Course Unit Descriptor

Study Programme: Physics, Professor of Physics

Course Unit Title: Mathematical physics

Course Unit Code: F18MATF

Name of Lecturer(s): Assistant Professor Petar Mali

Type and Level of Studies: Bachelor Academic Degree

Course Status (compulsory/elective): Elective

Semester (winter/summer): Winter

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 and Fundamentals of mathematical physics.

Course Aims: The aim of the course is to enable students to apply advanced mathematical knowledge from integral transformation and equations, special functions and group theory.

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 integral transformations and equations, special functions and group theory;
- understanding the concepts and application of this tools in physics;

Syllabus:

Theory

Integral transformations (Fourier, Laplace): definitions, properties, application on solving ordinary and partial differential equations. Integral equations. Classification. Volterra and Fredholm equation with difference kernel. Method of succesive approximation. Method of resolvent. Gauss hypergeometric equation. Gauss hypergeometric function. General hypergeometric functions. Bessel differential equation and Bessel functions. Finite groups. Dihedral groups. Homomorphism and isomorphism of groups. Theory of representation. Equivavelent representations. Irreducible representations. Direct sum and direct product of representations. Characters of representations. Lie groups. Generators. Groups of translations. Rotation groups.

Practice

Problem solving. Homeworks. Seminars.

Required Reading:

1. G.Arfken and H.Weber, Mathematical Methods for Physicists, Academic Press, San Diego, London 2001.
2. M. Stone and P. Goldbart, Mathematics for Physicist, A Guided Tour for Graduate Students, Cambridge University Press, 2009.
3. M. Hamermesh, Group Theory and its Application to Physical Problems, Dover Publications, 1989.
4. W. Greiner, B. Muller, Quantum Mechanics: Symmetries, Springer, 2nd edition, 2004.

Weekly Contact Hours:	**Lectures:** 3	**Practical work:** 2

Teaching Methods: Lectures

Knowledge Assessment (maximum of 100 points):

Pre-exam obligations	points	**Final exam**	points
Active class participation	5	written exam	20
Practical work		oral exam	50
Preliminary exam(s)	20	…….	
Seminar(s)	5		
The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.			