INTRODUCTION TO (EQUILIBRIUM) STATISTICAL MECHANICS

The aim of this course is to provide an introduction to the basic ideas of statistical mechanics for graduates in science (Chemistry, Biochemistry, Chemical engineering...). This course is not intended for graduates in physics who have studied these concepts during the degree.

Topics:

1. Principle of Maximum Entropy.
   Microcanonical ensemble.
   Application: defects in solids.

2. Maxwell-Boltzmann Distribution.
   Canonical ensemble. Equipartition theorem.
   Application: Ideal gas and paramagnet. Diatomic and polyatomic molecules.

3. Thermodynamic potentials.
   Free energy.
   Application: unzipping the DNA.

4. Chemical potential.
   Grand canonical ensemble.
   Law of mass action. Chemical equilibrium. Adsorption.
   Applications: fluctuations. Equilibrium constants.

5. Systems in interaction. Mean field.
   Ising Model.
   Van der Waals Gas.
   Classic and quantum ferromagnet.
   Landau Theory.
   Applications: First and second order transitions. Binary mixture.

6. Quantum Statistical Mechanics.
   Statistics of Bosons and fermions.
   Applications: Heat capacity at low temperatures. Black body radiation.

Bibliography

-"Lectures on Statistical Physics and Protein Folding", Kerson Huang, World Scientific (2005)

-"Introduction to modern statistical mechanics", D. Chandler, Oxford University Press (1987)

-" Statistical Mechanics & Properties of Matter. Theory and Applications", E.S.R. Gopal, John Wiley & Sons (1974)

-" Thermal Physics" D. V. Schroeder, Addison Wesley (2000).

-"Curso de Física Estadística", J. Ortin y J.M. Sancho. Edicions UB (2006).

Evaluation: The final grade is the weighted average of the continuous evaluation obtained from the delivery of exercises, development of topics, class participation..., (60%), and a final written

exam (40%).