האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

SELECTED TOPICS IN STATISTICAL THERMODYNAMICS - 69677

Last update 01-11-2023

HU Credits: 2

Degree/Cycle: 2nd degree (Master)

Responsible Department: Chemistry

Academic year: 0

Semester: 2nd Semester

Teaching Languages: Hebrew

Campus: E. Safra

Course/Module Coordinator: Prof Avinoam Ben-Shaul

Coordinator Email: avinoambs@mail.huji.ac.il

Coordinator Office Hours: Sunday 12-14

Teaching Staff:
Prof Avinoam Ben-Shaul

Course/Module description:
Study of important topics not included in elementary courses

Course/Module aims:
Advancing the knowledge and understanding of classical and statistical thermodynamics, obtaining tools for advanced research

Learning outcomes - On successful completion of this module, students should be able to:
Application of Statistical methods
Probability calculations
Deriving thermodynamic functions
Understanding statistical ensembles
getting familiar with polymer chain models
Application of approximation methods
Understanding phase transitions

Attendance requirements(%):
Free attendance

Teaching arrangement and method of instruction: Lecture, seminar, exercises

Course/Module Content:
Selected Topics in Statistical Thermodynamics
1. Recap: Statistical probability distributions, Ensembles, Fluctuations
2. Self-Assembly, Debye-Hückel theory of Ionic Solutions,
Debye model for the Heat Capacity of Solids
3. Phase transitions: Role of dimensionality.
Exact solutions: Tonks gas, 1D Ising model; Bose-Einstein Condensation
4. Mean-field and Landau theories of phase transitions: vdW and lattice models
Critical behavior and exponents
5. Liquids: Correlation and distribution functions and Scattering
6. Isotropic-Nematic transition of liquid crystals:
Onsager, Maier-Saupe, and Landau theories.
7. Scaling and Renormalization Group.
8. Laser cooling and Bose-Einstein condensation.

Required Reading:
The books of Hill, Reif, Chandler and others

Additional Reading Material:
Will be given as course evolves

Grading Scheme:
Essay / Project / Final Assignment / Home Exam / Referat 60 %
Presentation / Poster Presentation / Lecture/ Seminar / Pro-seminar / Research proposal 30 %
Active Participation / Team Assignment 10 %

Additional information: