

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet: Računalniška omrežja
Course title: Computer Networks

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Računalništvo in spletne tehnologije, visokošolski strokovni študijski program prve stopnje	-	Prvi	Drugi
Computer Science and Web Technologies, first cycle Professional Study Programme	-	First	Second

Vrsta predmeta / Course type

Obvezni / Obligatory

Univerzitetna koda predmeta / University course code:

2-RST-VS-RO-2020-05-14

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

Nosilec predmeta / Lecturer:

izr. prof. dr. Biljana Mileva Boshkoska

Jeziki / Languages:

Predavanja / Lectures:

Slovenski / Slovenian, Angleški / English

Vaje / Tutorial:

Slovenski / Slovenian, Angleški / English

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

Pogoj za vključitev v delo je vpis v 1. letnik študija.
 Študent/študentka mora pred pristopom k izpitu oddati in zagovarjati domače naloge, ter pripraviti in predstaviti seminarsko nalogo.

Prerequisites:

The prerequisite is enrolment into the first year of the study.
 Prior to the exam, the student has to submit and present solutions to homework assignments, as well as submit and present the seminar paper.

Vsebina:

- Uvod in osnovni pojmi, OSI (Open Systems Interconnection model) in drugi modeli.
- Povezovanje aplikacij (standardni protokoli – HTTP (Hypertext Transfer Protocol), DNS (Domain Name System), SMTP (Simple Mail Transfer Protocol), POP (post office protocol), IMAP (Internet Message Access Protocol);

Content (Syllabus outline):

- Systems Interconnection model) and other models.
- Connecting applications (standard protocols, HTTP (Hypertext Transfer Protocol), DNS (Domain Name System), SMTP (Simple Mail Transfer Protocol), POP (post office protocol), IMAP (Internet Message Access Protocol),

<p>spletne storitve; večpredstavnost; prekrivna omrežja – p2p).</p> <ul style="list-style-type: none"> • Povezovanje procesov (UDP (User Datagram Protocol), TCP (Transmission Control Protocol), vzpostavljanje in rušenje povezave, nadzor pretoka in zamašitev). • Uvod v omrežno programiranje z ilustracijami v programskem jeziku JAVA, vtičnice, tokovi podatkov, omrežne odjemalec/strežnik aplikacije, TCP programiranje z vtičnicami, UDP programiranje z vtičnicami • Preklapljanje, usmerjanje (stikala in usmerjevalniki; preklapljanje omrežij in preklapljanje povezav; IP (internet protocol) protokol v4 in v6, naslavljanje, ARP (address resolution protocol), DHCP (Dynamic Host Configuration Protocol), ICMP (Internet Control Message Protocol); usmerjevalni protokoli). • Fizično povezovanje naprav (vozlišča in povezave; okvirjanje, detekcija napak, zanesljiv prenos, standardi: Ethernet in brezžična omrežja). • Zagotavljanje varnosti (osnove kriptografskih tehnik – simetrične in asimetrične metode, PKI (public-key infrastructure)). • Avtentikacijski protokoli, SSH (secure shell), TLS (Transport Layer Security), SSL (Secure Sockets Layer), Ipsec; požarne pregrade; napadi in zaznavanje in preprečevanje). • Analiza delovanja omrežnih protokolov z prosto-dostopnimi računalniškimi orodji (npr. Wireshark) 	<p>web services, multimedia, peer to peer networks, overlay networks).</p> <ul style="list-style-type: none"> • Connecting processes ((UDP (User Datagram Protocol), TCP (Transmission Control Protocol), establishing and breaking connections, flow control, congestion recovery). • Introduction to network programming with illustrations in JAVA, sockets, data streams, network client/server applications, TCP socket programming, UDP socket programming • Switching, routing (switches and routers, network and connection switching, IP (internet protocol) protocols v4 and v6, addressing, ARP (address resolution protocol), DHCP (Dynamic Host Configuration Protocol), ICMP (Internet Control Message Protocol, routing protocols). • Physical connectivity of devices (nodes and connections, framing, error detection, reliability mechanisms, standards: Ethernet and wireless networks). • Security (cryptography basics, asymmetric and symmetric cyphers, PKI (public-key infrastructure)). • Authentication protocols, SSH (secure shell), TLS (Transport Layer Security), SSL (Secure Sockets Layer), Ipsec; firewalls; threats and threat detection and prevention). • Network protocol analysis using free software tools (e.g., Wireshark)
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Temeljni literatura in viri / Readings:

