Course Unit Descriptor

Study Programme: Physics, Professor of Physics

Course Unit Title: Fundamentals of mathematical physics

Course Unit Code: F18OMATF

Name of Lecturer(s): Associate Professor Slobodan Radošević

Type and Level of Studies: Bachelor Academic Degree

Course Status (compulsory/elective): Compulsory

Semester (winter/summer): Summer

Language of instruction: English

Mode of course unit delivery (face-to-face/distance learning): Face-to-face

Number of ECTS Allocated: 6

Prerequisites: Mathematical methods I, Mathematical methods II, Mathematical methods III

Course Aims: The aim of the course is to enable students to apply advanced mathematical knowledge from linear algebra, vector, tensor and functional analysis.

Learning Outcomes: After taking the course, students 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 capabilities:
- mastering the elements of linear algebra, tensor and functional analysis;
- understanding the concepts of vector space and dual vector space and their application in classical and quantum physics;
- understanding the concept of eigenproblem and several methods for its solution.

Syllabus:

Theory

Finite-dimensional vector spaces: Vector; the notion and basic operations. Dual vectors and dual vector space. Operations on vector spaces (direct sum and tensor product of vector spaces). General tensors in vector spaces; linear operators.

Unitary and Euclidean spaces. Eigneproblem in complex and real space. Vector analysis and curvilinear coordinates.

Tensor analysis.

Infinite-dimensional vector spaces: Vectors, dual vectors and linear operators in Hilbert space. Eigneproblem in Hilbert space. Some application of functional analysis on quantum mechanics: Schrodinger equation and eigen problem of the Hamilton operator (stationary states): solutions for LHO and hydrogen-type atom. Special functions (Hermite, Legendre and Laguere functions).

Practice

Problem solving.

Required Reading:

1. G. Arfken, H. Weber: Mathematical methods for physicists, Academic Press (2001).
2. S. Hassani: Mathematical physics, Springer-Verlag (1999).

Weekly Contact Hours:	**Lectures:** 3	**Practical work:** 3

Teaching Methods: Lectures

Knowledge Assessment (maximum of 100 points):

Pre-exam obligations	points	**Final exam**	points
Active class participation		written exam	20

Practical work		oral exam	50
Preliminary exam(s)	30	…….	
Seminar(s)			
The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.			