

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)						
<b>Predmet:</b>		Uvod v C* algebre				
<b>Course title:</b>		Introduction to C* algebras				
<b>Študijski program in stopnja</b> Study programme and level		<b>Študijska smer</b> Study field		<b>Letnik</b> Academic year		<b>Semester</b> 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
<b>Vrsta predmeta / Course type</b>				izbirni / elective		
<b>Univerzitetna koda predmeta / University course code:</b>				M2117		
<b>Predavanja</b> Lectures	<b>Seminar</b> Seminar	<b>Vaje</b> Tutorial	<b>Klinične vaje</b> work	<b>Druge oblike</b> študija	<b>Samost. delo</b> Individ. work	<b>ECTS</b>
45		30			105	6
<b>Nosilec predmeta / Lecturer:</b>				prof. dr. Matej Brešar, prof. dr. Bojan Magajna		
<b>Jeziki / Languages:</b>		<b>Predavanja / Lectures:</b> slovenski / Slovene, angleški / English				
		<b>Vaje / Tutorial:</b> slovenski / Slovene, angleški / English				
<b>Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:</b>				<b>Prerequisites:</b>		
Vpis v letnik študija.				Enrolment in the programme.		
<b>Vsebina:</b>				<b>Content (Syllabus outline):</b>		

<p>Banachove algebre: ideali, kvocienti, holomorfen funkcijski račun, šibka* topologija in Banach Alaoglujev izrek, Gelfandova transformacija.</p> <p>C*-algebre: urejenost, približna enota, ideali in kvocienti, karakterizacija komutativnih C*-algeber, zvezen funkcijski račun, stanja in upodobitve, univerzalna upodobitev.</p> <p>Operatorske topologije in aproksimacijski izreki: von Neumannov o bikomutantu, Kaplanskega o gostosti in Kadisonov o tranzitivnosti.</p> <p>Spektralni izrek za omejene normalne operatorje: Borelov funkcijski račun, komutativne von Neumannove algebre, grupna algebra .</p>	<p>Banach algebras: ideals, quotients, holomorphic functional calculus, weak* topology, Banach Alaoglu's theorem, Gelfand's transform.</p> <p>C*-algebras: order, approximate units, ideals, quotients, the characterization of commutative C*-algebras, continuous functional calculus, states and representations, the universal representation.</p> <p>Operator topologies and approximation theorems: von Neumann's bicommutation theorem, Kaplansky's density theorem and Kadison's transitivity theorem.</p> <p>The spectral theorem for bounded normal operators: the Borel functional calculus, commutative von Neumann algebras, the group algebra .</p>
---	---

#### **Temeljni literatura in viri / Readings:**

- G. K. Pedersen: Analysis Now, Springer, Berlin, 1989.
- J. B. Conway: A Course in Functional Analysis, Springer, Berlin, 1978.
- J. B. Conway: A Course in Operator Theory, GSM 91, Amer. Math. Soc., 2000.
- R. V. Kadison in J. R. Ringrose: Fundamentals of the Theory of Operator Algebras I, II, Graduate Studies in Math. 15, 16, Amer. Math. Soc., 1997.
- I. Vidav: Banachove algebre, DMFA-založništvo, Ljubljana, 1982.
- I. Vidav: Uvod v teorijo C\*-algeber, DMFA-založništvo, Ljubljana, 1982.
- N. Weaver: Mathematical Quantization, Chapman & Hall/CRC, London, 2001.

#### **Cilji in kompetence:**

Spoznati osnovna orodja spektralne teorije in njihovo uporabo v C\*-algebrah.

#### **Objectives and competences:**

To master basic tools of spectral theory and their use in C\*-algebras.

**Predvideni študijski rezultati:**

Znanje in razumevanje: pridobljeno osnovno znanje o C\*-algebrah bo koristilo tudi izven matematike, npr. pri razumevanju kvantne fizike.

Uporaba: Pridobljeno znanje bo uporabno tudi drugod v matematični analizi in matematični fiziki.

Refleksija: C\*-algebre so eno temeljnih aktivnih področij sodobne matematike.

Prenosljive spretnosti – niso vezane le na en predmet:

Formulacija in reševanje problemov z abstraktnimi metodami.

**Intended learning outcomes:**

Knowledge and understanding: the basic knowledge on C\*-algebras may be useful also outside of mathematics, for example, it may facilitate the understanding of quantum physics.

Application: The acquired knowledge is applicable elsewhere in mathematics and mathematical physics.

Reflection: C\*-algebras are one of the basic active fields of modern mathematics.

Transferable skills:

An approach to problems using abstract methods.

**Metode poučevanja in učenja:**

predavanja, vaje, domače naloge, konzultacije

**Learning and teaching methods:**

Lectures, exercises, homeworks, consultations

**Načini ocenjevanja:**

Delež (v %) /

Weight (in %)

**Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

izpit iz vaj (2 kolokvija ali pisni izpit)

ustni izpit

Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)

50%

50%

Type (examination, oral, coursework, project):

2 midterm exams instead of written exam, written exam

oral exam

Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

---

**Reference nosilca / Lecturer's references:**

Matej Brešar:

BREŠAR, Matej, KISSIN, Edward, SHULMAN, Victor S. Lie ideals: from pure algebra to C[star]-algebras. Journal für die Reine und Angewandte Mathematik, ISSN 0075-4102, vol. 2008, b. 623, str. 73-121. [COBISS.SI-ID 14931289]

BREŠAR, Matej, ŠPENKO, Špela. Determining elements in Banach algebras through spectral properties. Journal of mathematical analysis and applications, ISSN 0022-247X. [Print ed.], 2012, vol. 393, iss. 1, str. 144-150. [COBISS.SI-ID 16287833]

BREŠAR, Matej, MAGAJNA, Bojan, ŠPENKO, Špela. Identifying derivations through the spectra of their values. Integral equations and operator theory, ISSN 0378-620X, 2012, vol. 73, no. 3, str. 395-411. [COBISS.SI-ID 16339289]

Bojan Magajna:

MAGAJNA, Bojan. The Haagerup norm on the tensor product of operator modules. Journal of functional analysis, ISSN 0022-1236, 1995, let. 129, št. 2, str. 325-348. [COBISS.SI-ID 8098905]

BLECHER, David P., MAGAJNA, Bojan. Duality and operator algebras: automatic weak [ast] continuity and applications. Journal of functional analysis, ISSN 0022-1236, 2005, vol. 224, no. 2, str. 386-407. [COBISS.SI-ID 13633113]

MAGAJNA, Bojan. Fixed points of normal completely positive maps on  $B(H)$ . Journal of mathematical analysis and applications, ISSN 0022-247X. [Print ed.], 2012, vol. 389, iss. 2, str. 1291-1302. [COBISS.SI-ID 16227673]