

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Simulacije telekomunikacijskih sistemov
<b>Course title:</b>	Simulations of Telecommunication Systems

Študijski program in stopnja Study programme and level	Modul Module	Letnik Academic year	Semester Semester
Informacijske in komunikacijske tehnologije, 3. stopnja	Komunikacijske tehnologije	1	1
Information and Communication Technologies, 3 <sup>rd</sup> cycle	Communication Technologies	1	1

**Vrsta predmeta / Course type**

Izbirni / Elective

**Univerzitetna koda predmeta / University course code:**

IKT3-645

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Druge oblike	Samost. delo Individ. work	ECTS
15	15			15	105	5

*\*Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

**Nosilec predmeta / Lecturer:**

Prof. dr. Aleš Švigelj

**Jeziki /**

**Predavanja / Lectures:** slovenščina, angleščina / Slovenian, English

**Languages:**

**Vaje / Tutorial:**

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

Zaključen študij druge stopnje s področja informacijskih ali komunikacijskih tehnologij ali zaključen študij druge stopnje na drugih področjih z znanjem osnov s področja predmeta. Potrebna so tudi osnovna znanja matematike, računalništva in informatike.

**Prerequisites:**

Completed second cycle studies in information or communication technologies or completed second cycle studies in other fields with knowledge of fundamentals in the field of this course. Basic knowledge of mathematics, computer science and informatics is also requested.

**Vsebina:**

Napredni koncepti računalniške simulacije  
Verjetnost in naključni procesi  
Napredni pristopi pri modeliranju telekomunikacijskih omrežij:  
    analitičen pristop  
    pristop z diskretno dogodkovnim modelom  
    hibridni pristop  
Dogodkovno orientirana simulacijska orodja  
Statistična analiza rezultatov simulacije:  
    zajemanje simulacijskih rezultatov

**Content (Syllabus outline):**

Advanced computer simulation concepts  
Probability and stochastic processes  
Advanced modelling of telecommunication networks:  
    analytical approach  
    discrete-event driven approach  
    hybrid approach  
Discrete event simulators  
Statistical analysis of simulation results:  
    statistical measures for simulation

verifikacija simulacijskega modela  
ovrednotenje simulacijskega modela

verification of simulation model  
validation of simulation model

### Temeljni literatura in viri / Readings:

Izbrana poglavja iz naslednjih knjig: / Selected chapters from the following books:

- J. Banks, J. Carson, B. L. Nelson, D. Nicol, *Discrete-Event System Simulation*, Prentice Hall; fifth edition, 2009. ISBN 978-0136062127
- J. F. Hayes, V. J. T., G. Babu, *Modeling and Analysis of Telecommunications Networks*, John Willey & Sons, 2004. ISBN 978-0471348450
- B. D. Hahn, D. T. Valentine, *Essential MATLAB for Engineers and Scientists*, Fifth edition, Elsevier, 2013. ISBN 978-0123943989
- *Modelling concepts*, OPNET user manual, 2015

### Cilji in kompetence:

Seznani študente z naprednimi koncepti, metodami in praktičnimi vidiki pri razvoju in analizi simulacijskih modelov in računalniških simulacijah telekomunikacijskih sistemov.

Posebno pozornost bomo namenili praktičnim znanjem s področja naprednih diskretnih dogodkovnih simulatorjev.

Kompetence študenta bodo po uspešno opravljenem predmetu obsegale sposobnost simuliranja telekomunikacijskih sistemov.

### Objectives and competences:

To acquaint students with the advanced concepts, techniques and practical aspects of the development and analysis of simulation models and computer simulations of telecommunication systems.

In particular the course will be concerned in its practical aspects with advanced discrete event simulation.

The competencies of the students completing this course successfully will include the ability to simulate telecommunication systems.

### Predvideni študijski rezultati:

Študenti bodo z uspešno opravljenimi obveznostmi tega predmeta pridobili:

- napredno znanje in razumevanja o modeliranju telekomunikacijskih sistemov, o načrtovanju simulacijskih modelov in o analizi simulacijskih rezultatov
- sposobnost izgradnje zahtevnih simulacijskih modelov, razumevanja različnih tehnik in problematike modeliranja ter analize simulacijskih rezultatov

### Intended learning outcomes:

Students successfully completing this course will acquire:

- advanced knowledge and understanding of modelling of telecommunication systems, design of simulation models and analysis of simulation results
- the ability to build advanced simulation models and understand different types of modelling techniques and awareness of the issues in building a simulation model and analysing the simulation results

### Metode poučevanja in učenja:

Predavanja, seminar, konzultacije, individualno delo

### Learning and teaching methods:

Lectures, seminar, consultancy, individual work

### Načini ocenjevanja:

Seminarska naloga  
Ustni zagovor seminarske naloge

Delež (v %) /

Weight (in %)

### Assessment:

Seminar work  
Oral defense of seminar work

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

- **A: Švigelj**, R. Sernec, K. Alič,. "Network-traffic modeling for load prediction: a user-centric approach", *IEEE Network Magazine*, IEEE Network, vol. 29, no. 4, pp. 88 - 96, 2015
- K. Alič, E. Pertovt, **A. Švigelj**, "Bearing-opportunistic network coding", *International Journal of Computers, Communications & Control*, vol. 10, no. 2, pp. 154-164, 2015
- **A. Švigelj**, M. Mohorčič, L. Franck, G. Kandus, "Signalling analysis for traffic class dependent routing in packet switched ISL networks", *Space communications*, vol. 22, no. 2/4, 191-203, 2013
- A. Volkov, J Žganec Gros, M. Žganec, T. Javornik, **A. Švigelj**, "Modulated acquisition of spatial distortion maps", *Sensors*, vol. 13, no. 8, pp. 11069-11084, 2013
- U. Kuhar M. Pantoš, G. Kosec, **A. Švigelj**, The impact of model and measurement uncertainties on a state estimation in three-phase distribution networks. *IEEE transactions on smart grid*, ISSN 1949-3053. [Print ed.], vol. , no. , str. 1-10, 2018