SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

Affiliated to the University of Mumbai

Programme: Sciences

Physics (Minor)

Syllabus for the Academic Year 2024-2025

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 and 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, 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.

SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

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.

SOPHIA COLLEGE FOR WOMEN (EMPOWERED AUTONOMOUS)

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

The learner will be able to:

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

Lectures per week (1 Lecture is 60 minutes)		**2**	
Total number of Hours in a Semester		**30**	
Credits		**3**	
Evaluation System	**Semester End Examination**	**2 Hours**	**30 marks**
	Internal Assessment	**--**	**20 marks**

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UNIT	Salient features up to phylum level of:		
UNIT 1 Mechanics (1 Credit)	1.1	Newton's law	15 hours
	1.2	Fluid dynamics	
	1.3	Elasticity	
UNIT 2 Optics (1 Credit)	2.1	Lens	15 hours
	2.2	Aberration	
	2.3	Interference	

PRACTICAL **Course Title: Fundamentals of mechanics & Optics Practical**		**Course Code: SPHY111P**	
COURSE OUTCOMES: The learner will be able to: 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 (1 Lecture is 120 minutes)		**1**	
Total number of Hours in a Semester		**20**	
Credits		**1**	
Evaluation System	**Semester End Examination**	**2 Hours**	**50 marks**
	Internal Assessment	**--**	

Sr. No.	Course Content	
Skill Experiment		
1	Vernier Calliper: To measure the dimensions (length, width, diameter, depth) of a given object accurately using a Vernier caliper.	
2	Micrometer screw gauge: To measure the thickness or diameter of small objects (such as wires or sheets) with high precision using a micrometer screw gauge	
3	Travelling microscope: To determine the dimensions or positions of small objects and perform precise measurements in experiments, such as the determination of refractive index or radius of curvature.	
4	Graph plotting: To represent experimental data graphically, analyze relationships between variables, and determine key parameters (e.g., slope, intercept) for better interpretation of results.	
Regular Experiment		
1	Torsional Oscillation: To determine modulus of rigidity η of a material of wire by torsional oscillations/Biological Fibre.	30 hours
2	Bifilar Pendulum: To determine moment of inertia of a bifilar pendulum	
3	Flywheel: To determine moment of inertia of flywheel	
4	Spectrometer: To determine the angle of Prism.	
5	Y by vibrations: To determine Y Young's Modulus of a wire material by method of vibrations- Flat spiral spring	
6	To determine Coefficient of Viscosity (η) of a given liquid by Poisseuli's Method/ Biological Fluid	
7	Surface Tension/ Angle of contact: To determine the surface tension of water by capillary rise method.	
8	Combination of Lenses to determine the equivalent focal length of a lens system by magnification method.	
9	Spectrometer: To determine the refractive index μ of the material of the prism	

10	Newton’s Rings: To determine the radius of curvature of a given convex lens using Newton's rings.	
11	Wedge Shaped Film: To determine the thickness of wire by obtaining fringes in wedge shaped air film.	

ASSESSMENT DETAILS:

I. Internal Assessment (IA): 50 marks

II. Semester End Examination (SEE): 50 marks

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.
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 and Electronics		**Course Code: SPHY122**	
COURSE OBJECTIVES: 1. To provide a foundational understanding of electrical and electronic principles. To introduce fundamental electronic components like diodes, transistors, and their applications. 2. To explore concepts like Ohm's law, Kirchhoff's laws, AC/DC currents, and power calculations. 3. To study the operation and applications of semiconductors, logic gates, and integrated circuits.			
COURSE OUTCOMES: The learner will be able to: 1. Students will be able to understand and explain basic concepts of electricity and electronics. 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. 3. They will be able to design and analyse simple electronic circuits. They will develop an understanding of the functioning of logic gates and basic digital circuits.			
Lectures per week (1 Lecture is 60 minutes)		**2**	
Total number of Hours in a Semester		**30**	
Credits		**2**	
Evaluation System	**Semester End Examination**	**2 Hours**	**50 marks**
	Internal Assessment	**--**	**20 marks**

UNIT 1 Electricity (1 Credit)	1.1	Alternating current theory	15 hours
	1.2	A C bridges	
UNIT 2 Electronics (1 Credit)	2.1	D C power supply	15 hours
	2.2	Digital electronics	

Programme: Sciences **Physics Minor**	**Semester – 2**
PRACTICAL COURSE: Fundamentals of Electricity and Electronics Practical	**Course Code: SPHY122P**

COURSE OUTCOMES:

The learner will be able to:

1. Students will acquire hands-on experience in constructing and analysing electrical and electronic circuits.
2. They will become proficient in using measuring instruments such as mustimeters and oscilloscopes.
3. They will develop troubleshooting skills for identifying and resolving issues in practical circuits.

Lectures per week (1 Lecture is 60 minutes)		**2**	
Total number of Hours in a Semester		**30**	
Credits		**1**	
Evaluation System	**Summative Assessment**	**2 Hours**	**50 marks**
	Continuous Assessment	**--**	

Sr. No	Course Content	
1	To study Zener Diode as voltage Regulator	30 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	Thevenin's Theorem: To verify Thevenin's theorem for DC circuits	
11	Norton's Theorem: To verify Norton's Theorem for DC circuits	
12	LDR Characteristics: To study the dependence of LDR resistance on intensity of light	
Sr. No.	Demonstration Practical	
1	Use of Digital Multimeter	
2	Use of Oscilloscope	
3	Use of PC for graph plotting	
4	Charging and discharging of a capacitor	

ASSESSMENT DETAILS:

I. Internal Assessment (IA): 50 marks

II. Semester End Examination (SEE): 50 marks

REFERENCES:

1. B.L. Theraja and A.K. Theraja, A Textbook of Electrical Technology Vol. I, S.Chand Publication
2. V K Mehta and R Mehta Electronics Principals, Multi coloured Revised 11th Ed. reprint in 2012 S Chand.
3. A B Bhattacharya, Electronics Principles and Applications, Central publisher.
4. A P Malvino, Digital Principles and Applications: Tata McGraw Hill Tokhiem Digital electronics, 4thed, McGraw Hill International Edition
5. Charles K Alexander, Mattew Sadiku, Fundamentals of electric circuits, 5th Edition, McGraw-Hill, 2013