Centre for High Energy Physics
Faculty of Science
University of the Punjab, Lahore

Course Outline

Program	BSCP	**Course Code**	CPHY 444	**Credit Hours**	3
Course Title	**Statistical Physics**				

Course Introduction

The course introduces Thermal and Statistical Physics at undergraduate level

Learning Outcomes

On the completion of the course, the students will:

1. Basic principles of equilibrium thermodynamics.
2. Basic principles of statistical mechanics.
3. Study of partition function and different statistical systems.

Course Content

Week 1	Equilibrium Thermodynamics
	Thermodynamical quantities
Week 2	The laws of thermodynamics
	Equations of state of an ideal gas
Week 3	Specific heats
	Maxwell relations and their applications
Week 4	(Continuing)
	Elements of Probability Theory: Probabilities and its laws
Week 5	Probability distributions; binomial distribution; Gaussian distribution.
	Formulation of Statistical Mechanics
Week 6	Micro and macro states of system
	counting the states of a system (harmonic oscillators, ideal gas)
Week 7	micro canonical system
	Thermal and mechanical interactions in statistical physics
Week 8	absolute temperature and equations of state
	Derivation of laws of thermodynamics
Week 9	System in contact with heat reservoir and canonical ensemble
	Partition Function
Week 10	Partition function and its relationship with thermodynamical variables
	Examples ideal gas
Week 11	Collection of simple harmonic oscillators

	Pauli and Van Vleckparamagnetization
Week 12	Theorem of equipartition of energy
	Classical Statistics: Maxwell-Boltzmann distribution
Week 13	Quantum Statistics:
	Bose-Einstein distribution
Week 14	Fermi- Dirac and Planck's distributions
	Back body radiations
Week 15	Bose-Einstein condensation
	Gas of electrons in solids
Week 16	Description of phase transitions in statistical physics and its types
	Ising model

Textbooks and Reading Material

1. Fundamental of Statistical and Thermal Physics, R. Reif, *McGraw-Hill* (1988).
2. Elementary Statistical Physics, C. Kittle, *Dover Publications* (1958).
3. Statistical and Thermal Physics, H. Gould and I. Tobochnik, *Princeton University Press* (2010).
4. Statistical Physics, Gregory H. Wannier, *Dover Publications, Inc., New York* (1987).

Teaching Learning Strategies

The instructor is required to make use of Mathematica/Maple/Python to teach the concepts through visualization/antimutation and symbolic/numerical calculations. The students are required to solve a large portion of related exercises/questions/problems of the main textbooks.

Assignments: Types and Number with Calendar

At least two assignments and two quizzes. A course project may also be assigned.

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.