M.C.E. Society's

Abeda Inamdar Senior College of Arts, Science & Commerce, Pune

(Autonomous)

Syllabus under National Education Policy

Department of

Physics

Academic Year

(2024–2025)

(Under the faculty of Science and Technology)

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Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune-1
(Autonomous) Affiliated to Savitribai Phule Pune University
NAAC accredited 'A' Grade

Course Offered as	**SEC**
Course/ Paper Title	**Experiments in Digital Electronics**
Course Code	**23SBPH21SE**
Semester	II
No. of Credits	2
No of Hours	60

Sr. No.	**Course objective**
1	To understand the general theory of numbers.
2	To get familiar with concepts of digital electronics.
3	To understand basic logic gates and basic electronic circuits.
4	To demonstrate the logic of arithmetic operations using logic gates.
5	To learn number systems and their representation.

Sr. No.	**Learning Outcomes**
1	To simplify arithmetic operations
2	To design basic logic circuits using gates
3	To understand conversion from one system to another

List of experiments

Sr. No.	**Title**
1	Binary Number System and Positive and Negative Logic
2	Basic Logic gates(Universal and Derived)
3	DeMorgan'sTheorem
4	Conversion from BIN to DEC

5	Conversion from DEC to BIN
6	Use of EX-OR as a 4-bit odd Parity Checker and Generator
7	Use of NEX-OR as a 4-bit even Parity Checker and Generator
8	Study of Half Adder
9	Study of Full Adder
10	Study of Multiplexer 4:1
11	Study of Demultiplexer 4:1
12	Study of D/T flip flop using logic gates
13	Study of RS flip flop using logic gates
14	Study of JK flip flop using logic gates
15	Study of binary counter
16	Study of shift registers
17	Study of decade counter using IC-7490
18	Study of temperature sensor using AD590
19	Study of 4:1 encoder
20	Study of 1:4 decoder

Reference:

1) Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education.
2) Digital Electronics: Jain R.P., Tata McGraw Hill.
3) Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.
4) M.MorrisMano,"DigitalDesign"3rdEdition,PHI,NewDelhi.
5) RonaldJ.Tocci."DigitalSystemsPrinciplesandApplications"6/e.PHI.NewDe lhi. 1999.(UNITS Ito IV).
6) G. K. Kharate-Digital Electronics-oxford university press.
7) S. Salivahana & S. Arivazhagan – Digital Circuits and Design.

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Course Offered as	**VSC**
Course/ Paper Title	**Experimental Skills in Physics**
Course Code	**23SBPH21VS**
Semester	II
No. of Credits	2
No of Hours	60

Sr. No.	**Course objective**
1	To understand working principle and applications of various instruments used in Physics laboratory.
2	To impart knowledge about measurement and analysis of various physical quantities.

Sr. No.	**Learning Outcomes**
1	Understand the working principles of various measuring instruments in Physics laboratory.
2	Acquire the scientific information of various physical and electrical instruments used in Physics practical.
3	Identify the errors in instruments and study their analysis.

Experiments

Sr. No.	**Title of experiment**
1	Overview of experimental methods and techniques: importance of precision and accuracy in measurements.
2	Error analysis: understanding and calculating uncertainties, sources of errors and error propagation
3	Laboratory safety: protocol for safe handling of electrical equipments
4	Introduction to laboratory instruments
5	Determine the least count of instruments like Vernier Calliper, Micrometer Screw

	Gauge, Travelling Microscope, Spectrometer, etc.
6	Determine the inner and outer radius of given pipe by using Vernier Calliper and determine the diameter of a a thin pin by using micrometer screw gauge.
7	Determine the radius of curvature of given lenses by using spherometer.
8	Plot the graph of distance verses time, velocity verses time etc. by given
9	Measurement of relative humidity using hygrometer.
10	To find unknown incident power using solar insolation calibration curve.
11	Determine the coefficient of viscosity of water by Viscometer
12	Determine the angle of prism by using spectrometer
13	To measure ac, dc voltage & current and resistance using analog and digital multimeter
14	To measure ac, dc voltage and frequency of a signal by using CRO
15	To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance
16	Measurement of Q factor using LCR bridge
17	To measure Q of a coil and its dependence of frequency , using a Q-METER.
18	Measurement of rise, fall and delay times using a CRO.
19	To study the exponential delay of amplitude of simple pendulum
20	To study front panel controls of functional generator

Reference Book:

1. Digital Circuits and system- K.R.Vngopal, Tata McGrew Hill Publishing Company Ltd.
2. Electronic circuits: Handbook of design and application – U. Tietze , Ch,Schenk
3. A text book in Electrical Technology - B L Theraja – S Chand and Co. (Volume III) Publishers, New Delhi
4. BSc Practical Physics,- Harnam Singh , S Chand Publisher , New Delhi
5. Advanced Practical Physics , B.L Worsnop and H.T. Flint , Khosla Publishing House , New Delhi
6. BSc. Practical Physics , Arora C.L. S Chand and Company , New Delhi

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Course Offered as	**Minor**
Course/ Paper Title	**Thermal Physics**
Course Code	**23SBPH31MN**
Semester	III
No. of Credits	2
No of Hours	30

Sr. No.	Course Objectives
1	To describe the properties and relationship between different variables of s pure substance
2	To describe the ideal and real gas equation and its limitations.
3	To apply the laws of thermodynamics and to formulate the relations necessary to analyze a thermodynamic process.
4	To study the heat engines and calculate the thermal efficiency.
5	To understand the concept of refrigerators and calculate the coefficient of performance.
	To understand the concept of entropy
6	To study different types of thermometers and their usage.

Sr. No.	Learning Outcomes
1	Students can describe the ideal gas equation and its limitations
2	Students will understand the concept of real gas equation.
3	Students will be able to apply the laws of thermodynamics and to formulate the relations necessary to analyze a thermodynamic process.
4	Students will calculate the thermal efficiency of heat engines.

5	Students will understand the concept of refrigerators and calculate the coefficient of performance.
6	Students will understand the concept of entropy
7	Students will be able to use different types of thermometers

Fundamentals of Thermodynamics (10L)

1.1 Concept of thermodynamics state.
1.2 Equation of State.
1.3 Van der Waal's equation of state..
1.4 Thermal equilibrium.
1.5 Zeroth law of thermodynamics.
1.6 Thermodyanmci processes adiabatic, Isothermal, isochoricand isobaric changes.
1.7 Indicator diagram
1.8 Work done during isothermal change.
1.9 Work done during adiabatic change
2.0 State function internal energy.
2.1 First law of thermodynamics.
2.2 Rversible and irreversible changes.
2.3 Problems

Applied Thermodynamics (8L)

2.1Second law of thermodyamics.
2.2 Temperature –entropy diagram.
2.3 T-dS equations.
2.4 Maxwell's equation (without derivation).
2.5 Claisius-Claperyon latent heat equation.
2.6 Problems.

Heat Transfer Mechanism (7L)

3.1Carnot cycle, Carnot heat engine and its efficiency.
3.2 Otto cycle and its effciency.
3.3 diesel cycle and its effcicency.
3.4 General principle and coeeficient of performance of refrigerator.
3.5 Simple structure of vapour compression refrigerator.
3.6 Principle of air conditioning and its application.
3.7 Problems.

Thermometry (5L)

1.1 Principle of thermometry.
1.2 Different temperature scales and interconversion.
1.3 Liquid filled thermometers
1.4 Gas filled thermometers
1.5 Bimetallic thermometers
1.6 Platinum resistance thermometers
1.7 Thermocouple thermometer
1.8 Problems.

