Fakulteta za industrijski inženiring
Faculty of Industrial Engineering

UČNI NAČRT PREDMETA / *COURSE SYLLABUS*	
Predmet:	Sistemi s čakalnimi vrstami
Course title:	Queueing systems

Študijski program *Study programme and level*	**Študijska smer** *Study field*	**Letnik** *Academic year*	**Semester** *Semester*
Inženiring in avtomobilska industrija Podiplomski (tretja)	Program nima smeri	prvi	drugi
Engineering and Automotive Industry Graduate – Master (third)	Program nima smeri	First	Second

Vrsta predmeta / *Course type*	izbirni	Optional

Univerzitetna koda predmeta / *University course code:*	31017

Predavanja *Lectures*	**Seminar** *Seminar*	**Sem. vaje** *Tutorial*	**Lab. vaje** *Laboratory work*	**Teren. vaje** *Field work*	**Samost. delo** *Individ. work*	**ECTS**
60	-	30	-	-	180	10

Nosilec predmeta / Lecturer:	**izr. prof. dr. Blaž Rodič / assoc. prof. Blaž Rodič, PhD**

Jeziki / *Languages:*	**Predavanja / *Lectures*:**	**Vaje / *Tutorial:***
	angleški	angleški
	English	English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	***Prerequisits:***
Znanje angleškega jezika.	Command of the English language

Vsebina:	***Content (Syllabusoutline):***
- Modeli praznih Markovskihvrst, napredni modeli Markova. Mreže, serije in ciklične vrste. Splošni modeli uporabe. Meje in aproksimacije. Numerične metode in simulacija. - Projektiranje optimalnih sistemov s čakalnimi vrstami: Optimalna hitrost prihoda v vrsto z enim strežnim mestom. Dinamični prilagojeni algoritmi. Optimalna hitrost vstopanja v vrsto z več strežnimi mesti. - Vzporedne vrste čakanja. Mreža vrst z enim strežnim mestom. Mreža vrst z več strežnimi mesti. Terminiranje dela vrst z enim strežnim mestom.	- Empty Markovian queue models, advanced Markovian queue models. Networks, series and cyclic queues. General models. Limitations and approximations. Numerical methods and simulation. - Design of optimal queueing systems: optimal arrival times in single server queues. Dynamic adaptive algorithms. Optimal entry times in multiple server queues. - Parallel queues. Queueing network with single server; queueing network with multiple servers. Terminating single server queues.

Temeljni literatura in viri / *Readings:*

- Gross, D. (2009). *Fundamentals of Queueing Theory, Set*. (Wiley Series in Probability and Statistics), Wiley; 4 edition.
- Kleinrock, l. (1975). *Queueing Systems. Volume 1: Theory*. Wiley-Interscience.
- Kleinrock, l. Gail, R. (1996). *Queueing Systems: Problems and Solutions*. Wiley-Interscience.
- Stidham S. Jr. (2009). *Optimal Design of Queueing Systems*. 1 edition. Chapman & Hall: CRC.
- Curry, G.L., Feldman, R.M. (2008). *Manufacturing Systems Modeling and Analysis.* 1 edition. Springer.
- Bose, S.K. (2001). *An Introduction to Queueing Systems (Network and Systems Management*). 1 edition. Springer.

Priporočljiva literatura / *Recomended Textbooks*

- Hudoklin, A. (2003). *Stohastični procesi : skripta. 6.* izd. Moderna organizacija: Kranj. 189 str., graf. prikazi, tabele. ISBN 961-232-075-6.
- Hudoklin, A., Sabolek, R., Brezavšček, A. (2000). *Stohastični procesi, Zbirka rešenih nalog.* Moderna organizacija: Kranj. 123 str., graf. prikazi, tabele. ISBN 961-232-081-0.

