Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Statistical Mechanics	PHYS604	3	-	3	8	1st	2nd	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	45	Preparation for classes	106
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	25
		Study for exam	48
Total	50	Total	179
Total Learning Hours = 229		Equivalent ECTS points = Total LH/28 = 8	

BRIEF COURSE DESCRIPTION

- This course covers topics such as Review of classical physics: basic idea of statistics and thermodynamics; Kinetic theory of gas: phase space representation, Liouville's theorem, statistical ensembles, relation with thermodynamics, partition function, application of partition function, equipartition theorem; Quantum statistical mechanics: density matrix, expectation value, statistical ensembles, quantum statistical formulations, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics, idea gas (ideal Bose and ideal Fermi), relation with statistics.

COURSE OBJECTIVES

1. **The main objectives of this course are focused on the following:**
2. Apply the basic relation of statistical and thermodynamic concepts in both classical and quantum regimes.
3. Distinguish between the interpretations in terms of classical and quantum statistical mechanics.
4. Perform relevant parameters using the methods of statistical mechanics.
5. Describe the theoretical and mathematical background of statistical mechanics.
6. Apply methods of statistical mechanics to study physical systems.

COURSE CONTENTS

- Short review of statistical physics: Review of preliminary concepts and description of systems in statistical mechanics, correlations, central limit theorem.
- Kinetic theory of gas: Kinetic theory, phase space, Liouville's theorem, the Boltzmann equation, transport phenomena; Classical statistical mechanics, phase space dynamics and entropy, the micro-canonical ensemble, canonical and grand-canonical ensembles, equi-partition theorem, Maxwell-Boltzmann distribution.
- Quantum statistical physics: Quantum statistical Mechanics, quantization effects, Bose-Einstein and Fermi-Dirac statistics, density matrix formulation, quantum gases, Fermi liquids, Bose condensation.

ASSESSMENT CRITERIA

- Mid-Term exams: 30 %
- Assignments, classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Discussion, Tutorial, Expository and Discovery, and Interactive Discussions.

TEXT BOOK

- R. K. Pathria and P. D. Beale, Statistical Mechanics, (Butterworth-Heinemann, 2011).

REFERENCE BOOKS

- M. Kardar, Statistical Physics of Particles (Cambridge University Press, 2007).
- D. A. McQuarrie, Statistical Thermodynamics (University Science Book 2000).
- K. Huang, Statistical Mechanics, 2nd edition (John Wiley and Sons, 1987).