UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Matematično modeliranje v naravoslovju in družbenih vedah
Course title:	Mathematical modeling in life and social sciences

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
drugostopenjski magistrski študijski program Poučevanje	Predmetno poučevanje	1. letnik	zimski
drugostopenjski magistrski študijski program Poučevanje	Predmetno poučevanje	1. letnik	zimski
drugostopenjski magistrski študijski program Poučevanje	Predmetno poučevanje	1. letnik	zimski

Vrsta predmeta / Course type: C - Strokovni izbirni predmet

Univerzitetna koda predmeta / University course code: /

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individ. Work	ECTS
15	15	0	0	0	60	3

Nosilec predmeta / Lecturer:

izr. prof. dr. Marko Slapar
doc. dr. Boštjan Kuzman

Jeziki / Languages		
	Predavanja / Lectures:	slovenščina, angleščina
	Vaje / Tutorial:	slovenščina, angleščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Vpis v študijski program.

Prerequisits:

Enrolment into the study program.

Vsebina:

Deterministični modeli: - modeliranje ene ali več populacij (diskretni modeli, eksponentna rast, logistična rast, Latka-Volterra, simbioza, tekmovanje za vire); - modeliranje tumorjev (von Bertalanffyjev model, Gompertzov model); - modeliranje oboroževalne tekme (Richardsonov model); - modeliranje epidemij in opravljanja (diskreti modeli, SIR model in posplošitve); - epidemiološki modeli za modeliranje opravljanja, širjenja mitov, problema pijančevanja, zombies. Aksiomatski modeli: - volitve (Arrowov izrek nezmožnosti, Gibbard-Satterthwaitejev izrek, liberalni paradox,…); - teorija pričakovane koristnosti; - menjalne ekonomije (2 ali več oseb), Nash-Debreujev pristop, Paretova učinkovitest, ravnovesne točke. Verjetnostni modeli (Markovski procesi): - kulturna stabilnost (sistem Gadda); - Bowerjev PAL model za učenje; - Stohastični modeli v epidemiologiji. Vse teme ne bodo obravnavane. Obravnavane teme bodo izbrane glede na zanimanje študentov.

Content (Syllabus outline):

Deterministic models: - modeling on or many populations (discrete models, exponential growth, logistic growth, Latka-Volterra, symbiosis, competition for natural resources); - modeling tumors (von Bertalanffyjev model, Gompertzov model); - arms race model (Richardsonov model); - modeling epidemics (discrete models, SIR model and generalisations); - epidemiological models in modeling gossips, myth propagations, problem drinking, zombies. Aksiomatic models: - votings (Arrow's impossibility theorem, Gibbard-Satterthwaite’s theorem of gloomy alternatives, the liberal paradox,…); - utility theory; - exchange economies (2 or more

persons), Nash-Derbeu approach, Pareto utility, equilibrium points. Probabilistic models (Markov processes): - coltural stability (the Gadda system); - Bowers Paired Associate Learning model; - stochastic models in epidemiology. All topics will not be covered. The topics covered will be selected depending on students interests.

Temeljni literatura in viri / Readings:

- Olinick, M., Mathematical Modeling in the Social and Life Sciences, Wiley, 2014, 574 str. - Edelstein-Keshet, L., Mathematical Models in Biology, The Random House/Birkhäuser Mathematics Series. Random House, Inc., New York, 1988. xviii+586 str - Smith?., R., ed., Mathematical Modelling of Zombies, University of Ottawa Press, 468 str.

Cilji in kompetence:

- Zmožnost raziskovanja in prenašanja spoznanj v prakso. - Razvijanje novega znanja in razumevanja področja. - Razvijanje višjih kognitivnih veščin, povezanih z ustvarjanjem novega znanja. - Poznavanje, razumevanje in apliciranje zahtevnejših vsebin elementarne matematike. - Uveljavljanje pomena matematike v kulturi in v interdisciplinarnem pedagoškem delovanju. - Obvladovanje splošnih in za matematiko specifičnih informacijsko-komunikacijskih tehnologij.

Objectives and competences:

- Ability to conduct research and to transfer knowledge into practice. - Developing new knowledge and understanding of the field. - Development of higher cognitive skills related to the creation of new knowledge. - Knowledge, understanding and applying of advanced contents of elementary mathematics - Enforcement of the importance of mathematics in culture in interdisciplinary pedagogical activities. - Mastering general information and mathematics-specific information and communication technologies.

Predvideni študijski rezultati:

Znanje in razumevanje: - Poznavanje temeljnih pojmov in konceptov s področij, ki so navedena pri vsebini. - Razumevanje temeljnih principov matematičnega modeliranja. Uporaba: - Uporaba temeljnih znanj in konceptov matematike na konkretnem področju raziskovanja. - Načrtovanje novih oblik reševanja problemov pri raziskovalnem delu. Refleksija: - Reflektiranje obstoječih modelov za modeliranje naravnih in družbenih pojavov. Prenosljive spretnosti: - Zmožnost modeliranja v novih okoljih.

Intended learning outcomes:

Knowledge and understanding: - Knowledge of fundamental terms and concepts in the areas mentioned in the course contents. - Understanding of basic principles of mathematical modelling. Application: - Application of fundamental skills and concepts in mathematics to the specific field of research. - Design new forms of problem solving in research. Reflection: - Reflection of existing models used to model certain natural and social phenomena. Transferable skills: - Ability to make predictive models in new settings.

Metode poučevanja in učenja:

Frontalna pri predavanjih. Samostojno raziskovalno delo: izdelava modelov in izvajanje eksperimentov, postavljanje hipotez in dokazovanje, priprava seminarskih nalog.

Learning and teaching methods:

Frontal at lectures. Individual research work: performing experiments, posing conjectures and performing their verification, preparation of a seminar.

Načini ocenjevanja:	**Delež (v %) / Weight (in %)**	**Assessment:**
pisni izpit	80	written exam
seminarska naloga	20	seminar

Za pozitivno oceno pri predmetu mora biti študent/-ka pozitivno ocenjen/-a pri vsakem posameznem deležu, ki sestavlja končno oceno. Ocenjevalna lestvica je v skladu s Statutom UL.

To pass the course, the student must have successfully completed (with the passing grade) all the course parts. The grading scale is prescribed by the University of Ljubljana Statute.

Reference nosilca / Lecturer's references:

1. SLAPAR, Marko; Torres, Rafael Existence results of totally real immersions and embeddings into CN. Proc. Amer. Math. Soc. 146 (2018), no. 12, 5463–5473. 2. SLAPAR, Marko; Starčič, Tadej On normal forms of complex points of codimension 2 submanifolds. J. Math. Anal. Appl. 461 (2018), no. 2, 1308–1326. 3. SLAPAR, Marko. On complex points of codimension 2 submanifolds. The Journal of geometric analysis, ISSN 1050-6926, 2016, vol. 26, iss. 1, str. 206-219. 4. KUZMAN, Boštjan. On graphs of prime valency admitting a solvable arc-transitive group. Bulletin of the Australian Mathematical Society, ISSN 0004-9727, 2015, vol. 92, iss. 2, str. 214-227. 5. KOVÁCS, István, KUZMAN, Boštjan, MALNIČ, Aleksander, WILSON, Stephen. Characterization of edge-transitive 4-valent bicirculants. Journal of graph theory, ISSN 0364-9024, 2012, vol. 69, no. 4, str. 441-463. 6. KUZMAN, Boštjan. Invariant subspaces of matrix groups and elementary-abelian covers of K [sub] {4,4}. Filomat, ISSN 0354-5180, 2011, vol. 25, no. 4, str. 37-53.