<ul style="list-style-type: none"> • Kurose, J. & Ross, K. (2017). <i>Computer Networking (7th ed.)</i>. A Top-Down Approach. Pearson. • Kurose, J. Ross, K., Bosnić, Z., Ciglarić, M. & Brodnik, A. (2015). <i>Računalniška omrežja : compiled from Computer networking, sixth edition (2. izdaja)</i>. Pearson. • Harold, E. R. (2014). <i>Java Network Programming (4th ed.)</i>. O'Reilly Media, Inc.
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Cilji in kompetence:

Učna enota prispeva k razvoju naslednjih splošnih in predmetno-specifičnih kompetenc:

Splošne kompetence:

- poznavanje pomena kakovosti in prizadevanje za kakovost strokovnega dela skozi avtonomnost, samoiniciativnost, (samo)kritičnost, (samo)refleksivnost in (samo)evalviranje v strokovnem delu
- prepoznavanje in ocenitev aktualnih in nastajajočih tehnologij ter ocenitev njihove uporabnosti za reševanje potreb uporabnikov
- usposobljenost za samoučenje s ciljem obvladovanja najnovejših relevantnih spletnih in mobilnih tehnologij
- poznavanje komunikacijskih priložnosti, ki jih ponujajo splet in mobilne naprave
- sposobnost varnega in namenskega koriščenja najzahtevnejših spletnih storitev
- sposobnost prilagoditve spletnih aplikacij za poljubno mobilno platformo
- možnost za prepoznavanje in izkoriščanje priložnosti, ki jih ponuja spletna tehnologija

Predmetno-specifične kompetence:

- razumevanje delovanja računalniških omrežij (arhitektura, protokoli, nivoji)
- pridobivanje podrobnejših informacij o delovanju posameznih komponent in protokolov računalniških omrežij na svetovnem spletu in v strokovni literaturi
- izbira in uporaba ustreznih strojnih komponent za postavitve lokalnih ožičenih in brezžičnih računalniških omrežij
- upravljanje računalniških omrežij (uporabniki, obremenitev, varnost)

Objectives and competences:

The instructional unit contributes to the development of the following general and subject-specific competences:

General competences:

- familiarity with the importance of quality, striving to maintain the quality of professional work through practicing autonomous behaviour, showing initiative, as well as through (self-) criticism, (self-)reflection and (self-) evaluation
- identification and evaluation of current and emerging technologies, and assessment of their usability in terms of fulfilling user requirements
- ability to self-educate with the aim to master relevant state-of-the-art web and mobile technologies
- familiarity with communication opportunities offered by the web and mobile devices
- ability to safely and purposefully use the most complex web services
- ability to adapt web applications to any mobile platform
- ability to recognize and seize opportunities offered by the web technology

Subject-specific competences:

- understanding the functioning of computer networks (architecture, protocols, levels)
- acquire detailed information on the functioning of individual computer network components and protocols by resorting to the world wide web and specialized literature
- selection and use of adequate machine components necessary for installation of local wired and wireless computer networks
- management of computer networks (user management, load management, security management)

Predvideni študijski rezultati:

Znanje in razumevanje:

Študent/študentka:

- se seznanj z osnovnimi gradniki in napravami, ki sestavljajo sodobna komunikacijska omrežja
- spozna princip gradnje odprtih sistemov in večplastnih protokolarnih skladov in se nauči razmišljati o protokolih na temu primeren način
- pozna najpomembnejše standardne protokole vsake protokolarne plasti, njihov namen, uporabo in omejitve
- razume zgradbo in delovanje interneta
- pozna in razume varnostna tveganja in različne načine obrambe pred napadi v sodobnih omrežjih
- je sposoben/a zasnovati in postaviti preprosto računalniško lokalno in brezžično omrežje ter konfigurirati in spremljati osnovne parametre njegovega delovanja

Intended learning outcomes:

Knowledge and understanding:

The student:

- becomes familiar with the basic elements and specific devices used in modern communication networks
- understands the principles of open systems design and multilevel architecture of protocol stacks and develops appropriate mental models
- knows the core standard protocols of every layer, their purpose, usage and limitations
- understands the structure and operation of the internet
- knows and understands the security threats and the corresponding security measures including detection, response and recovery mechanism in modern networks
- is able to design and construct a basic local and wireless network, configure it and monitor its operation

Metode poučevanja in učenja:

