Study programme(s): Applied Mathematics (MB)

Level: master

Course title: Relativity theory (ФДОИ18И12)

Status: elective

ECTS: 6

Requirements: Mathematics I, Mathematics II, Mechanics

Learning objectives

Becoming familiar with the basic concepts of theory of relativity of students of physics and astrophysics. Elaborating the concept of time, space and causality. Expanding intellectual horizon and qualifying for facing open problems at front of scientific ideas.

Learning outcomes

After taking the course, students should have developed:

General abilities: basic knowledge in the area, application in other subjects, following expert literature, analysis of different solutions and the selection of the most adequate solutions, finding solutions.

Subject-specific abilities: getting familiar with the basic ideas of kinematics, dynamics and electrodynamics of special theory of relativity (STR). Adopting mathematical tool- tensor calculus, as a facility to understand and formulate ideas of STR, but also as a technique for serious approach to further relativistic disciplines.

Syllabus

Theoretical instruction

Introduction. Michelson-Morley experiment. Attempts of overcoming contradictions. The basic ideas of Einstein theory of relativity, postulates of special theory of relativity. (4) Lorenz transformation. Consequences of Lorenz transformation. (3) Minkowski space. Scalars, vectors and tensors in Minkowski space. Covariant and contravariant quantities. Kinematic and dynamic elements of particle in Minkowski space. Covariant formulation of physical laws. (4) Relativistic mechanics. Covariant formulation of laws of mechanics. (4) Relativistic kinematics. The basic equations of dynamics in covariant form. Energy and momentum. Relativistic dynamics of collisions. (5)

Covariant formulation of electrodynamics of vacuum. Covariant formulation of equations of electromagnetic potentials. Covariant formulation of Maxwell equations for vacuum. (5) Covariant formulation of electrodynamics of material medium. Covariant formulation of Lorenz force. Motion of charge particle in electromagnetic field. (5)

Practical instruction

Problem solving sessions.

Weekly teaching load				Other:
Lectures: 3	Exercises: 2	Other forms of teaching:	Student research:	