total
1	2	3				4		5	6	5 + 6
		Att.	CAT I	Mid Term	CAT II	Att.	CAT			
DSC/DSE/ GE/OE/Minor	100	10	10	20	10	-	-	40	60	100
DSC	75	05	10	15	10	-	-	30	45	75
Lab Course/AIPC/ OJT/FP/SEC (Science & Technology)	50	-	-	-	-	05	20	-	25	50
VSC/SEC/ AEC/VEC/CC	50	05	05	10	05	-	-	20	30	50

Note:

1. All Internal Exams are compulsory
2. Out of 02 CATs best score will be considered
3. Mid Term Exam will be conducted by the Exam Section
4. Mid Term Exam is of Objective nature (MCQ)
5. Semester End Exam is of descriptive in nature (Long & Short Answer)
6. CAT Practical (20 Marks): Lab Journal (Record Book) 10 Marks, Overall Performance 10 Marks