LEARNING MODULE DESCRIPTION

GENERAL INFORMATION

1. Module title: Statistical Physics
2. USOS code: 04-W-STPH-45
3. Term: Spring
4. Duration: 45 (30 lectures+15 classes)
5. ECTS: 5.0
6. Module lecturer: Przemyslaw Chelminiak
7. E-mail: geronimo@amu.edu.pl
8. Language: English

DETAILED INFORMATION

1. Module aim (aims)
   Transfer of knowledge in the field of basic theoretical methods used in research of multiparticle classical and quantum systems.
   Development of skills concerning the analysis and solution of problems related to statistical physics.

2. Pre-requisites in terms of knowledge, skills and social competences (where relevant)
   Foundations of thermodynamics, theory of probability and calculus.

READING LIST

S. J. Blundell, K. L. Blundell, Concepts in Thermal Physics, Oxford University Press 2003.
S. R. A. Salinas, Introduction to Statistical physics, Springer 2001.
D. Yoshioka, Statistical Physics. An Introduction, Springer 2007.
M. V. Sadovskii, Statistical Physics, De Gruyter 2012.

SYLLABUS:

Week 1: Introduction to statistical physics. Some examples
Week 2: Statistical methodology. Classical and quantum systems
Week 3: Microscopic description of a microscopic system. Phase space, Liouville's theorem and evolution of the density function, equilibrium systems, relevant constants of motion
Week 4: Statistical Gibbs ensembles: microcanonical, canonical and grand canonical ensembles
Week 5: Practical cases: ideal gas and ideal paramagnetic
Week 6: Quantum Gibbs ensemble. N-particle quantum systems, identical particles, statistical spin theorem, fermions and bosons
Week 7: Density operator. Pure states and mixtures
Week 8: Statistical description of a subsystem as a part of a system, partial trace concept
Week 9: Quantum microcanonical, canonical and grand canonical ensembles
Week 10: Fluctuations
Week 11: Ideal gas of bosons. Photons and blackbody radiation
Week 12: Phonons and vibrations in a crystalline solid and their contribution to the heat capacity
Week 13: Ideal gas of fermions. Magnetic properties, paramagnetism and diamagnetism
Week 14: Ferromagnetism
Week 15: Other applications of the fermion gas