Reference Books:

1. H. C. Verma Concepts of Physics, Bharat Bhavan Publishers.
2. Heat and Thermodynamics, Brijlal, N. Subramanyam, S. Chand and Company.
3. Heat and Thermodynamics, Mark W. Zemansky, Richard Dittman.
4. Thrmodynamics and Stistical Physics, J.K. Sharma, K.K. Sarkar, Himalayta Publishin House
5. Thermal Physics (Heat and Thermodynamics), A.B.Gupta, H.P.Roy, S. Chhand publications
6. Instrumentation Devices and Sensors, Rangan, Mani and Sharma

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NEP – Pattern

Course Offered as	**Minor**
Course/ Paper Title	**Basic Physics Laboratory - I**
Course Code	**23SBPH32MN**
Semester	III
No. of Credits	2
No of Hours	60

Sr. No.	Course Objectives
1	To get hands on training of measuring instruments
2	To understand concept of errors and least count.
3	To understand the use of basic instruments for measuring fundamental quantities.
4	To apply the techniques for basic measurements in experiments
5	To apply basic Physics principles in day-to-day life

Sr. No.	Learning Outcomes
1.	To acquire skills of measuring fundamental quantities of simple objects
2.	To find the most accurate values of quantities
3.	To understand the importance of errors.
4.	To acquire skills of instrument handling.

Section I

Sr. No.	Title of experiments
1.	To study and use various measuring instruments such as Vernier Calliper, Micrometer Screw Gauge, Travelling microscope, spectrometer.
2.	Determination of Young's Modulus 'Y' of Flat Spiral Spring
3.	Determination of Modulus of Rigidity 'η' of Flat Spiral Spring
4.	Determination of modulus of Rigidity 'η' by torsional oscillations.
5.	Determination of Viscosity by Poiseullie's method.
6.	Determination of Surface Tension by Jaeger's method.
7.	Determination of acceleration due to gravity by using bar pendulum.
8.	Determination of Young's Modulus 'Y' by uniform bending method
9.	Determination of Surface Tension of mercury by Quincke's method.
10.	Determination of Surface Tension of mercury by method of ripples.

Section II

Sr. No.	Title of experiments
1.	Study of Kirchhoff's voltage and current law
2.	Study of AC and DC voltage sensitivity by CRO
3.	Study of I-V characteristics of Zener diode.
4.	Study of L-R circuit.
5.	Study of series resonance circuit (LCR circuit).
6.	Study of charging/discharging of capacitor.
7.	Study of series and parallel circuit using resistors.
8.	Determination of frequency of AC by sonometer.
9.	Study of digital multimeter for resistance, AC/DC voltage, diodes and transistor,
10.	Study of half and full wave rectifiers.

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Course Offered as	**VSC**
Course/ Paper Title	**Data Handling and Analysis**
Course Code	**23SBPH31VS**
Semester	III
No. of Credits	2
No of Hours	60

Sr. No.	**Learning Objectives**
	Perform basic operations on MS-Excel and Google Spreadsheet
	Acquire Data handling skills like sorting, filtering etc.
	Learn the application of excel function to ease the work
	Learn to design and develop small application using excel and spreadsheet
	Perform basic operations on MS
Sr. No.	Learning Outcomes
	Students will be able to perform basic operations on MS-Excel and Google Spreadsheet
	They will be able to handle Big Data for the purpose of sorting, filtering, drawing analysis etc.
	Students can use excel function for smart, quick and effective presentation of work
	Students will be able to design and develop small application using excel and spreadsheet

Module I: Basics of Excel and Spreadsheet

1.	Introduction to Excel: Worksheet, Workbook, Shortcut keys
2.	Introduction to Google Sheet: Spreadsheet, Fill series
3.	Difference in Excel and Spreadsheet
4.	Install Excel and Spreadsheet Apps in mobile & / Laptop
5.	Data Entry, Data editing and number formatting
6.	Working with cells and ranges in sheets
7.	Formatting tools.
8.	Useful features of Home Ribbon i. Font, Alignment, Styles ii. Custom formatting iii. Conditional formatting
9.	Auto fill and custom lists
10.	Data Sorting
11.	Module 2: Functions
12.	Excel Formula Basic
13.	Operators
14.	Relational operators, Logical operators
15.	Logical Functions AND, OR, NOT, IF, IFERROR, IS… functions
16.	Cell Reference, Relative reference, Absolute reference, Mixed reference
17.	Count and sum Count, Sum, sumif
18.	Lookup Functions Vlookup, Hlookup, Index, Match

