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

DEPARTMENT OF PHYSICS & ELECTRONICS

SEMESTER – IV

SYLLABUS

OF

BSc PHYSICS (HONOURS)

BASED ON UNDERGRADUATE CURRICULUM FRAMEWORK (NEP – 2020)

(Effective from Academic Year 2023)

Curriculum Framework for Semester – IV

Course	Title	Content		Credit
DSC-8 (Theory)	PHMC441C Modern Physics and Nuclear Physics	U1	Modern Physics	4
		U2	Special Relativity	
		U3	Nuclear Physics	
		U4	Nuclear Physics: Instrumentation	
DSC-9 (Theory)	PHMC442C Electromagnetism and Thermal Physics	U1	Magnetic Field in Matter	4
		U2	Electric Field in Matter	
		U3	Kinetic Theory and Thermoelectricity	
		U4	Thermodynamics	
DSC-10 (Laboratory)	PHMC443L Physics and Experiential Lab-IV	14 Physics Experiments		4
		Experiential Lab		
Minor-1 (Theory + Lab)	PHMN441C Basic Physics-III	U1	Electric Field in Matter	2
		U2	Kinetic Theory and Thermoelectricity	
		U3 U4	14 Physics Experiments	2
Minor-1 (Theory + Lab)	ELMN441C Basic Electronics-III	U1	Voltage Regulators	2
		U2	Impedance Transformer and Coupled Circuits	
		U3 U4	14 Experiments	2
SEC	PHSE441C Arduino (Swayam)	U1	Arduino	2
		U2	Laboratory Component	
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–IV to be implemented from the Academic Year **2025-26.**

DEPARTMENT OF PHYSICS & ELECTRONICS

Minor Course: Basic Physics – III

Course Code & Title	Credit Distribution of The Course				Eligibility Criteria	Prerequisite(s) of the Course (if any)
	Cr	Lecture + Tutorials hrs	Laboratory Hrs per week	Activity/Case study analysis		
PHMN441C: Basic Physics – III	4	12x2 + 3x2	4		10 + 2 from a recognized board	Science Stream Math-Group

Learning Objectives:

LO1	Understand and interpret the concepts of polarization, bound charges and electric displacement in dielectric materials subjected to electric fields.
LO2	Lean and apply the kinetic theory of gases, including Maxwell's speed distribution, mean free path, and related experimental verifications to understand gas behavior.
LO3	Understand measurement techniques, demonstrating knowledge of experimental physics concepts.
LO4	Construct and analyze circuits, estimating errors, and relating textbook physics to real-world observations to bridge the gap between theory and experiment.

Course Outcomes:

CO1	Apply Ampere's law and boundary conditions to solve problems involving electric fields in dielectric materials.
CO2	Analyze the behavior of ideal gases and statistical distributions, specifically Maxwell's speed distribution and mean free path theories, in thermal physics applications.
CO3	Students will have a good foundation in the fundamentals related to the experiments included in this course and their advanced applications.
CO4	Students will learn to handle instruments such as Multimeters, Ballistic Galvanometer, Spectrometer, Telescopes and Microscopes, make accurate measurements, analyze data, and report results effectively.

Unit 1: Electric Field in Matter

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

Polarization: Dielectrics, Induced dipoles, alignment of polar molecules, field of a polarized object, Physical interpretation of bound charges, the field inside a dielectric.
The Electric Displacement: A deceptive parallel, boundary conditions. Linear Dielectrics: Boundary value problems with linear dielectrics, Energy in dielectric systems. Forces on dielectric

Text Book

- Introduction to Electrodynamics vy David J. Griffiths – Articles 4.1, 4.1.2 – 4.1.3, 4.2.1 – 4.2.3, 4.4, 4.4.1 – 4.4.4

Unit 2: Kinetic Theory and Thermoelectricity

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

Introduction, Assumption of the kinetic theory, Deduction of ideal gas equation, Deduction from pressure expression, Kinetic theory and molecular chaos, Distribution of speeds, Maxwell's velocity or speed distribution law, Average speed, r.m.s. Speed, Most probable speed, Degree of freedom of a dynamical system, principal of classical equipartition of energy, Degree of freedom and ratio of heat capacities, Dulong and Petit's law, Mean free path, Isotherms and deviations from ideal gas, van der Waals equation of state, Critical constants of van der Waals gas.

Thermoelectricity: Seeback effect, Peltier effect, Thomson effect, Total emf in thermocouple.

Text Book

- Thermal Physics by AB Gupta and HP Roy – Articles 2.1 – 2.22 (Chapter 2)

Unit 3 & 4: List of Practical

S. No.	Experiment
1	Double refraction in calcite prism
2	Resolving power of grating
3	Identification of elements in line spectra
4	Analysis of elliptical polarized light
5	UJT Characteristics
6	Solar cell
7	Fixed bias and potential bias
8	Absorption coefficient of glass
9	e/k by power transistor
10	Study of Numerical interpolation
11	C_1/C_2 by Desauty's method
12	Study of electron diffraction pattern
13	Dielectric constant
14	Phonon dispersion