

| UČNI NAČRT PREDMETA / COURSE SYLLABUS   |                                      |                                     |                              |  |   |             |
|---|--------------------------------------|-------------------------------------|------------------------------|--|---|-------------|
| <b>Predmet:</b>   | Aktuarska matematika                 |                                     |                              |  |   |             |
| <b>Course title:</b>  | Actuarial mathematics                |                                     |                              |  |   |             |
| <b>Študijski program in stopnja</b><br>Study programme and level                      | <b>Študijska smer</b><br>Study field |                                     |                              | <b>Letnik</b><br>Academic year   | <b>Semester</b><br>Semester             |             |
| Magistrski študijski program<br>Matematika  | ni smeri                             |                                     |                              | 1 ali 2  | prvi ali drugi                          |             |
| Master's study programme<br>Mathematics   | none                                 |                                     |                              | 1 or 2   | first or second                         |             |
| <b>Vrsta predmeta / Course type</b>   |                                      |                                     |                              | izbirni  |   |             |
| <b>Univerzitetna koda predmeta / University course code:</b>                          |                                      |                                     |                              | M2516  |   |             |
| <b>Predavanja</b><br>Lectures   | <b>Seminar</b><br>Seminar            | <b>Vaje</b><br>Tutorial             | <b>Klinične vaje</b><br>work | <b>Druge oblike študija</b>  | <b>Samost. delo</b><br>Individ.<br>work | <b>ECTS</b> |
| 30  | 15                                   | 30                                  |                              |  | 105                                     | 6           |
| <b>Nosilec predmeta / Lecturer:</b>   |                                      |                                     |                              | prof. Janez Bernik, prof. Mihael Perman  |   |             |
| <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>  |   |             |
|   |                                      |                                     |                              |  |   |             |
| <b>Vsebina:</b>   |                                      |                                     |                              | <b>Content (Syllabus outline):</b>   |   |             |
| Modeliranje v zavarovalništvu:<br>porazdelitve izgub,<br>izračun agregatnih izplačil, |                                      |                                     |                              | Mathematical models for insurance:<br>loss distribution,<br>methods to compute aggregate payments, |   |             |

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| <p>modeliranje pogostnosti zahtevkov,</p> <p>rekurzivne metode za izračun agregatnih škod,</p> <p>teorija kredibilnosti,</p> <p>verjetnost bankrota,</p> <p>modeli za odvisna tveganja,</p> <p>modeli za ekstremne dogodke,</p> <p>stabilnost.</p> | <p>modeling of the claim frequencies,</p> <p>recursive methods for aggregate loss computation,</p> <p>credibility theory,</p> <p>probability of default,</p> <p>dependent risks modeling,</p> <p>extreme events modeling,</p> <p>stability.</p> |
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### Temeljni literatura in viri / Readings:

H. H. Panjer, G. E. Willmot: Insurance Risk Models, Schaumburg, Society of Actuaries, 1992.

R. Kaas, M. Goovaerts, J. Dhaene, M Denuit: Modern Actuarial Risk Theory, Boston, Kluwer, 2001.

M. Denuit, J. Dhaene, M. Goovaerts, R. Kaas: Dependent Risks, Measures, Orders and Models, Wiley, 2005.

S. A. Klugman, H. H. Panjer, G. E. Willmot: Loss Models : From Data to Decisions, Wiley, 1998.

H. Bühlmann: Mathematical Methods in Risk Theory, Springer, 2005.

P. Embrechts, C. Klüppelberg, T. Mikosch: Modelling Extremal Events for Insurance and Finance, Springer, 1997.

### Cilji in kompetence:

Bolj kompleksni zavarovalni produkti zahtevajo bolj poglobljene matematične modele in bolj rafinirane mere tveganja. Tečaj bo prikazal ustaljene načine matematičnega razmišljanja v zavarovalništvu.

Zaradi nepostredne uporabnosti vsebin bodo pri predmetu sodelovali tudi strokovnjaki iz prakse.

### Objectives and competences:

The complexity of the insurance products requires more and more sophisticated mathematical models and more refined measures of risk. The course will cover current mathematical modelling for insurance. 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:

Znanje in razumevanje: Razumevanje pojma

### Intended learning outcomes:

Knowledge and understanding: Understanding

tveganja in merjenja tveganja je bistvenega pomena za vrednotenje in razvoj zavarovalnih produktov. Za oceno tveganja pa je potrebno razumevanje osnovnih stohastičnih modelov, ki jih uporabljajo aktuarji pri svojem delu.  
 Uporaba: Pridobljeno znanje je neposredno uporabno v zavarovalnem sektorju.

Refleksija: Medigra med uporabo, statističnim modeliranjem, povratno informacijo iz drugih ved in spodbude iz uporabe za matematično razmišljanje.

Prenosljive spretnosti – niso vezane le na en predmet: Spretnosti so prenosljive na druga področja matematičnega modeliranja, še najbolj pa je predmet pomemben zaradi svoje neposredne uporabnosti.

of risks and its measuring is a central issue in pricing and development of modern insurance products. Knowledge of the basic stochastic models for insurance is needed to assess the risks involved.  
 Application: The knowledge is directly applicable in insurance sector of the economy.

Reflection: Interplay between applications, statistical modelling and feedback information from other fields. Mathematical thinking based on concrete applications.

Transferable skills: Skills are transferable to many other fields of mathematical modelling. The value of the course is in concrete applications to insurance.

**Metode poučevanja in učenja:**

predavanja, vaje, domače naloge, konzultacije

**Learning and teaching methods:**

Lectures, exercises, homeworks, consultations

**Načini ocenjevanja:**

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)

Delež (v %) /  
 Weight (in %)  
 50%  
 50%

**Assessment:**

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)

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

Janez Bernik:

- BERNIK, Janez, MASTNAK, Mitja, RADJAVI, Heydar. Realizing irreducible semigroups and real algebras of compact operators. *Journal of mathematical analysis and applications*, ISSN 0022-247X. [Print ed.], 2008, vol. 348, no. 2, str. 692-707. [COBISS.SI-ID 14899289]
- 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]
- 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]

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]