10702-721(16) Statistical Physics B (3 l,3 p)

2014

Course summary:

Phase transitions and critical phenomena, phenomenological theories (Landau-Ginsburg, scaling hypothesis), simple model systems, approximation methods (mean field theory, self-consistent approach). Statistical physics of liquid crystals and polymers. Simulation methods. Dynamic correlation and response functions, Langevin theory, stochastic differential equations (Fokker-Planck equations).

Outcomes of course:

The student will develop an understanding of both the formal aspects of statistical mechanics and of applying these in order to understand real systems. The concept of scaling in phase transitions will feature strongly. The student will also develop skills in the most important approximation methods in statistical physics.

Lecturer:

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Course content:

Formal aspects of statistical physics are covered, i.e, statistical ensemble theory. The role of interactions is investigated firstly using the Mayer cluster expansion method. The role of interactions is further investigated by the study of phase transitions using mainly the Ising model as a prototype and scaling laws are introduced. Several approximation methods are discussed. Finally, Langevin dynamics, the fluctuation-dissipation theorem and Boltzmann's *H*-theorem are treated as an introduction to nonequilibrium statistical mechanics

Practical (Tutorials):

Weekly tutorials for discussion of homework and any additional problems take place as per honours timetable.

Study material:

Various books are recommended, *but not prescribed*: J. Yeomans ***"Statistical Mechanics of Phase transitions"***, Clarendon (Oxford), 1992. R.K. Pathria ***"Statistical Mechanics"***, Pergamon (Oxford), 1972. These references and other literature for consultation during the course will be made available in the reserve section in the Departmental Library.

Learning opportunities:

Lectures, discussions and tutorials as per **honours course schedule.**

Assessment:

Methods of Assessments
Assessment is based on continuous assessment, comprising two exams taken orally, at least two group presentations and four or more in-class advanced assignments.

Venue and time of assessment opportunities
See timetable

Availability of marks:
Immediately following assessment

Calculation of final mark for the module:
Oral exams 1/3, Group presentations 1/6, advanced assignments 1/2.