UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2016/17)			
Predmet:	Izbrana poglavja iz finančne matematike 2		
Course title:	Topics in financial mathematics 2		

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Magistrski študijski program Matematika	ni smeri	1 ali 2	prvi ali drugi
Master's study programme Mathematics	none	1 or 2	first or second

Vrsta predmeta / Course type	izbirni / elective
Univerzitetna koda predmeta / University course code:	M2527

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**	**ECTS**
30	**15**	**30**			**105**	**6**

Nosilec predmeta / Lecturer:	prof. dr. Tomaž Košir, prof. dr. Mihael Perman

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:**
Vpis v letnik študija.	Enrolment in the programme.
Vsebina:	**Content (Syllabus outline):**

Predavatelj izbira med naslednjimi in drugimi aktualnimi temami: Modeli pri upravljanju portfeljev: model povprečje-varianca. Markowitzeva teorija. Razpršenost donosov in njeno merjenje. Optimalne strategije. Teorija vrednotenja brez arbitraže. CAPM model. Enofaktorski in večfaktorski modeli. Modeli Bayesovega tipa. Black- Littermanov algoritem. Enoobdobni in večobdobni modeli. Linearni faktorski modeli. Vrednotenje naložb v zveznem času. Matematični modeli za algoritmično in visokofrekvenčno trgovanje. Potrošnja in naložbe: definicije, optimizacijski problemi, ravnovesje, problemi s stranskimi pogoji, nepolni trgi. Stohastična optimizacija: stohastična teorija upravljanja, Malliavinov račun. Viskoznostne rešitve.	Lecturer can choose amon the following and some other current topics: Portfolio management: mean-variance model. Markowitz theory. Volatility of returns and its measurement. Arbitrage pricing. CAPM model. One and multifactor models. Bayesian models. Black-Litterman algorithm. One period and multiperiod models. Pricing in continuous time. Mathematical models for high frequency trading. Consumption and investment: definitions, optimization problems, general equilibrium, side conditions, incomplete markets. Stochastic optimization: stochastic control theory, Malliavin calculus. Viscosity solutions.

Temeljni literatura in viri / Readings:

I. Aldridge: High frequency trading: A practical guide to algorithmic strategies and trading systems. Wiley, 2013.

M. Capinski, T. Zastawniak, Mathematics for Finance, An Introduction to Financial Engineering, London, Springer, 2. izdaja, 2011.

D. G. Luenberger, Investment science, New York, Oxford University Press, 2. izdaja, 2013.

E. J. Elton, M. J. Gruber, S. J. Brown, W. N. Goetzmann, Modern Portfolio Theory and Investment Analysis, New York, Wiley, 8. izdaja, 2009.

G. Da Prato, Introduction to stochastic analysis and Malliavin calculus, Pisa : Edizioni della Normale, 2. izdaja, 2008.

D. Nualart, The Malliavin calculus and related topics, Berlin, Heidelberg, New York: Springer, 2006.

Cilji in kompetence:	**Objectives and competences:**

Predmet pokriva poglavja iz matematičnih financ, pri katerih se prepleta ekonomsko razmišljanje z zapletenimi matematičnimi orodji. Nekatera poglavja so nadgradnja prejšnjih z dodatnimi interpretacijami, nekatera pa so pomemben del razmišljanja o tveganju. Zaradi nepostredne uporabnosti vsebin bodo pri predmetu sodelovali tudi strokovnjaki iz prakse.	The course covers topics im mathematical finance in which economic reasoning is combined with advanced mathematical tools. Some of them are based on previous courses and give additional interpretation, some contribute to understanding of the risks. Since the content is of great practical importance we expect that also specialists from financial practice will present their work experience during the course.
Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje matematičnih modelov, ki se uporabljajo v matematičnih financah in sredstev za njihovo obravnavo. Uporaba: Pridobljeno znanje je po eni strani neposredno prenosljivo, po drugi strani pa je izhodišče za kobiniranje matematičnega znanja z ekonomskimi vsebinami. Refleksija: Področje, in s tem posledično predmet, združuje številne znanja iz matematike od linearna algebre do parcialnih diferencialnih enačb. Prenosljive spretnosti – niso vezane le na en predmet: Pridobljeno znanje je neposredno uporabno v finančnih ustanovah kot so banke in zavarovalnice. Vsebina predmeta tudi pomaga izostritvi sposobnosti matematičnega modeliranja.	Knowledge and understanding: Understanding of mathematical models used in mathematical finance and the mathematical tools used in solutions. Application: The knowledge and skills acquired are directly transferable and can also serve for combining mathematical reasoning with economic topics. Reflection: The subject of the course, hence the course itself, combines numerous mathematical skills starting from linear algebra to partial differential equations. Transferable skills: The knowledge and skills acquired are immediately applicable in financial institutions such as banks and insurance companies. The content alsoserves to deepen the ability to use mathematical models.

Metode poučevanja in učenja:	Learning and teaching methods:
predavanja, vaje, konzultacije, seminarske naloge	Lectures, exercises, consultations, seminars

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
samostojna seminarska naloga		individual seminar
teoretični del izpita	50%	exam on the course content
Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50%	Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

Tomaž Košir:

BERNIK, Janez, DRNOVŠEK, Roman, KOKOL-BUKOVŠEK, Damjana, KOŠIR, Tomaž, OMLADIČ, Matjaž, RADJAVI, Heydar. On semitransitive jordan algebras of matrices. Journal of algebra and its applications, ISSN 0219-4988, 2011, vol. 10, iss. 2, str. 319-333. [COBISS.SI-ID 15908697]

KOŠIR, Tomaž, OBLAK, Polona. On pairs of commuting nilpotent matrices. Transformation groups, ISSN 1083-4362, 2009, vol. 14, no. 1, str. 175-182. [COBISS.SI-ID 15077977]

BERNIK, Janez, DRNOVŠEK, Roman, KOŠIR, Tomaž, LIVSHITS, Leo, MASTNAK, Mitja, OMLADIČ, Matjaž, RADJAVI, Heydar. Approximate permutability of traces on semigroups of matrices. Operators and matrices, ISSN 1846-3886, 2007, vol. 1, no. 4, str. 455-467. [COBISS.SI-ID 14492761]

Mihael Perman:

PERMAN, Mihael, WELLNER, Jon A. On the distribution of Brownian areas. Annals of applied probability, ISSN 1050-5164, 1996, let. 6, št. 4, str. 1091-1111. [COBISS.SI-ID 7101017]

HUZAK, Miljenko, PERMAN, Mihael, ŠIKIĆ, Hrvoje, VONDRAČEK, Zoran. Ruin probabilities and decompositions for general perturbed risk processes. Annals of applied probability, ISSN 1050-

5164, 2004, vol. 14, no. 3, str. 1378-1397. [COBISS.SI-ID 13168985]

HUZAK, Miljenko, PERMAN, Mihael, ŠIKIĆ, Hrvoje, VONDRAČEK, Zoran. Ruin probabilities for competing claim processes. Journal of Applied Probability, ISSN 0021-9002, 2004, vol. 41, no. 3, str. 679-690. [COBISS.SI-ID 13207641]