Level: PhD

Course title: Phase Transitions and Critical Phenomena

Status: elective

ECTS: 15

Requirements: Bachelor degree

Learning objectives

Students should become familiar with both common and specific features of various phase transitions. They also learn about different theoretical models and the application of statistical physics methods.

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 a particular transition, independent estimate of transition temperature in various approximations; the estimate of critical indices in various approximations.

Syllabus

Theoretical instruction

Basic concepts in phase transitions. Critical phenomena. Modern approach to the study of the critical phenomena. Critical exponents and their inequalities. Universality. Scaling hypothesis. Exact relations between critical exponents. Critical and tricritical point.

Ginzburg – Landau- Wilson theory of phase transitions: examples of physical systems. Model systems and exactly soluble cases. Modern theories of critical phenomena. Renormalization group equations and statistical sum. Dimensionality as a continual parameter. Kosterlitz-Thouless transition, vortices and spin waves. Quantum phase transitions.

Practical instruction

Homework and seminars.

Weekly teaching load				Other:
Lectures: 4	Exercises:	Other forms of teaching:	Student research: 6	