Reference Books

1. Excel 2019 Bible 1st Edition by Michael Alexander , Richard Kusleika , John Walkenbach

2. Excel 2019 All-in-One, Greg Harvey, For Dummies

3. https://trumpexcel.com/

4. Google Sheet Functions: A step-by-step guide (Google Workspace apps) by Barrie Roberts

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NEP – Pattern

Course Offered as	**Minor**
Course/ Paper Title	**Electronics**
Course Code	**23SBPH41MN**
Semester	IV
No. of Credits	2
No of Hours	30

Sr. No.	Course Objectives
1	To acquire knowledge and skills to undertake higher studies/research in physics and related interdisciplinary areas thereby enabling students' employment/entrepreneurship
2	To acquire critical and analytical thinking, scientific reasoning, problem-solving skills, communication skills and teamwork.
3	To acquire competence and skill in solving both theoretical and applied physics problems.
4	To acquire in-depth knowledge in physics through understanding of key physical concepts, principles, theories and their manifestations.
5	To develop a conducive learning environment to ensure cognitive development of students.

Sr. No.	Learning Outcomes
1	To understand different theorems and laws of electrical circuits.
2	To understand the relations in electricity.
3	To u understand the parameters, characteristics and working of transistors.
4	To understand the functions of operational amplifiers.
5	To understand circuit design using components.
6	To understand the Boolean algebra and logic circuits.

1. **Circuit elements and Network Theorems (6L)**
   - **1.1.** Kirchhoff's Law
   - **1.2.** Voltage and current Divider Circuit
   - **1.3.** Thevenin's Theorem
   - **1.4.** Norton's Theorem
   - **1.5.** Superposition Theorem
   - **1.6.** Maximum Power transfer theorem (With proof)
   - 1.7. Problems

2. **Study of Transistor (8L)**
   - 2.1. Bi-junction Transistor
   - 2.2. Revision of bipolar Junction Transistor, Types, Symbol and basic action.
   - 2.3. Configuration (Common Base, Common Emitter and Common Collector)
   - 2.4. Current Gain Factors (α and β) and their relations
   - 2.5. Characteristics of CE Configuration
   - **2.6.** Problems

3. **Operational Amplifiers and Application (10L)**
   - 3.1 Introduction
   - 3.2 Ideal and practical Characteristics
   - 3.3 Operational Amplifier: IC741- Block Diagram and Pin diagram
   - 3.4 Concept of Virtual Ground
   - 3.5 Inverting and Non-inverting operational amplifiers with concept of gain
   - 3.6 Operational amplifier as an Adder and Subtractor.
   - 3.7 Problems

4. **Number System and Logic Gates (6L)**
   - **4.1.** Number System: Binary, Binary coded Decimal (BCD), Octal, Hexadecimal
   - **4.2.** Basic Logic gates (OR, AND, NOT)
   - **4.3.** Derived gates: NOR, NAND, EXOR, EXNOR, with symbols and truth table
   - **4.4.** Boolean Algebra
   - **4.5.** Problems

Reference Books:

2. Electronic Principles, Malvino, 7th Edition Tata Mc-Graw Hills publication.
3. Principles of Electronics, V.K. Mehta, S. Chand publication.
4. Op-amp and Linear Integrated Circuit, Ramakant Gaikwad, Prentice Hall of India publication.
5. Integrated Circuit, Botkar, Khanna Publication, New Delhi.
6. Digital Principles and Application, 6th Edition, Malvino and Leech, Tata Mc-Graw Hills publication.

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NEP – Pattern

Course Offered as	**Minor**
Course/ Paper Title	**Basic Physics Lab - II**
Course Code	**23SBPH42MN**
Semester	IV
No. of Credits	2
No of Hours	60

Sr. No.	Course Objectives
1	To study basic concepts of thermal physics.
2	To acquire sufficient knowledge of thermal physics in everyday life.
3	To understand the use of basic instruments for measuring fundamental thermal quantities.
4	To apply the techniques for basic measurements in experiments

Sr. No.	Learning Outcomes
1.	To acquire skills of measuring electrical quantities.
2.	To identify circuit components and devices.
3.	To understand the importance of graphs.
4.	To understand the measurement of temperature and its impact on material.

