

M138	Operators on normed spaces	L	P	S	ECTS 4
		2	1	0	

Course objectives. The objective of this is to make students familiar with the basic concepts related to bounded linear operators on normed spaces. Special attention will be paid to some of the classical functional analysis theorems and the spectrum of bounded operators. Also, an introduction to the theory of normed algebras will be presented.

Prerequisites. Knowledge of basic results of the Normed spaces.

Course content.

1. Bounded linear operators. Normed space $L(X,Y)$.
2. Continuous sesquilinear functionals on Hilbert space. Adjoint operator. Projectors. Symmetric operators. Unitary operators.
3. Convergence in space $L(X,Y)$. The principle of uniform boundedness. Banach-Steinhaus theorem.
4. Positive operators. Square root of positive operators on Hilbert spaces. Partly isometric operators. Polar form of the operator.
5. Normed algebra. Spectral radius. Regular elements of normed algebras. Spectrum. Spectrum of bounded operators. Spectrum of normal, unitary and self-adjoint operator.
6. Compact operators. Compact operators on Hilbert space. Compact self-adjoint operators.
7. Dual operator for bounded operator.
8. Non-bounded operators.

LEARNING OUTCOMES

No.	LEARNING OUTCOMES
1.	Know basic definitions related to the bounded linear operators on normed spaces.
2.	Know and analyse basic theorems of functional analysis like uniform boundedness theorems.
3.	Present important concepts related to the positive operators and derive second root of the positive operators on Hilbert spaces.
4.	Emphasize basic concepts related to normed algebras.
5.	Know theorems about spectral properties and spectral radius.
6.	Derive conclusions about spectral radius of bounded operator and also of normal, unitary and self-adjoint operators.
7.	Analyse basic properties of compact operators.
8.	Make independent conclusions and prove or disapprove them using previous knowledge.

RELATING THE LEARNING OUTCOMES, ORGANIZATION OF THE EDUCATIONAL PROCESS AND ASSESSMENT OF THE LEARNING OUTCOMES

TEACHING ACTIVITY	ECTS	LEARNING OUTCOME **	STUDENT ACTIVITY*	EVALUATION METHOD	POINTS	
					min	max
Attending lectures and exercises	1	1-8	Lecture attendance, discussion, team work and independent work on given tasks	Attendance lists, tracking activities	0	4
Written exam (Mid-terms)	1	1-8	Preparing for written exam	Evaluation	25	48

Final exam	2	1-8	Revision	Oral exam	25	48
TOTAL	4				50	100

Teaching methods and student assessment. Lectures and exercises are obligatory. The exam consists of a written and an oral part. Upon completion of the course, students can take the exam. Successful midterm exam scores replace the written exam.

Can the course be taught in English: Yes

Basic literature:

1. S. Kurepa, Funkcionalna analiza, Školska knjiga, Zagreb, 1981.
2. G. Bachman, L. Narici, Functional analysis, Academic Press, 1966.

Recommended literature:

1. P. R. Halmos, A Hilbert space problem book, Van Nostrand, 1967.
2. G. K. Pedersen, Analysis NOW, Springer Verlag, 1998.