SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

Affiliated to the University of Mumbai

Programme: Science

PHYSICS

F.Y. B.Sc. PHYSICS (Minor)

Syllabus for the Academic Year 2025-2026 based on the National Education Policy 2020

SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

DEPARTMENT OF PHYSICS

COURSE DETAILS FOR MINOR:

	SEMESTER 1		SEMESTER 2
TITLE	Fundamentals of Mechanics & Optics		Fundamentals of Electricity & Electronics
TYPE OF COURSE - DSC	Minor		Minor
CREDITS	4		4

Preamble:

The systematic and planned curricula from these courses shall motivate and encourage learners to understand basic concepts of Physics. Physics, a First-Year program, embarks on a journey of discovery through the fundamental principles of physics. Throughout this program, we will explore the diverse and fascinating realms of classical mechanics, optics, thermodynamics, modern physics, and electronics. From the laws of motion to the mysteries of quantum theory, our aim is to cultivate a deep understanding of the natural world and its underlying principles. Through experimentation, analysis, and critical thinking, we will strive to unravel the complexities of the universe and lay the groundwork for further exploration and innovation. Join us as we embark on this exciting intellectual adventure, where curiosity and inquiry are the guiding lights on our path to knowledge and understanding.

PROGRAMME OBJECTIVES

PO 1	Equip students with the fundamental principles of mechanics, optics, electricity, and electronics to build a solid base for advanced studies in physics and engineering.
PO 2	Highlight the interconnection between mechanical, optical, electrical, and electronic systems to prepare students for interdisciplinary fields like photonics, robotics, and material sciences.
PO 3	Lay the groundwork for careers in science, technology, engineering, or further academic pursuits in related fields

PROGRAMME SPECIFIC OUTCOMES

PSO 1	Students will develop a clear understanding of core concepts in mechanics, optics, electricity, and electronics.
PSO 2	Students will demonstrate the ability to identify, formulate, and solve complex problems in mechanics, optics, electricity, and electronics
PSO 3	Students will be equipped to pursue careers in engineering, technology, or research requiring knowledge of mechanics, optics, and electronics.

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Programme: Sciences **Physics Minor**	**Semester – 1**
Course Title: Fundamentals of Mechanics & Optics	**Course Code:** SPHY111

COURSE OBJECTIVES:

CO 1.	Demonstrate skills and competencies to conduct a wide range of scientific experiments.
CO 2.	To provide structured curricula, this supports academic development of students
CO 3.	To provide structured curricula, this supports academic development of students
CO 4.	To be able to connect the theory and experiment of interference using Newton's ring- and wedge-shaped film.

COURSE OUTCOMES:

CLO 1.	Learners would be able to achieve strong foundation knowledge and comprehend the basic concepts and principles in Physics.
CLO 2.	Learners would apply the concepts, principles and theories behind the subject.

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Theory Lectures per week (2 Lecture is 60 minutes)		**2**	
Total number of Hours in a Semester		**30**	
Credits		**2**	
Evaluation System	**Semester End Examination**	**1 Hour**	**30 marks**
	Internal Assessment	**--**	**20 marks**

UNIT 1 (1 Credit)	1.1	Newton's first, second and third laws of motion, interpretation and applications, pseudo forces, Inertial and non-inertial frames of reference. Worked out examples (with friction present)	**15 Hours**
	1.2	Viscous force, Stokes' law, Streamline and Turbulent flow, Equation of continuity, Bernoulli's equation, Poiseuille's equation. Introduction to surface tension, angle of contact, surface energy. Application: Garden watering, Airplanes. Elasticity: Review of Elastic constants Y, K, η and σ; Equivalence of shear strain to compression and extension strains. Relations between elastic constants, Couple for twist in cylinder.	
UNIT 2 (1 Credit)	2.1	Lenes, Lens maker's formula, magnification, power of lens. Application cameras. Aberration: Introduction, Types of aberration, Spherical aberration, reduction of spherical aberration, chromatic aberration.	**15 Hours**
	2.2	Interference: Introduction, interference in thin films, Newton's ring, Wedge shaped film. Applications: Blue Morpho butterfly, soap bubbles, color patches on wet roads.	

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PRACTICAL **Course Title: Fundamentals Of Mechanics & Optics**	**Course Code: SMCB111P**

COURSE OUTCOMES:

1. Describe the basic concepts of Physics
2. Apply the concepts to interference in daily life.
3. Create the list of instruments to design the interference pattern.

Lectures per week (2 Lecture is 120 minutes)		**2**	
Total number of Hours in a Semester		**60**	
Credits		**2**	
Evaluation System	**Semester End Examination**	**3 Hours**	**50 marks**
	Internal Assessment	**--**	

Skill Experiment	1	Vernier Calliper	60 hours
	2	Micrometre screw gauge	
	3	Travelling microscope	
	4	Graph plotting	
Regular Experiment	5	Torsional Oscillation: To determine modulus of rigidity η of a material of wire by torsional oscillations.	
	6	Bifilar Pendulum: To determine moment of inertia of a bifilar pendulum	
	7	Flywheel: To determine moment of inertia of flywheel	
	8	Spectrometer: To determine the angle of Prism.	
	9	Y by vibrations: To determine Y Young's Modulus of a wire material by method of vibrations- Flat spiral spring.	
	10	To determine Coefficient of Viscosity (η) of a given liquid by Poisseuli's Method/ Biological Fluid	
	11	Surface Tension/ Angle of contact: To determine the surface tension of water by capillary rise method.	
	12	Combination of Lenses to determine the equivalent focal length of a lens system by magnification method.	
	13	Spectrometer: To determine the refractive index μ of the material of the prism	
	14	Newton's Rings: To determine the radius of curvature of a given convex lens using Newton's rings.	
	15	Wedge Shaped Film: To determine the thickness of wire by obtaining fringes in wedge shaped air film.	

