Level: master

Course title: Phase Transition Theory

Status: obligatory

ECTS: 8

Requirements: all common and module specific subjects in previous four years

Learning objectives

Students are introduced to both common and specific features of various phase transitions. They are also introduced to various theoretical models and the application of the methods of statistical physics.

Learning outcomes

After taking the course, the student should have developed:

General capabilities: basic knowledge of this field, following the literature, analysis of various solutions and the choice of the most adequate solution, application in practice and other subjects. **Subject-specific capabilities:** assigning the corresponding model to particular phase transition; the estimate of transition temperature in various approximations; the estimate of critical indices in various approximations.

Syllabus

Theoretical instruction

The description of the thermodynamic system in terms of thermodynamic potentials. Phase transitions. Classification of phase transitions in terms of order parameter behaviour. Phase transitions of I and II order. Critical phenomena. Classical approach. Liquid and magnetic systems. Ferroelectrics. Modern approach to the study of critical phenomena. Critical exponents and inequalities with critical exponents. Universality. Scaling hypothesis. Critical exponents and exact relations among them. Critical and tricritical point.

Classical theories of cooperative phenomena: van der Waals theory, method of molecular (mean) field, pair correlation function in the theory of Ornstein-Zernike. Ising model. Landau phenomenological theory of phase transitions.

Modern theories of critical phenomena. Model systems and exactly soluble cases. Kadanoff scaling hypothesis. Wilson formulation of Kadanoff theory. Renormalization group quations and statistical sum. Dimensionality as continual parameter.

Practical instruction

Homework and seminars.

Weekly teaching load

Lectures: Exercises: Other forms of Student research:	
3 2 teaching: 0	

Other