

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)						
<b>Predmet:</b>		Finančna matematika 1				
<b>Course title:</b>		Financial mathematics 1				
<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	
Univerzitetni študijski program Finančna matematika		ni smeri		2	drugi	
First cycle academic study programme Financial Mathematics		none		2	second	
<b>Vrsta predmeta / Course type</b>				obvezni / compulsory		
<b>Univerzitetna koda predmeta / University course code:</b>				M0317		
<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>
30		30			90	5
<b>Nosilec predmeta / Lecturer:</b>		prof. dr. Janez Bernik, prof. dr. Tomaž Košir, prof. dr. Mihael Perman				
<b>Jeziki / Languages:</b>		<b>Predavanja / Lectures:</b>		slovenski / Slovene		
		<b>Vaje / Tutorial:</b>		slovenski / Slovene		
<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>Obrestni račun, vrednotenje denarnih tokov, časovna struktura obrestnih mer.</p> <p>Obveznice. Izvedeni finančni instrumenti.</p> <p>Modeli trgov: opis tipov vrednostnih papirjev, diskretni modeli gibanja cen, osnovna izreka vrednotenja.</p> <p>Vrednotenje opcij: definicije opcij, evropske opcije, ameriške opcije, eksotične opcije.</p> <p>Vrednotenje evropskih opcij: Binomski model. Black-Scholesova formula.</p> <p>Optimalne naložbe: pojem strategije, statistični primer, dinamični primer.</p> <p>Ameriške opcije: pogojne terjatve ameriškega tipa, časi ustavljanja, Snellova ovojnica, kupčeva cena, prodajalčeva cena.</p> <p>Stohastične obrestne mere: diskretni modeli, opcije na obrestne mere.</p>	<p>Interest rates, time value of money, term structure.</p> <p>Bonds, financial derivatives.</p> <p>Market model: finite sets of assets, discrete time, The Fundamental Asset Pricing Theorems.</p> <p>Option pricing: definitions, European options, American options, exotic options.</p> <p>Pricing of European options: Binomial model, Black-Scholes Formula.</p> <p>Optimal investment: strategies, static model, dynamic model.</p> <p>American options: American contingent claims, stopping times, Snell envelope, buyer's price, seller's price.</p> <p>Stochastic models of interest rates: discrete models, term rate options.</p>
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### **Temeljni literatura in viri / Readings:**

- P. Koch Medina, S. Merino. Mathematical finance and probability: a discrete introduction. Birkhäuser, 2003.
- J. Hull. Options, futures and other derivatives. Prentice Hall. 8. izdaja, 2011.
- S. E. Shreve. Stochastic calculus for finance 1: The binomial asset pricing model. Springer, 2005.
- S. M. Ross, An elementary introduction to mathematical finance : options and other topics. 2. izdaja, Cambridge University Press, 2003.
- D.G. Luenberger. Investment science. Oxford University Press, 2. izdaja, 2013.
- Z. Bodie, A. Kane, A. Marcus. Investments. 9. izdaja, McGraw-Hill Irwin, Boston, ZDA, 2011.
- B. Steiner. Mastering financial calculations: A step-by-step guide to the mathematics of financial market instruments. 2. izdaja, Financial Times Prentice Hall, 2007.
- M. Capiński, T. Zastawniak: Mathematics for Finance : An Introduction to Financial Engineering, Springer, London, 2005.

J. Y. Campbell, L. M. Viceira: Strategic Asset Allocation : Portfolio Choice for Long-Term Investors, Oxford Univ. Press, Oxford, 2002.

### **Cilji in kompetence:**

Celotni finančni matematiki je skupnih nekaj osnovnih principov. Namen predmeta je predstaviti te principe na diskretnih modelih, kjer je najlažje predstaviti intuitivne ideje. V prvem delu obravnavamo vprašanje naložb. To nas navede na vprašanje modelov trga, optimalne izbire naložb, osnovnega izreka vrednotenja opcij in mer tveganja. Osrednji del je namenjen binomskemu modelu in Black-Scholesovi formuli ter časom ustavljanja in vrednotenju pogojnih terjatev ameriškega tipa. Pomemben element finančne matematike so tudi stohastični modeli obrestnih mer.