ASSESSMENT DETAILS:

1. Internal Assessment (IA): Any one activity / assignment / test of 20 marks
2. Semester End Examination (SEE): Theory exam of 30 marks – One hour duration
3. Semester End Examination (SEE): Practical exam of 50 marks – Two hours duration

REFERENCES:

SPHY111 Fundamentals of Mechanics & Optics

1. Applied Fluid Mechanics: Mott Robert, Pearson Benjamin Cummir, VIth Edition. Pearson Education /Prentice Hall International, New Delhi.
2. Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley and Sons.
3. H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. Bharati Bhavan Publishers.
4. Brijlal, Subramanyam and Avadhanulu A Textbook of Optics, 25th revised ed. (2012) S. Chand.
5. Concepts of Physics – (Part–I) by H. C. Verma, 2002 Ed. Bharati Bhavan Publishers.
6. Brijlal, Subramanyam and Avadhanulu a Textbook of Optics, 25th revised ed. (2012) S. Chand.

SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

Programme: Sciences **Physics Minor**	**Semester – 2**
Course Title: Fundamentals of Electricity & Electronics	**Course Code:** SPHY122

COURSE OBJECTIVES:

CO 1.	To provide a foundational understanding of electrical and electronic principles. To introduce fundamental electronic components like diodes, transistors, and their applications.
CO 2.	To explore concepts like Ohm's law, Kirchhoff's laws, AC/DC currents, and power calculations.
CO 3.	To study the operation and applications of semiconductors, logic gates, and integrated circuits.

COURSE OUTCOMES:

CLO 1.	Students will be able to understand and explain basic concepts of electricity and electronics.
CLO 2.	They will understand the differences between AC and DC systems and their practical applications. They will be able to calculate power, energy, and efficiency in electrical systems.
CLO 3.	They will be able to design and analyze simple electronic circuits. They will develop an understanding of the functioning of logic gates and basic digital circuits.

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Theory Lectures per week (1 Lecture is 60 minutes)		**2**	
Total number of Hours in a Semester		**30**	
Credits		**2**	
Evaluation System	**Semester End Examination**	**1 Hour**	**30 marks**
	Internal Assessment	**--**	**20 marks**

UNIT 1 (1 Credit)	1.1	Alternating current theory: (Concept of L, R, and C: Review) AC circuit containing pure R, pure L and pure C, representation of sinusoids by complex numbers, Series L-R, C-R and LCR circuits. Resonance in LCR circuit (both series and parallel), Power in ac circuit. Q-factor.	15 hours
	1.2	AC bridges: AC-bridges: General AC bridge, Maxwell, de-Sauty, Wien Bridge, Hay Bridge.	
UNIT 2 (1 Credit)	2.1	DC power supply: Half wave rectifier, Full wave rectifier, Bridge rectifier, PIV and Ripple factor of full wave rectifier, Clipper and Clampers (Basic circuits only), Capacitor Filter, Zener diode as voltage stabilizer.	15 hours
	2.2	Digital electronics: Logic gates (Review), NAND and NOR as universal building blocks. EXOR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications, Boolean algebra, Boolean theorems. De-Morgan theorems, Half adder and Full adder	

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PRACTICAL COURSE **Course Title: Fundamentals of Electricity & Electronics**	**Course Code: SPHY122P**

COURSE OUTCOMES:

CLO 1.	To understand and practice the skills while doing physics practical.
CLO 2.	To understand the use of apparatus and their use without fear.
CLO 3.	To correlate their physics theory concepts through practical.
CLO4	Understand the concepts of errors and their estimation

Lectures per week (1 Lecture is 120 minutes)	**2**
Total number of Hours in a Semester	**60**
Credits	**2**

Evaluation System	**Semester End Examination**	**2 Hours**	**50 marks**
	Internal Assessment	**--**	

Regular Experiment	1	To study Zener Diode as Regulator	60 hours
	2	To study load regulation of a Bridge Rectifier	
	3	LR Circuit: To determine the value of given inductance and phase angle	
	4	CR Circuit: To determine value of given capacitor and Phase angle	
	5	Frequency of AC Mains: To determine frequency of AC mains.	
	6	LCR series Resonance: To determine resonance frequency of LCR series circuit.	
	7	To study NAND and NOR gates as Universal Building Blocks	
	8	To study EX-OR Gate, half adder and full adder and verify their truth tables.	
	9	To verify De Morgan's Theorems	
	10	LDR Characteristics: To study the dependence of LDR resistance on intensity of light.	

ASSESSMENT DETAILS:

1. Internal Assessment (IA): Any one activity / assignment / test of 20 marks
2. Semester End Examination (SEE): Theory exam of 30 marks – One hour duration
3. Semester End Examination (SEE): Practical exam of 50 marks – Three hours duration

REFERENCES:

1. Applied Fluid Mechanics: Mott Robert, Pearson Benjamin Cummir, VIth Edition. Pearson Education /Prentice Hall International, New Delhi.
2. Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley and Sons.
3. H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. Bharati Bhavan Publishers.
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5. Concepts of Physics – (Part–I) by H. C. Verma, 2002 Ed. Bharati Bhavan Publishers.
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