

| UČNI NAČRT PREDMETA / COURSE SYLLABUS | | | | | | |
|--|---|---|-------------------------------------|------------------------------------|---|-------------|
| Predmet: | | Teorija operatorjev | | | | |
| Course title: | | Operator theory | | | | |
| Študijski program in stopnja Study programme and level | | Študijska smer Study field | | Letnik Academic year | Semester Semester | |
| Magistrski študijski program Finančna matematika | | ni smeri | | 1 ali 2 | prvi ali drugi | |
| Master's study programme Financial Mathematics | | none | | 1 or 2 | first or second | |
| Vrsta predmeta / Course type | | | | izbirni | | |
| Univerzitetna koda predmeta / University course code: | | | | M2123 | | |
| Predavanja Lectures | Seminar Seminar | Vaje Tutorial | Klinične vaje work | Druge oblike študija | Samost. delo Individ. work | ECTS |
| 45 | | 30 | | | 105 | 6 |
| Nosilec predmeta / Lecturer: | | prof. Peter Šemrl, prof. Roman Drnovšek | | | | |
| Jeziki / Languages: | Predavanja / Lectures: | | slovenski/Slovene, angleški/English | | | |
| | Vaje / Tutorial: | | slovenski/Slovene, angleški/English | | | |
| Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: | | | | Prerequisites: | | |
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| Vsebina: | | | | Content (Syllabus outline): | | |
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| <p>Kompaktni operatorji na Banachovih prostorih.</p> <p>Schauderjev izrek o negibni točki.</p> <p>Invariantni podprostori. Izrek Lomonosova. Rieszov razcep kompaktnega operatorja.</p> <p>Fredholmovi operatorji. Calkinova algebra. Bistveni spekter.</p> <p>Parcialne izometrije in unitarni operatorji.</p> <p>Schmidtova reprezentacija kompaktnih operatorjev.</p> <p>Hilbert-Schmidtovi operatorji. Dualnost med algebrami vseh omejenih operatorjev, vseh operatorjev s sledjo in vseh kompaktnih operatorjev.</p> <p>Spekter normalnih operatorjev.</p> <p>Spektralni izrek za normalne operatorje (v obliki operatorja množenja in v integralski obliki).</p> <p>Fuglede-Putnamov izrek.</p> | <p>Compact operators on Banach spaces. The Schauder fixed point theorem.</p> <p>Invariant subspaces. Lomonosov's theorem. The Riesz decomposition of a compact operator. Fredholm operators. The Calkin algebra. The essential spectrum. Partial isometries and unitary operators. The Schmidt representation of a compact operator. Hilbert-Schmidt operators. Duality between the algebra of all bounded operators, the algebra of all trace-class operators and the algebra of all compact operators. The spectrum of normal operators. The spectral theorem for normal operators (in the multiplication operator form and in the integral form).</p> <p>The Fuglede-Putnam theorem.</p> |
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Temeljni literatura in viri / Readings:

- R. Bhatia: Notes on Functional Analysis, Texts and Readings in Mathematics 50, Hindustan Book Agency, New Delhi, 2009.
- J. B. Conway: A Course in Functional Analysis, 2nd edition, Springer, New York, 1990.
- I. Gohberg, S. Goldberg, M. A. Kaashoek: Classes of Linear Operators I, Birkhäuser, Basel, 1990.
- G. K. Pedersen: Analysis Now, Springer, New York, 1996.
- I. Vidav: Linearni operatorji v Banachovih prostorih, DMFA-založništvo, Ljubljana, 1982.

Cilji in kompetence:

Objectives and competences:

Obravnava nekaterih razredov omejenih linearnih operatorjev na Hilbertovih in Banachovih prostorih.

Treatment of some classes of bounded linear operators on Hilbert and Banach spaces.

Predvideni študijski rezultati:

Znanje in razumevanje: Poznavanje osnovnih razredov linearnih operatorjev, sposobnost aplikacije pridobljenega znanja.
 Uporaba: Uporaba teorije operatorjev sega tudi v naravoslovje in druga področja znanosti kot na primer ekonomijo.
 Refleksija: Razumevanje teorije, utrjeno s primeri uporabe.
 Prenosljive spretnosti – niso vezane le na en predmet: Identifikacija in reševanje problemov. Spretnost uporabe domače in tuje literature.

Intended learning outcomes:

Knowledge and understanding: Knowledge of some classes of linear operators, the ability to apply the acquired knowledge.
 Application: Operator theory is used in natural sciences and other areas of science such as economics.
 Reflection: Understanding of the theory, strengthened by examples.
 Transferable skills: Identifying and solving problems. Ability to use a wide range of references.

Metode poučevanja in učenja:

predavanja, vaje, domače naloge, konzultacije

Learning and teaching methods:

Lectures, exercises, homeworks, consultations

Načini ocenjevanja:

Delež (v %) /
 Weight (in %)

Assessment:

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| Način (pisni izpit, ustno izpraševanje, naloge, projekt): | 10% | Type (examination, oral, coursework, project): |
| domače naloge | 50% | homeworks |
| izpit iz vaj | 40% | written exam |

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| ustni izpit | | oral exam |
| Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL) | | Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL) |

Reference nosilca / Lecturer's references:

Roman Drnovšek:

- DRNOVŠEK, Roman. Common invariant subspaces for collections of operators. Integral equations and operator theory, ISSN 0378-620X, 2001, vol. 39, no. 3, str. 253-266 [COBISS.SI-ID 10597721]
- DRNOVŠEK, Roman. A generalization of Levinger's theorem to positive kernel operators. Glasgow mathematical journal, ISSN 0017-0895, 2003, vol. 45, part 3, str. 545-555 [COBISS.SI-ID 12825945]
- DRNOVŠEK, Roman. Invariant subspaces for operator semigroups with commutators of rank at most one. Journal of functional analysis, ISSN 0022-1236, 2009, vol. 256, iss. 12, str. 4187-4196 [COBISS.SI-ID 15167321]

Peter Šemrl:

- ŠEMRL, Peter. Similarity preserving linear maps. Journal of operator theory, ISSN 0379-4024, 2008, vol. 60, no. 1, str. 71-83 [COBISS.SI-ID 15079257]
- ŠEMRL, Peter. Local automorphisms of standard operator algebras. Journal of mathematical analysis and applications, ISSN 0022-247X. [Print ed.], 2010, vol. 371, iss. 2, str. 403-406 [COBISS.SI-ID 15672665]
- ŠEMRL, Peter. Symmetries on bounded observables: a unified approach based on adjacency preserving maps. Integral equations and operator theory, ISSN 0378-620X, 2012, vol. 72, iss. 1, str. 7-66 [COBISS.SI-ID 16568665]