ST. XAVIER'S COLLEGE (AUTONOMOUS), AHMEDABAD-9 FACULTY OF SCIENCE

DEPARTMENT OF PHYSICS & ELECTRONICS

SEMESTER – I

SYLLABUS

OF

BSc PHYSICS (HONOURS)

BASED ON UNDERGRADUATE CURRICULUM FRAMEWORK (NEP – 2020)

(Effective from Academic Year 2023)

Curriculum Framework for Semester – I

Course	Title	Content		Credit
DSC-1 (Theory)	PHMC111C Introduction to Classical Physics	U1	Vector Analysis	4
		U2	Oscillations and Waves	
		U3	Optics	
		U4	Fourier series and Matrices	
DSC-2 (Laboratory)	PHMC112L Physics and Experiential Lab-I	14 Physics Experiments		4
		Experiential Lab: 1 Hands on experiment.		
Minor-1 (Theory + Lab)	PHMN111C Basic Physics-I	U1	Vector Analysis	2
		U2	Oscillations and Waves	
		U3 U4	14 experiments as mentioned in syllabus	2
Minor-1 (Theory + Lab)	ELMN111C Basic Electronics-I	U1	Diodes and Their Applications	2
		U2	Number systems and Codes	
		U3 U4	14 experiments as mentioned in syllabus	2
SEC	PHSE111C Basic Skill in Electronics: Soldering Testing Fabrication	U1		2
		U2	Laboratory Component	
MDC	MDC206C Astronomy for Beginners	U1	Intr. to Astronomy and Observations in Astronomy	4
		U2	Principles and Tools for Observations in Astronomy	
		U3	Celestial Objects and Their Nature	
		U4	Field Trip/Project/Stargazing	
AEC	Ability Enhancement Course	(To be offered by the concerned subject Department)		2
VAC	Value Added Course	(To be chosen from a basket of courses)		2
Total Credits				**22**

* DSC: Discipline Specific Core

St. Xavier's College (Autonomous), Ahmedabad

Syllabus of Semester–I to be implemented from the Academic Year **2025-26.**

DEPARTMENT OF PHYSICS & ELECTRONICS

Major Course: Introduction to Classical Physics

Course Code & Title	Credit Distribution of The Course				Eligibility Criteria	Prerequisite(s) of the Course (if any)
	Cr	Lecture hrs	Tutorial hrs	Activity/Case study analysis		
PHMC111C: Introduction to Classical Physics	4	12x4	3x4		10 + 2 from a recognized board	Science Stream Math-Group

Learning Objectives:

LO1	Apply basic vector algebra and differential operations, including gradient, divergence, and Gauss and Stokes theorems, in both Cartesian and curvilinear coordinates.
LO2	Understand and analyze interference phenomena in thin films, wedge-shaped films, Newton's rings, Haidinger fringes, and transmitted light.
LO3	Comprehend Fermat's principle, reflection and refraction, and construct images using cardinal points for single and compound lens systems.
LO4	They will be able to analyze problems involving SHM, Describe the types and properties of travelling waves, Understand wave propagation and behavior, Apply wave equations to solve problems and Analyze real-life scenarios involving the Doppler effect

Course Outcomes:

CO1	Understand and apply vector algebra and essential vector calculus theorems relevant to physical systems.
CO2	Gain conceptual understanding of thermal equilibrium, temperature measurement, the Zeroth and First Laws of Thermodynamics, Carnot cycle, and related theorems.
CO3	Understand the concept, characteristics, and equations of simple harmonic motion, Learn about the types, properties, and behavior of standing and travelling waves and comprehend the principles and applications of the Doppler effect in sound waves.
CO4	Apply matrix methods as tools for solving differential equations and analyzing physical phenomena.

Unit 1: Vector Analysis

Credit of Course: 1 Cr **Lecture 12 Hrs** **Tutorial 3Hrs**

Vector Algebra, Differential Calculus, Integral Calculus, Curvilinear Coordinates, The Dirac Delta Function

Text Book:

- Introduction to Electrodynamics: Third Edition **David J Griffiths.** Ch-1, 1.1, 1.2, 1.3, 1.4, 1.5.

References Books:

- Mathematical Methods in Physical Sciences, **M.L. Boas**.

Unit 2: Oscillations and Waves

Credit of Course: 1 Cr **Lecture 12 Hrs** **Tutorial 3Hrs**

Review of ordinary differential equations: first and second order linear differential Equations - Definitions, methods of solving, and examples. Simple harmonic oscillator: Differential equation for the simple harmonic oscillator and its general solution; Superposition of two or more simple harmonic oscillators; Lissajous figures; damped and forced oscillators; resonance. Wave Equation; traveling and standing waves in one-dimension; energy density and energy transmission; concepts of group velocity and phase velocity. Sound Waves: propagation of sound waves in different media; energy transport in sound waves; Doppler effect.

