Level: bachelor

Course title: Mathematical physics

Course leader: Petar Mali

Status: Elective

ECTS: 6

Requirements: Mathematical methods I, Mathematical methods II, Mathematical methods III and Fundamentals of mathematical physics.

Learning objectives

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

Theoretical instruction

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.

Practical instruction

Problem solving. Homeworks. Seminars.

Reading list:

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.
5. V. Urumov, Matematička fizika, Prosvetno delo Skoplje, 1996.

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