### **Objectives and competences:**

There are some fundamental principles underlying the modern financial mathematics. The aim of the course is to present these principles (the law of one price, the no arbitrage condition) in the simplest discrete models. Optimal investment theory leads to market models, the fundamental asset pricing theorem and to option pricing theory. The main topics include binomial model and the Black-Scholes Formula. Stopping times are introduced and pricing of an American claim is presented. Important elements of the theory are also stochastic models for interest rates.

### **Predvideni študijski rezultati:**

Znanje in razumevanje: Razumevanje matematičnih modelov, ki se uporabljajo za vrednotenje finančnih produktov. Razumevanje zveze med izbiro modela in posledicami izbire modela.

Uporaba: Uporabnost konceptov je dana sama po sebi, saj so vse metode neposredno uporabne v finančnem svetu. Poleg tega je ta tečaj osnova za matematično bolj zahtevne modele.

Refleksija: Razumevanje teoretičnih konceptov na številnih primerih iz prakse.

Prenosljive spretnosti – niso vezane le na en predmet: Pridobljene spretnosti so neposredno prenosljive v delovno prakso v finančnih

### **Intended learning outcomes:**

Knowledge and understanding: Understanding of mathematical models that are used in the pricing and hedging on the financial markets. Understanding the relation of model selection and its consequences.

Application: All the methods are directly applicable in the financial markets. They also give a base to study more advanced models.

Reflection: Understanding theoretical concepts in practice.

Transferable skills: The knowledge is directly transferable to the practice in financial institutions, such as banks and insurance companies. Besides the practical aspects also skills of financial modelling are advanced

ustanovah, kot so banke ali zavarovalnice. Poleg praktične vrednosti pa gre za brušenje sposobnosti matematičnega modeliranja.

through the course.

**Metode poučevanja in učenja:**

Predavanja, vaje, konzultacije

**Learning and teaching methods:**

Lectures, exercises, consultations

**Načini ocenjevanja:**

Delež (v %) /  
Weight (in %)

**Assessment:**

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

2 kolokvija namesto izpita iz vaj, izpit iz vaj,

izpit iz teorije

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

theoretical exam

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

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

Mihael Perman:

KOMELJ, Janez, PERMAN, Mihael. Joint characteristic functions construction via copulas. Insurance. Mathematics & economics, ISSN 0167-6687, 2010, vol. 47, iss. 2, str. 137-143. [COBISS.SI-ID 16242777]

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]

Tomaž Košir:

GRUNENFELDER, Luzius, KOŠIR, Tomaž, OMLADIČ, Matjaž, RADJAVI, Heydar. Finite groups with submultiplicative spectra. *Journal of Pure and Applied Algebra*, ISSN 0022-4049. [Print ed.], 2012, vol. 216, iss. 5, str. 1196-1206. [COBISS.SI-ID 16183385]

BUCKLEY, Anita, KOŠIR, Tomaž. Plane curves as Pfaffians. *Annali della Scuola normale superiore di Pisa, Classe di scienze*, ISSN 0391-173X, 2011, vol. 10, iss. 2, str. 363-388. [COBISS.SI-ID 15928409]

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]

Janez Bernik:

BERNIK, Janez, MASTNAK, Mitja. Lie algebras acting semitransitively. *Linear Algebra and its Applications*, ISSN 0024-3795. [Print ed.], 2013, vol. 438, iss. 6, str. 2777-2792. [COBISS.SI-ID 16553561]

BERNIK, Janez, MARCOUX, Laurent W., RADJAVI, Heydar. Spectral conditions and band reducibility of operators. *Journal of the London Mathematical Society*, ISSN 0024-6107, 2012, vol. 86, no. 1, str. 214-234. [COBISS.SI-ID 16357721]

BERNIK, Janez, MASTNAK, Mitja, RADJAVI, Heydar. Positivity and matrix semigroups. *Linear Algebra and its Applications*, ISSN 0024-3795. [Print ed.], 2011, vol. 434, iss. 3, str. 801-812. [COBISS.SI-ID 15745625]