Text Book:

- A textbook of oscillation, waves and acoustics, **M. Ghosh and D. Bhattacharya.** Ch-2, 2.2-2.11, 3.1-3.7, 8.9, 8.13
- Mechanics, wave motion and heat, **Francis Weston Sears.** 16.3-16.6

References Books:

- Mechanics, wave motion and heat, **Francis Weston Sears**
- A textbook of sound, **N Subrahmanyam and Brij Lal**

Unit 3: Optics

Credit of Course: 1 Cr **Lecture 12 Hrs** **Tutorial 3Hrs**

Fermat's principle and its applications: Fermat's principle of least time, laws at reflection, laws of refraction. Interference in thin films: Thin film, Plane parallel film, Interference due to transmitted light, Haidinger fringes, variable thickness (wedge-shaped) film, Newton's ring.
Optical system and Cardinal Points: Introduction, cardinal points, Construction of the image using cardinal points, A system of two thin lenses. Cardinal Points of a coaxial system of two thin lenses.

Text Book:

- The Textbook of Optics, **Subramanyam and Brijlal**. 2.1, 2.2, 2.5, 2.6, 5.1, 5.2, 5.3, 5.10, 15.1, 15.2, 15.3, 15.4, 15.5, 15.6

References Books:

- The Textbook of Optics, **Subramanyam and Brijlal**

Unit 4: Fourier series and Matrices

Credit of Course: 1 Cr **Lecture 12 Hrs** **Tutorial 3Hrs**

Fourier series: Introduction, Simple Harmonic motion & wave motion – Periodic functions, Applications of Fourier series, Average value of a function, Fourier coefficients, Dirchlet conditions, complex form of Fourier series, other intervals, Even & odd functions, Parsevel's theorem, Applications/Numerical on Fourier series.
Matrices: Matrix equations, Multiplication of a Matrix by a number, Multiplication of Matrices, Zero

matrix, Identity Matrix or Unit Matrix, Applications of matrix Multiplication, Inverse of a Matrix, Rotation of Matrices.

Text Book:

- Mathematical Methods in Physical Sciences **M.L. Boas,** 6.1- 6.11 and articles from ch 7

References Books:

- Matrices, **Shanti Narayan**

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DEPARTMENT OF PHYSICS & ELECTRONICS

Major Course: Physics and Experiential Lab -I

Course Code & Title	Credit Distribution of The Course			Eligibility Criteria	Prerequisite(s) of the Course (if any)
	Cr	Laboratory Hrs per week	Activity/Case study analysis		
PHMC112L: **Physics Lab and Experiential Lab-I**	4	8		10 + 2 from a recognized board	Science Stream Math-Group

Learning Objectives:

(Physics Laboratory)

LO1	Learn the physical principles underlying thermal radiation, oscillations, magnetism, optics, electronics, and mechanics.
LO2	Acquire hands-on experience in using laboratory instruments like the vibration magnetometer, transformer, rectifier circuits, and flywheel.
LO3	Practice accurate data collection, analysis using methods such as least squares fitting, and error estimation techniques.
LO4	Investigate mechanical and electrical resonance phenomena (Melde's experiment, series resonance) and their practical significance.
LO5	Examine I–V characteristics of p–n junction diodes and understand concepts of rectification and load line analysis.

(Experiential Lab)

LO1	Independently identify the aim of a basic experiment with a creative or modified twist.
LO2	Collaboratively understand the problem and set up the complete experiment through self-learning in a team of 2–3 students
LO3	Analyse potential sources of error and assess their impact on the results.

Course Outcomes:
(Physics Laboratory)

CO1	Demonstrate the ability to perform experiments based on mechanics, optics, and thermal physics (e.g., simple pendulum, moment of inertia, Stefan's constant).
CO2	Analyze and interpret experimental results to extract physical parameters like capacitance, resonant frequency, and diode characteristics.
CO3	Apply the method of least squares and error analysis to validate experimental data and assess its reliability.
CO4	Operate and troubleshoot basic electronic components such as diodes, transformers, and rectifiers in circuit configurations.
CO5	Correlate theoretical concepts with experimental outcomes and communicate scientific findings effectively in written and oral formats.

(Experiential Lab)

CO 1	Set up and demonstrate new experiments to verify assigned physics principles and measure physical quantities.
CO 2	Independently calculate errors in measured results.
CO 3	Present and submit the experiment in the form of a scientific report.

B.Sc. (PHYSICS) SEMESTER -I PHMC111L (Practical)

01	Stefan's Constant
02	Melde's Experiments
03	Resonator
04	Vibration Magnetometer
05	Study of Transformer
06	Value of Capacitance
07	Series Resonance
08	Half Wave Rectifier
09	M I of Flywheel
10	Method of Least Square Fitting
11	Analysis of Error
12	Simple Pendulum
13	I-V Characteristics of P-N Junction and Load Line
14	Liquid Lens