Study programmes: Master studies – Mathematics	
Course name: CODE – Optimal Control	
Lecturers: Aleksandra Delić, Sandra Živanović	
Status: Optional	
ECTS: 6	
Attendance prerequisites: Analysis 3, Variational Calculus	

Course aims: Introduction to the problems of modern variational calculus and optimal control.

Course outcome: After completing this course, the student should be able to solve Bolza type problems in variational calculus and optimal control.

Course content:

Additional lessons about normed spaces. Product of normed spaces. Polylinear operators. Series in normed spaces. Isomorphism between normed spaces and inversion operators.

Differentiation of vector valued functions of a real variable. Concept and basic properties of the derivative of the vector valued function of a real variable. A generalisation of the Lagrange mean value theorem.

Differentiation of vector functions of vector variables. Concepts of a weak, strong and strict derivative. Derivative of a sum of functions. Derivative of the composition of functions. A mean value theorem. Continuous differentiability. Partial derivatives. The case when a domain is a subset of products of normed space. The case when the codomain is the product of the normed space. Implicit function. Jacobi's matrix. Gradient.

The spaces of smooth functions of the kth-order. Definition and basic properties. Relations between spaces of smooth functions of the kth order. Nemicky operator.

Bolza problem in a variational calculus. Formulation of a problem and optimality in a weak sense. Necessary and sufficient conditions of optimum. Application of general theory to the classical problems of the variational calculus.

Bolza problem in optimal control. Formulation of a problem and optimality in a strong sense. Pontryagin's maximum principle as a necessary condition for optimality (without proof). Sufficient conditions for some optimum. Application of the maximum principle to the simplest problem of the variational calculus.

Literature:

В.М. Алексеев, В.М. Тихомиров, С.В. Фомин, Оптимальное управление, Москва, 1979.
В.М. Алексеев, Э.М Галеев, В.М. Тихомиров, Сборник задач по оптимизации, Москва, 1984.

Number of hours: 5	Lecures: 3	Tutorials: 2	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	30	
Exercises / Tutorials	-	Oral exam	40	
Colloquia	30	Written-oral exam		
Essay / Project	-			