Study programmes: PhD studies – Mathematics, Applied mathematics

Course name: Selected Chapters of the Theory of Extremal Problems

Lecturers: Sandra Živanović, Aleksandra Delić

Status: Optional

ECTS: 9

Attendance prerequisites: Optimal Control

Course aims: Introduction to the convex analysis and extremal problems that relate to it.

Course outcome: After completing this course, the student should know separation theorems of convex sets in linear topologic spaces, duality of convex functions, subdifferentials of convex functions and the application of convex analysis in the study of problems of convex programming, linear programming, and Lyapunov's problem.

Course content: **Convex sets**. Concept and basic properties. Convex sets in linear topological spaces. Convex envelope. Theorems on the separation of convex sets.
Convex functions. Concept and basic properties. Continuity of convex functions. Operations with convex function.
Duality of convex functions. The Jung-Fenchel transformation. Basic properties of dual functions. The Fenchel-Moreau theorem. Duality and operations with convex functions**.**
Local convex analysis. Homogeneous functions. Derivative of function in direction. The concept of subdifferential. Basic theorems on subdifferentials. The Moreau-Rockafellar theorem
The problem of convex programming. Formulation of the problem. Kun-Taker's theorem. The method of perturbation and the theorem of duality.
Linear programming problem. Existence of the solution. The duality theorem.
Lyapunov's problem. Solving the problem of optimal linear control by the phase variable on Lyapunov's problem. The Lyapunov theorem on vector measures. Necessary and sufficient conditions for Lyapunov's problem.

Literature:
1. А.Д. Иоффе, В.М. Тихомиров, *Теория экстремальных задач*, Москва, 1974.
2. В.М. Алексеев, В.М. Тихомиров, С.В. Фомин, *Оптимальное управление*, Москва, 1979.

Number of hours: 10	**Lecures: 4**	**Tutorials: 6**	**Laboratory: -**	**Research: -**

Teaching and learning methods: Frontal / Individual / Interactive / Tutorials / Lectures / Exercises

Assessment (maximal 100 points)

Course assignments	**points**	**Final exam**	**points**
Lectures	-	Written exam	-
Exercises / Tutorials	-	Oral exam	70
Colloquia	30	Written-oral exam	-
Essay / Project	-		