Course Specifications

General Information

Course name	Statistical Physics
Course number	PHYS2310
Faculty	
Department	
Course type	College Needs
Course level	2
Credit hours (theoretical)	3
Credit hours (practical)	0
Course Prerequisites	

Course Objectives

1 - Apply thermodynamic principles and the standard formulae to analyze thermal behavior of simple physical systems.

2 - Explain the origin of the laws of thermodynamics from the fundamental principles of equilibrium statistical mechanics.

3 - Compute various thermodynamic properties of idealized simple classical and quantum mechanical systems using standard techniques, such as the partition function and the grand partition function.

4 - Learn how the computed results relate to understanding of thermal properties of a wide variety of physical systems, such as clasical and quantum gases, crystalline solids, magnetic systems, thermal radiation, electrons in metals .

Intended Learning Outcomes

Knowledge and Understanding

* define and discuss the concepts of microstate and macrostate of a model system
* define and discuss the concepts and roles of entropy and free energy from the view point of statistical mechanics
* define and discuss the Boltsmann distribution and the role of the partition function
* apply the machinery of statistical mechanics to the calculation of macroscopic properties resulting from microscopic models of magnetic and crystalline systems
* discuss the concept and role of indistinguishability in the theory of gases; know the results expected from classical considerations and when these should be recovered
* define the Fermi-Dirac and Bose-Einstein distributions; state where they are applicable; understand how they differ and show when they reduce to the Boltsman distribution
* apply the Fermi-Dirac distribution to the calculation of thermal properties of elctrons in metals
* apply the Bose-Einstein distribution to the calculation of properties of black body radiation

Course Contents

1 - the canonical ensemble, grand and other ensample, fluctuation, Boltzmann statistics, Fermi-Dirac statistics and Bose-Einstein statistics, ideal monatomic gas, ideal diatomic gas, classical statistical mechanics, ideal polyatomic gas, Einstein and Debye theories of the specific heat of crystals, phonons.

Teaching and Learning Methods

1 - lecturing and homeworks

Students Assessment

Assessment Method	TIME	MARKS
Midterms	60 minute each	40
quiz		10

Books and References

Essential books	McQuarrie, Donald A. (1975). Statistical mechanics. New York: Harper & Row. ISBN 0-06-044366-9. 2e (2000) Sausalito, Calif.: University Science ISBN 1-891389-15-7
Recommended books	Pathria, R. K. (1972). Statistical Mechanics. Oxford: Pergamon. ISBN 0-08-016747-0. 2e (1996) Oxford: Butterworth-Heinemann (now Elsevier) ISBN 0-7506-2469-8
	Reif, Frederick (1965). Fundamentals of Statistical and Thermal Physics. McGraw-Hill. ISBN 0-07-051800-9.
	Reichl, Linda E (1980). A modern course in statistical physics. London: Edward Arnold. ISBN 0-7131-2777-5. ISBN 0-7131-3517-4. ISBN 0-7131-2789-9. ISBN 0-292-75051-X. ISBN 0-292-75080-3.