Course title: COMPUTER NETWORKS

Lecturers	Asst. Prof. Nikola Ivković, Ph.D., Assoc. Prof. Ivan Magdalenić, Ph.D., Elvis Popović, mag. Inf.
Language of instruction:	English
Study level	Bachelor
Study programme	Information and Business Systems
Semester	4th (summer)
ECTS	6
Goal	This course introduces computer networks, network services and applications, and provides conceptual and practical knowledge for a successful IT career. The students are prepared to solve communication problems and determine parameters important for quality of service and efficient communication. The importance of layered approach of ISO-OSI and the modern Internet model will be explained and the inner working of networks is studied through the application, transport, network, and link layer, which is demonstrated by relevant protocols and network applications. The goal of the course is also to prepare students for more advanced topics and specialization in some areas for which conceptual and practical knowledge of computer networks is necessary such as computer security, internet of things, network application development, multimedia streaming, etc. This course develops critical thinking and promotes expert opinions and decisions based on the analytical approach, research, modelling, and simulation.
General and specific learning outcomes	1. Keep track of professional literature in Croatian and a foreign language, prepare and independently deliver presentations in Croatian and a foreign language to professional and general public, and critically evaluate a presented professional topic. 2. Understand and apply processes, methods and technologies pertaining to IT services and resources management, and provisioning and support of different ICT related services. 3. Understand and apply contemporary technical concepts and practices in information technologies (computer architecture, operating systems, computer networks).
Content	**1. INTRODUCTION** Computer networks, network elements, edge, core, access networks, data transfer, datagram switching, circuit switching, the structure of Internet, protocols and services. Performance, delays, packet loss, transmission rate, throughput, utilization. Modern internet model, ISO/OSI referent model, layers, encapsulation. The area of network security, attacks on network infrastructure and applications, malware, denial of service, packet sniffing, IP spoofing. **2. APPLICATION LAYER** Conceptual and implementational aspects of application protocols and networked applications. Choosing a transport layer service model and an available protocol. The architecture of networked applications (client-server and peer-to-peer).

	Sockets and computer process in a network. Examples of important network protocols (e.g. DNS, Web, HTTP, e-mail, SMTP, POP3, IMAP, MIME, file transfer and automatic synchronization, SSH, ...). Cookies, cache and proxies. Attacks on DNS and abusing DNS for multiplying attack. **3. TRANSPORT LAYER** Multiplexing/demultiplexing, reliable data transfer over unreliable channel, efficiency of reliable transfer protocol, establishing connection, attack by abusing mechanism for TSP connection, flow control, congestion control, protocols UDP and TCP, fairness of TCP. Stateful and stateless protocols. **4. NETWORK LAYER – INTRODUCTION AND DATA PLANE** Network layer service models, forwarding, routing, the architecture of router, switching datagrams, switching virtual circuits, data plane, protocols IPv4, IPv6, ICMP, IP addressing, subnetting, NAT, DHCP, fragmenting, tunneling. **5. LINK LAYER** Link layer services and their implementation, error detection and error correction, multiple accesses protocols, MAC addresses, Ethernet, switch, bridge, hub, links, VLAN, local networks in data centers. **6. SYNTHESIS OF LAYERS** Putting layers in together and examples of joint action of protocols and mechanisms. The lab practice is based on recording and analyzing real network traffic, using simulations, and network tools like traceroute, ping, nslookup, ipconfig, ifconfig, arp, netsh.
Realization and examination	Classes: Lectures, seminars and laboratory exercises Exam: Written and oral exam and seminars
Related courses	Similar courses at MIT.
Literature	Basic: Kurose, J.F.; Ross, K.W. Computer Networking: A Top-Down Approach. 8th edition, Pearson, 2021. Additional: Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall. Computer Networks, 6th edition, Pearson 2021 L. L. Peterson , B. S. Davie. Computer Networks: A Systems Approach, 6th edition, Morgan Kaufmann, 2021