Section I

Sr. No.	Title of experiments
1.	Study of thermal conductivity by Lee's method.
2.	Interpretation of Isothermal and adiabatic curves on P-V diagram and theoretical study of Carnot's cycle.

3.	Study of Solar constant.
4.	Study of Temperature coefficient of thermistor.
5.	Study of thermocouple and determination of inversion temperature.
6.	Determination of calorific values of different fuels.
7.	To study temperature coefficient of resistivity.
8.	To study coefficient of linear expansion of metals.
9.	To determine Joule equivalent of electrical energy
10.	To determine specific heat of water by electrical method.

Section II

Sr. No.	**Title of experiments**
1.	Determination of resistors and its color codes.
2.	Determination of basic types and measurement of capacitor values.
3.	Determination of basic types and measurement of resistor values.
4.	Demonstration of transistor and its basic types.
5.	Demonstration of logic gates and De Morgan’s theorem
6.	To study and verify basic logic gates.
7.	Use of CRO to measure current and voltage.
8.	Use of transformer (Step-up and Step-down)
9.	Use of DMM for measurement of current, voltage and resistors.
10.	Study of KVL and KCL.

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Course Offered as	**SEC**
Course/ Paper Title	Magic of Mirrors and Lenses
Course Code	**23SBPH41SE**
Semester	IV
No. of Credits	2
No of Hours	60

Sr. No.	Learning Objectives
1.	Understand and apply the laws of reflection.
2.	Investigate the characteristics of images formed in plane, concave and convex mirrors.
3.	Explore image formation with concave and convex lenses.
4.	Derive and apply the mirror and lens formula.
5.	Investigate the combined effects of multiple lenses.
6.	Identify and analyze lens aberrations.
7.	Explore real-world applications of lenses in devices.
8.	Understand the working principle of microscopes and telescopes.
9.	Introduction to holography using mirrors and lenses.
10.	Explore the role of mirrors and lenses in photography.
11.	Study the basics of fiber optics.
12.	Investigate the use of optics in medical devices.

Sr. No.	Course Outcomes
1.	Ability to analyze and describe reflection phenomena.
2.	Proficiency in predicting and explaining images formed in plane mirrors
3.	Ability to analyze the type of mirrors &lenses and their applications
4.	Competence in calculating image distances and magnifications
5.	Recognition of different lens types and their applications.
6.	Understanding the principles and applications of combination of lenses.
7.	Recognition of optical imperfections and their impact
8.	Understanding the role of lenses in everyday technology
9.	Familiarity with functionality of optical instruments like microscope and telescope.
10.	Familiarity with holographic imaging.
11.	Understanding the optics behind image capturing.
12.	Awareness of modern optical communication technology.
13.	Recognition of optical applications in healthcare.

Sr. No.	Title of Experiment
1.	Overview of Mirrors and Lenses
2.	Laws of Reflection and Image Formation in Plane Mirrors
3.	Concave and convex mirrors
4.	Investigation of Mirror formula
5.	Type of lenses and their characteristics
6.	Ray diagrams for lenses
7.	Verification of lense formula
8.	Image formation by combination of lenses
9.	Magnification and power of lenses
10.	Study of anamorphic images with curved mirror
11.	Total internal reflection
12.	Lens aberrations
13.	Application of lenses in devices
14.	Study of Microscope
15.	Study of Telescope

16.	Interference with mirrors and lenses
17.	Polarization of light
18.	Holography
19.	Optics in photography
20.	Fiber Optics
21.	Optics in medicine

References Books:

1. Text Book of Optics by Subrahmanyam, Brij Lal & Avadhanulu.
2. Optics/7th Edition by Ajoy Ghatak.
3. "Concepts of Physics" by H.C. Verma.
4. https://www.sciencefriday.com/educational-resources/fun-with-optics/.