Study programme(s): Mathematics (M3)

Level: bachelor

Course title: Metric and normed spaces (M3-14)

Lecturer: Miloš S. Kurilić

Status: obligatory

ECTS: 7

Requirements: none

Learning objectives:
Consolidation of the knowledge concerning metric and normed spaces (obtained in courses in mathematical analysis) in a more general level. Getting new knowledge (for example about infinitely dimensional linear spaces) necessary for understanding several subjects (e.g. Topology, Functional analysis, Theory of measure and integration, Operator theory).

Learning outcomes:
Minimal: Understanding the structures of metric and normed spaces. Ability to work in the spaces of sequences and functions.
Desired: Ability to apply the techniques of successive approximations and Hilbert spaces in solving equations.

Syllabus:
Theoretical instruction: Cardinal number. Operations with cardinal numbers. Infinite, countable, uncountable sets. Cantor's theorem. Continuum.
Topological space. Neighbourhoods. Hausdorff and normal space. Convergence of sequences. Closure and derivative of a set. Separability. Continuity and sequential continuity.
Metric space. Equivalent matrices. Metric spaces are normal and first countable. Closure and derivative of a set. Separability. Continuity, uniform continuity. Convergence of sequences. Product of metric spaces.
Continuity of a metric. Compactness of a metric space. Mappings of compact sets. Continuity. Metric and topological properties. Completeness. The space BC(X,R). Completion of a metric space. The Banach fixed point theorem. Normed space. Continuity of the operations and norm. Continuity of a linear mapping. The norm on L(X,Y). Completeness of L(X,Y). Finitely dimensional normed spaces. The inverse operator theorem. Pre-Hilbert and Hilbert spaces. Maximal and complete orthonormal system. Separable Hilbert space. Complete orthonormal system. Fourier coefficients. Congruence with l^2.
Practical instruction-Exercises: Analysis of several spaces and mappings.

Literature
1. O. Hadžić, S. Pilipović, Uvod u funkcionalnu analizu, Novi Sad, 1996.
2. LJ. Gajić, M. Kurilić, S. Pilipović, B. Stanković, Zbirka zadataka iz funkcionalne analize, Novi Sad, 2000.

Weekly teaching load				Other:
Lectures: 3	Exercises: 3	Other forms of teaching:	Student research:	

Teaching methodology:
Lectures: Theoretical basis. Exercises: analysis of several normed spaces and their mappings through exercises.

Grading (maximum number of points 100)

Pre-exam obligations	**points**	**Final exam**	**points**
Activity during lectures	--------	Written exam	
Practical classes	--------	Oral exam	50
Colloquia	50		