UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Uvod v modeliranje in simulacijo
Course title:	Introduction to modelling and simulation

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Socialni menedžment, 1. stopnja		**2., 3.**	**4., 6.**
Social management, 1st level		**2nd, 3rd**	**4th, 6th**

Vrsta predmeta / Course type	Izbirni / Elective
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	**0**	**45**	**0**	**0**	**105**	**6**

Nosilec predmeta / Lecturer:	Izr. prof. dr. Blaž Rodič

Jeziki / Languages:	**Predavanja / Lectures:**	**Slovensko, angleško / Slovenian, English**
	Vaje / Tutorial:	**Slovensko, angleško / Slovenian, English**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Uvodni predmet. Ni dodatnih pogojev.	Introductionary course. No additional conditions.

Vsebina: **Content (Syllabus outline):**

- *Uvod v predmet.*
  Namen študija predmeta, povezanost predmeta z drugimi predmeti, vsebina študija predmeta, študijska literatura.
  Simulacija sistemov in reševanje poslovnih in organizacijskih problemov
- *Diskretna dogodkovno orientirana simulacija*
  Stohastične spremenljivke in verjetnostna funkcija
  Verjetnostne porazdelitve in generiranje slučajne spremenljivke
  Modeli strežbe
- *Zvezna simulacija in sistemska dinamika*
  Diferenčne in diferencialne enačbe v simulaciji
  Vzročno posledični diagrami in referenčni odziv sistema
  Razvoj modelov sistemske dinamike
  Zbiranje podatkov, izračun statistike in analiza rezultatov
- *Agentna simulacija*
  Vrste agentov
  Primeri agentnih modelov
- *Uvod v projekt, Izbira teme projekta*
- *Testiranje in validacija modelov*
- *Načrtovanje eksperimentov*
- *Simulacijski primeri:*
  Kreativno Jedro: Simulacije in drugi projekti
- *Modeliranje kompleksnih sistemov:* Metode iz projekta Kreativno Jedro: Simulacije

- *Introduction to the course .*
  The purpose of the study object , integration with other subjects , study the course content , textbooks .
  Simulation systems and solving business and organizational problems
- *Discrete event- oriented simulation*
  Stochastic variables and probability function
  Probability distribution and generatig random variables
  Service models
  Queue discipline
- *Continuous simulation and system dynamics*
  Difference and differential equations in simulation
  Cause and effect diagram and reference system response
  Development of system dynamics models
  Data collection , calculation and statistical analysis results
- *Agent based simulation*
  Agent types
  Agent based model examples
- *Introduction to the project, choice of theme for the project*
- *Testing and validation of models*
- *Design of Experiments*
- *Simulation examples:*
  Creative Core: Simulations and other projects
- *Modelling complex systems:* Automated model building (methods developed in Creative Core: Simulations)

Temeljni literatura in viri / Readings:

- Banks, J., Carson, J. S., Nelson, B. L., Nicol, D. M. (2009). Discrete-Event System Simulation, Prentice Hall.
- Borschchev A. (2013), The Big Book of Simulation Modeling. Multimethod Modeling with AnyLogic 6, AnyLogic North America
- Grigoryev, I., Borschchev A. (2012), AnyLogic 6 in Three Days: A Quick Course in Simulation Modeling
- Sterman, J. D. (2000) Business Dynamics: Systems Thinking and Modeling for a Complex World, Irwin/McGraw-Hill.
- Law, A., Kelton, W. D. (1999) Simulation Modeling and Analysis. McGraw-Hill.
- Severance, F. L. (2001) System Modeling and Simulation: An Introduction, John Wiley & Sons, Chichester
- Kljajić M. (1994), Teorija sistemov, Fakulteta za organizacijske vede
- Prašnikar J., Debeljak, Ž. (1998), Ekonomski modeli za poslovno odločanje, Gospodarski vestnik.

Cilji in kompetence:

- Seznaniti slušatelje s področjem uporabe dogodkovne simulacije in sistemske dinamike pri reševanju organizacijskih problemov
- Spoznati metode in tehnike modeliranja po principih dogodkovne simulacije in sistemske dinamike
- Obvladati kvantitativni pristop k izgradnji

Objectives and competences:

- The main objective of the course is to introduce the application of discrete simulation and system dynamics at solving of the organizational problems
  Understand the methods and techniques of modeling by the principles of discrete event

dogodkovnih modelov in modelov sistemske dinamike.
- Obravnavati osnove simulacijskih jezikov
- Osvojiti postopke priprave eksperimenta in interpretacijo rezultatov
- Izvedba celovitega projekta s področja dogodkovne simulacije in sistemske dinamike na akademskem primeru.
- Poznavanje in obvladanje simulacijskih metod in orodij, v domeni zveznih kakor tudi dogodkovnih modelov
- Celovito načrtovanje in obvladovanje dogodkovnih in zveznih procesov
- Izgradnja dogodkovnih simulacijskih modelov
- Izgradnja modelov sistemske dinamike
- Povezovanje simulacijskih modelov s podatkovnimi bazami in produkcijskimi informacijskimi sistemi
- Harmonizacija delovnih procesov
- Odprava ozkih grl v delovnih procesih
- Analiza strukture in odziva sistema s pomočjo sistemske dinamike

simulation and system dynamics
- Learn the quantitative approach to the discrete event models building and system dynamics models
- Learn the basics of simulation languages
- Study the experimental design approaches and interpretation of the results
- Conduct of the complete project in the field of discrete event simulation and system dynamics in an academic case.
- Knowledge and ability to use simulation methods and tools, both discrete and continuous
- Complete design and control of discrete and continuous processes
- Building of discrete event simulation models
- Building of system dynamics models
- Connection of the simulation models with databases and production information systems
- Harmonization of production processes
- Elimination of bottle-necks in production processes
- Analysis of structure and response of the system by the aid of system dynamics

Predvideni študijski rezultati:

- Kvantitativno modeliranje organizacijskih problemov na področju proizvodnje, logistike in sistemov strežbe
- Analizo vhodnih podatkov, priprava in statistična obdelava
- Definicijo kriterijev in dinamično testiranje hipoteze pri izboru rešitve
- Optimizacija procesov z uporabo simulacijskih orodij

Intended learning outcomes:

- Quantitative modeling of organizational problems in manufacturing, logistics, and service systems
- Input data analysis, preparation and statistical processing
- Definition of criterions and dynamical hypothesis testing at the solution selection
- Process optimization using simulation tools

Metode poučevanja in učenja:

- Predavanja in vaje na podlagi intenzivnih refleksij in diskusij v skupini in manjših skupinah študentov
- Individualni študij literature
- On-line študijske metode (moodle, socialni mediji)
- Individualno in/ali skupinsko raziskovanje posameznih primerov

Learning and teaching methods:

- Lectures and tutorials based on intensive reflections and discussions within the group and smaller groups of students
- Individual study of literature
- On-line study methods (moodle, social media)
- Individual and/or group research of particular cases of virtual

virtualnih skupnosti - Preučevanje primerov, ki ponazarjajo teorijo, v skupinah in individualno: samostojno in/ali s pomočjo učitelja in/ali asistenta - Ustne prezentacije ugotovitev in refleksij posameznih študentov s kritičnimi odzivi drugih študentov	communities - Exploring the examples illustrating the theory in groups and individually: individually and/or assisted by the teacher and/or teaching assistant - Oral presentations of findings and reflections by individual students with critical responses by other students

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
• Pisni/ustni izpit • Empirična seminarska naloga s poročili eksperimentalnih vaj ter predstavitev naloge .	• Pisni/ustni izpit - 50% ocene. • Written/oral examination - 50% of the grade • Empirična seminarska naloga s poročili eksperimentalnih vaj ter predstavitev naloge 50%. • Empirical student assignment with the reports from experimental exercises together with the presentation of the assignment - 50% of the grade	• Written/oral examination • Empirical student assignment with the reports from experimental exercises together with the presentation of the assignment.

Reference nosilca / Lecturer's references:

- RODIČ, Blaž. Mobile agents for distributed decision support systems. Int. Sci. J. Manag. Inf. Syst., 2011, vol. 6, no. 1, str. 20-27.
- RODIČ, Blaž. Across the digital divide with regional strategies and e-services = Premoščanje digitalne ločnice z regionalnimi strategijami in e-storitvami. Raziskave in razprave, 2011, letn. 4, št. 1, str. 46-61.
- VUKOVIČ, Goran, ZAVRŠNIK, Bruno, RODIČ, Blaž, MIGLIČ, Gozdana. The training of civil servants in the Slovene state administration: issues introducing training evaluation. Int. rev. adm. sci., dec. 2008, vol. 74, no. 4, pg. 653-676.
- KLJAJIĆ, Miroljub, BRESKVAR, Uroš, RODIČ, Blaž. Computer aided scheduling with use of genetic algorithms and a visual discrete event simulation model. WSEAS Trans. Syst., 2004, vol. 3, no. 3, pg. 1021-1026.
- RODIČ, Blaž, KLJAJIĆ, Miroljub. Mobile agents and XML for distributed simulation support. V: KLJAJIĆ, Miroljub (ed.), ŠKRABA, Andrej (ed.). Simulation based decision support, (Organizacija, Letn. 38, 2005, No. 9). Kranj: Moderna organizacija, 2005, pg. 490-498.