Cilji in kompetence:	**Objectives and competences:**
Cilji	***Objectives***
- Cilj predmeta je, da nauči študenta, kako modelira sisteme s čakalnimi vrstami in da izvaja optimizacijo njihovega dela.	- The aim of the course is to teach students how to model queueing systems and to perform queueing system operation optimization.
Kompetence	***Competences***
- Modeliranje vrst z enim ali več strežnimi mesti. - Optimizacija dela sistemov s čakalnimi vrstami.	- Modeling of queues with one or more servers . - Optimization of queueing systems operation.

Predvideni študijski rezultati:	***Intended learning outcomes:***
Znanje in razumevanje: ***Študent/študentka:***	***Knowledge and understanding:*** ***Student:***
- Modeliranje in analiza sistemov s čakalnimi vrstami, z enim ali več strežnimi mesti. - Simulacija dela sistemov z vrstami. - Optimizacija sistemov s čakalnimi vrstami.	- Modeling and analysis of queueing systems, with a single or multiple servers . - Simulation of queueing systems operation. - Optimization of queueing systems.

Metode poučevanja in učenja:	**Learningandteachingmethods:**
- Študent bo na predavanjih dobil tudi tekste z znanstvenih del z nalogo, da poda komentar na vsako tematsko celoto. - Študent mora izdelati projektno nalogo na dobljeno temo.	- Students will receive scientific texts at lectures, and will be required to deliver a commentary on each the matic whole. - The student must develop a project assignment on the topic assigned.

Načini ocenjevanja:	**Delež (v %) / *Weight (in%)***	***Assessment:***
Način (pisni izpit, ustno izpraševanje, naloge, projekt): - Analiza dobljenih znanstvenih del – 20% ocene, tj. do 20 točk - Projektna naloga– 50% ocene, tj. do 50 točk - Pisni izpit – 30% ocene, tj. do 30 točk		Type (examination, oral, coursework, project): - Analysis of the scientific texts - 20% ofthe grade, ie. 20 points - Project assignment- 50% ofthe grade, ie. 50 points - Written exam - 30% ofthe grade, ie. 30 points

Reference nosilca / *Lecturer's references:*

- RODIČ, Blaž. Distribuirani sistemi za podporo odločanju in programski agenti. (Distributed decision support systems and softwareagents), Nova Gorica: Fakulteta za uporabne družbene študije, 2008. 170 pgs. ISBN 978-961-6718-05-9.
- KANDUČ, Tadej and RODIČ, Blaž. Optimisation of machinel a youtusing a force generated graph algorithm and simulated an nealing, International Journal of Simulation Modelling, Vol. 15, No. 2, pp 1726-4529, 2016.
- KANDUČ, Tadej and RODIČ, Blaž. Optimization of a furniture factory layout, Croatian Operational Research Review, 2015.
- RODIČ, Blaž, BAGGIA, Alenka. Dynamic airport ground crew schedulingusing a heuristic schedulingalgorithm. International journal of applied mathematics and informatics, ISSN 2074-1278, 2013, vol. 7.
- RODIČ, Blaž, VUKOVIČ, Goran, ZAVRŠNIK, Bruno, MIGLIČ, Gozdana. Issues in introducing training needs analysis in Slovenia´s public administration. Transylvanian review of administrative sciences, 2012, no. 37 E, pgs. 155-171.
- RODIČ, Blaž. Mobile agents for distributed decision support systems. Int. Sci. J. Manag. Inf. Syst., 2011, vol. 6, no. 1, pgs. 20-27.
- VUKOVIČ, Goran, ZAVRŠNIK, Bruno, RODIČ, Blaž, MIGLIČ, Gozdana. The training of civilservants in the Slovene state administration: issues introducing training evaluation. Int. rev. adm. sci., dec. 2008, vol. 74, no. 4, pgs. 653-676.
- RODIČ, Blaž, KLJAJIĆ, Miroljub. Accessing distributed data sources with mobile agents and XML. V: JAŠKOVÁ, Mária (ur.). ECON '05 : [selected research papers], (Research works proceedings, Vol. 12, 2005). Ostrava: Technical Universityof Ostrava, Faculty of Economics, 2005, pgs. 280-287.
- 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, pgs. 1021-1026.