Level: master

Course title: Nonlinear Phenomena in Condensed Media

Status: elective

ECTS: 9

Requirements: bachelor degree

Learning objectives

Obtaining the basic knowledge from nonlinear physics.

Learning outcomes

After taking the course, the student should have developed:

General abilities: 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 abilities**:

- basic equations used in nonlinear physics (sine-Gordon, nonlinear Schroedinger equation);
- soliton solutions of given equations;
- application of the soliton model in biophysics;
- dynamics of domain walls in ferromagnetics and ferroelectrics.

Syllabus

Theoretical instruction

Nonlinear Toda–lattice and Toda solitons: application to heat conduction. Applications in biophysics; alpha helix. Sine-Gordon nonlinear equation. Solution of magnetic type; solutions of electric type. Dislocations dynamics in crystal; the motion of Bloch waves. Tunnelling Josephson effect in superconductors. Double-well potential in quasionedimensional structures. Domain wall dynamics in ferromagnets and ferroelectrics. Kink-soliton excitation in biological structures. Cubic nonlinear Schroedinger equation. Optical self-focusing and Langmuir waves in plasma. Morse potential and applications in biophysics.

Practical instruction

Problem solving.

Weekly teaching load				Other:
Lectures:	Exercises:	Other forms of	Student research:	
3	1	teaching: 1		