UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)								
Predmet:	Numerične metode v finančni matematiki							
Course title:	Numerical methods for financial mathematics							
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:		M2524						
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. Janez Bernik, prof. dr. Tomaž Košir, prof. dr. Marjeta Krajnc, prof. dr. Mihael Perman, prof. dr. Jaka Smrekar							
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):**

Algoritmi za vrednotenje opcij v diskretnem času. Monte Carlo metode za evropske opcije. Simulacije klasičnih porazdelitev. Metoda inverzne transformacije. Izračun matematičnga upanja. Tehnike za zmanjšanja variance. Drevesne metode za evropske in ameriške opcije. Red konvergence v binomskih metodah. Ocenjevanje občutljivosti. Numerični algoritmi za zaščito portfeljev. Drevesne metode in metode Monte Carlo za eksotične opcije (opcije z mejo. azijske opcije, povratne opcije, mavrične opcije). Monte Carlo metode za ameriške opcije. Metode končnih diferenc za Balck-Scholesovo parcialno diferencialno enačbo.	Algorithms for option pricing in discrete models. Monte Carlo Methods for European options. Simulation methods of classical law. Inverse transform method. Computation of expectation. Variance reduction techniques. Tree methods for European and American options. Conver- gence orders of binomial methods. Estimating sensitivities. Numerical algorithms for portfolio insurance. Tree methods and Monte Carlo methods for Exotic options (barrier options, asian options, lookback options, rainbow options). American Monte Carlo methods. Finite difference methods for the Black-Scholes partial differential equation.

Temeljni literatura in viri / Readings:

J. Hull. Options, Futures, and Other Derivatives. Prentice Hall, 2011.

N. H. Bingham, R. Kiesel. Risk-Neutral Valuation: Pricing and Hedging of Financial Derivatives. Springer Finance, 2004.

P. Glasserman. Monte Carlo Methods in Financial Engineering. Springer, 2003.

Cilji in kompetence:	**Objectives and competences:**
Predmet pokriva poglavja iz matematičnih financ, ki so pomembna za numerične izračune pri vrednotenju izvedenih finančnih instrumentov vseh vrst. Zaradi nepostredne uporabnosti vsebin bodo pri predmetu sodelovali tudi strokovnjaki iz prakse. V okviru seminarskih/projektnih aktivnosti študentje z individualnim delom in predstavitvijo ter delom v skupinah pridobijo izobraževalno komunikacijske in socialne kompetence za prenos znanj in za vodenje	The course covers the chapter of mathematical finance that deal with numerical methods for pricing of derived financial instruments of all kinds. Since the content is of great practical importance we expect that also specialists from financial practice will present their work experience during the course. With individual presentations and team work interactions within seminar/project activities

(strokovnega skupinskega dela).	students acquire communication and social competences for successful team work and knowledge transfer.

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 kombiniranje matematičnega znanja s finančnimi vsebinami. Refleksija: Področje, in s tem posledično predmet, združuje številne znanja iz matematike , predvsem tistih povezanih numeričnimi metodami in teorijo verjetnosti. Prenosljive spretnosti – niso vezane le na en predmet: Pridobljeno znanje je neposredno uporabno v finančnih ustanovah .	Knowledge and understanding: Understanding of mathematical models used in finance. Mathematical tools necessary in modelling. Application: The knowledge is directly usable in practice, it is also the source for combing of mathematical theories with finance. Reflection: The subject connects many mathematical topics, specially those of numerical methods and probablity theory, with application. Transferable skills: The knowledge is directly applicable in everyday practice in financial institutions.

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

Delež (v %) /

Načini ocenjevanja:	Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt): samostojna seminarska naloga ustni izpit Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	 50% 50%	Type (examination, oral, coursework, project): seminar work oral exam Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

Janez Bernik:
BERNIK, Janez, RADJAVI, Heydar. Invariant and almost-invariant subspaces for pairs of idempotents. Integral equations and operator theory, ISSN 0378-620X, 2016, vol. 84, iss. 2, str. 283-288. [COBISS.SI-ID 17449049]
BERNIK, Janez, POPOV, Alexey I. Obstructions for semigroups of partial isometries to be self-adjoint. Mathematical proceedings of the Cambridge Philosophical Society, ISSN 0305-0041, 2016, vol. 161, iss. 1, str. 107-116. [COBISS.SI-ID 17690457]
BERNIK, Janez, MARCOUX, Laurent W., POPOV, Alexey I., RADJAVI, Heydar. On selfadjoint extensions of semigroups of partial isometries. Transactions of the American Mathematical Society, ISSN 0002-9947, 2016, vol. 368, no. 11, str. 7681-7702. [COBISS.SI-ID 17801049]

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]

Marjeta Krajnc:
GROŠELJ, Jan, KRAJNC, Marjetka. C[sup]1 cubic splines on Powell-Sabin triangulations. Applied mathematics and computation, ISSN 0096-3003. [Print ed.], 2016, vol. 272, part 1, str. 114-126. [COBISS.SI-ID 17608537]
KOZAK, Jernej, KRAJNC, Marjetka, VITRIH, Vito. Parametric curves with Pythagorean binormal. Advances in computational mathematics, ISSN 1019-7168, 2015, vol. 41, iss. 4, str. 813-832. [COBISS.SI-ID 1537835204]
KRAJNC, Marjetka, POČKAJ, Karla, VITRIH, Vito. Construction of low degree rational motions. Journal of Computational and Applied Mathematics, ISSN 0377-0427. [Print ed.], 2014, vol. 256, str. 92-103. [COBISS.SI-ID 1024532052]

Mihael Perman:
PERMAN, Mihael. An excursion approach to Ray-Knight theorems for perturbed Brownian motion. Stochastic Processes and their Applications, ISSN 0304-4149. [Print ed.], 1996, let. 63, str. 67-74. [COBISS.SI-ID 7621465]
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]
PERMAN, Mihael, WELLNER, Jon A. An excursion approach to maxima of the Brownian bridge. Stochastic Processes and their Applications, ISSN 0304-4149. [Print ed.], 2014, vol. 124, iss. 9, str. 3106-3120. [COBISS.SI-ID 17154393]
PERMAN, Mihael. A decomposition for Markov processes at an independent exponential time. Ars mathematica contemporanea, ISSN 1855-3974. [Spletna izd.], 2017, vol. 12, no. 1, str. 51-65. [COBISS.SI-ID 17677145]

Jaka Smrekar:
FORSTNERIČ, Franc, SMREKAR, Jaka, SUKHOV, Alexandre. On the Hodge conjecture for q-complete manifolds. Geometry & topology, ISSN 1465-3060, 2016, vol. 20, no. 1, str. 353-388. [COBISS.SI-ID 17622361]
SMREKAR, Jaka. CW towers and mapping spaces. Topology and its Applications, ISSN 0166-8641. [Print ed.], 2015, vol. 194, str. 93-117. [COBISS.SI-ID 17413721]
SMREKAR, Jaka. Turning a self-map into a self-fibration. Topology and its Applications, ISSN 0166-8641. Print ed.], 2014, vol. 167, str. 76-79. [COBISS.SI-ID 16943705]