- *predavanja* z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov)
- *vaje v računalniški učilnici*: pri teh vajah bodo študentje spoznali konkretne protokole in orodja, katerih so se učili na predavanjih. Te vaje bodo potekale v manjših skupinah, tako da bo imel vsak študent na razpolago en računalnik
- *seminarska naloga*: v okviru samostojnega dela ali dela v parih bo študent samostojno preučil določeno vsebinsko področje ali rešil konkreten problem ter ga ustrezno predstavil

Learning and teaching methods:

- *lectures* with active student participation (presentation, discussion, questions, cases, problem solving)
- *lab work*: in the lab work the students will become familiar with the protocols and tools they have learnt about in the lectures. Lab work will be done in small groups, with one workstation per student
- *seminar paper*: through individual work or work in pairs the students will autonomously study a selected field of study or solve a real-life problem and present the work process and the solution

Delež (v %) /

Weight (in %)

Načini ocenjevanja:**Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

Type (examination, oral, coursework, project):

- pisni izpit
- domače naloge
- empirična seminarska naloga

60
20
20

- written exam
- homework assignments
- empirical seminar paper

Reference nosilca / Lecturer's references:

- STROJNIK, Lidija, STOPAR, Matej, ZLATIČ, Emil, KOKALJ, Doris, NAGLIČ, Mateja, ŽENKO, Bernard, ŽNIDARŠIČ, Martin, BOHANEC, Marko, MILEVA BOSHKOSKA, Biljana, LUŠTREK, Mitja, GRADIŠEK, Anton, POTOČNIK, Doris, OGRINC, Nives. Authentication of key aroma compounds in apple using stable isotope approach. *Food chemistry*, ISSN 0308-8146. [Print ed.], 2019, vol. 277, str. 766-773, doi: 10.1016/j.foodchem.2018.10.140. [COBISS.SI-ID 31834663].
- BOŠKOSKI, Pavle, DEBENJAK, Andrej, MILEVA BOSHKOSKA, Biljana. Rayleigh copula for describing impedance data - with application to condition monitoring of proton exchange membrane fuel cells. *European journal of operational research*, ISSN 0377-2217. [Print ed.], 2018, vol. 266, no. 1, str. 269-277, doi: 10.1016/j.ejor.2017.08.058. [COBISS.SI-ID 30736167].
- GRAŠIČ, Valerij, KOS, Andrej, MILEVA BOSHKOSKA, Biljana. Classification of incoming calls for the capital city of Slovenia smart city 112 public safety system using open Internet of Things data. *International journal of distributed sensor networks*, ISSN 1550-1477. [Online ed.], 2018, vol. 14, no. 9, str. 1-12, ilustr. <https://journals.sagepub.com/doi/pdf/10.1177/1550147718801703>, doi: 10.1177/1550147718801703. [COBISS.SI-ID 2048569107].
- MILJKOVIĆ, Dragana, LAVRAČ, Nada, BOHANEC, Marko, MILEVA BOSHKOSKA, Biljana. Discovering dependencies between domains of redox potential and plant defence through triplet extraction and copulas. *International journal of intelligent engineering informatics*, ISSN 1758-8723, 2018, vol. 6, no. 1/2, str. 61-77. <http://www.inderscience.com/info/ingeneral/forthcoming.php?jcode=ijiei>, doi: 10.1504/IJIEI.2018.10012065. [COBISS.SI-ID 2048463379].
- MILEVA BOSHKOSKA, Biljana, LIU, Shaofeng, CHEN, Huilan. Towards a knowledge management framework for crossing knowledge boundaries in agricultural value chain. *Journal of decision systems*, ISSN 1246-0125, [in press] 2018, 15 str., doi: 10.1080/12460125.2018.1468173. [COBISS.SI-ID 31392807].
- MILEVA BOSHKOSKA, Biljana, RONČEVIČ, Borut, DŽAJIĆ URŠIČ, Erika. Modeling and evaluation of the possibilities of forming a regional industrial symbiosis networks. *Social sciences*, ISSN 2076-0760, 2018, vol. 7, iss. 1. <http://www.mdpi.com/2076-0760/7/1/13/pdf>, doi: 10.3390/socsci7010013. [COBISS.SI-ID 2048488723].
- BOHANEC, Marko, MILEVA BOSHKOSKA, Biljana, PRINS, Theo W., KOK, Esther. SIGMO: a decision support System for Identification of genetically modified food or feed products. *Food control*, ISSN 0956-7135. [Print ed.], 2016, vol. 71, str. 168-177, doi: 10.1016/j.foodcont.2016.06.032. [COBISS.SI-ID 29620007].