

Course Title	Computer Networks				
Course Code	WSS501				
Course Type	Compulsory (Both Specializations)				
Level	MSc (Level 2)				
Year / Semester	1 / 1				
Teacher's Name	Chrysostomos Chrysostomou, PhD				
ECTS	10	Lectures / week	3	Laboratories / week	0
Course Purpose	<p>The aim of the course is to bring in students to the deep concepts and principles underlying the field of modern networking, and to enable students develop the skills required for the design, application, and evaluation of advanced computer networks. Particular emphasis is given to provide students with deep knowledge of the recent revolutions relating special issues like SDN (software-defined networks), NFV (network functions virtualization), QoE (quality of experience), QoS (quality of service), next-generation Internet systems, and new architectures.</p>				
Learning Outcomes	<p>By the end of the course, the students are expected to:</p> <ol style="list-style-type: none"> 1. develop in-depth knowledge of the main principles underlying the field of modern networking; 2. justify the position that traditional network architectures are inadequate for modern networking needs; 3. list and explain the key requirements for an SDN architecture, and outline SDN architecture; 4. assess the concept of virtual machine, list and explain the key benefits and requirements of NFV, and outline NFV architecture; 5. analyse the QoS architectural framework, define and evaluate IP performance metrics; 6. describe and assess the motivations for QoE; 7. define QoE, explain and evaluate the factors that could influence QoE; 8. outline how QoE can be measured, and distinguish between subjective and objective assessment; 9. describe and evaluate QoE application areas; 10. translate metrics from QoS to QoE domain; 11. generate the appropriate QoE/QoS mapping model for a given operational situation; 12. define and examine QoE-centric monitoring solutions over a given infrastructure; 13. describe and evaluate QoE-aware applications over QoE-centric infrastructure; 14. define and examine the key security requirements and main threats; 				

	15. perform research literature review and apply appropriate methods to pursue research or other detailed investigation of technical issues, and present, explain and report recent advances and open research issues and challenges in advanced computer networks.		
Prerequisites	None	Required	None
Course Content	<ul style="list-style-type: none"> • Elements of Modern Networking: The Networking Ecosystem. Example Network Architectures. Ethernet. Wi-Fi. 4G/5G Cellular. Internet of Things. Network Convergence. Unified Communications. • Requirements and Technology: Types of Network and Internet Traffic. Demand: Big Data, Cloud Computing, and Mobile Traffic. Requirements: QoS and QoE. Routing. Congestion Control. SDN and NFV. Modern Networking Elements. • Software-defined Networks (SDNs): Evolving Network Requirements. The SDN Approach. SDN Data Plane: OpenFlow Protocol. SDN Control Plane: Cooperation and Coordination Among Controllers. SDN Application Plane. • Network Functions Virtualization (NFV): Concepts and Architecture. • Network Virtualization: Architecture and Benefits. • Quality of Service (QoS): QoS Architectural Framework. Integrated Services Architecture. Differentiated Services. Service Level Agreements. IP Performance Metrics. OpenFlow QoS Support. • QoE: User Quality of Experience: The need for QoE. Definition of Quality of Experience. QoE Strategies in Practice. Factors Influencing QoE. Measurements of QoE. Applications of QoE. • Network Design Implications of QoS and QoE: Classification of QoE/QoS Mapping Models. IP-Oriented Parameter-Based QoS/QoE Mapping Models. Actionable QoE over IP-Based Networks. QoE Versus QoS Service Monitoring. QoE-Based Network and Service Management. • Modeling and Performance Evaluation of Network and Computer Systems: Selection of proper evaluation techniques and performance metrics. Monitoring. Capacity planning. Experimental design. Computer Simulations. Case Study. • Wireless Mobile Networks: Medium access control. Principles of cellular networks. Cellular network organization. Cell Characteristics. Cell Planning. Mobility and Handover Issues. • Multimedia Networking: Performance requirements of Voice over IP, Streaming/Real time Video, Streaming stored audio and video. Protocols for real-time interactive applications. • Security: Security Requirements. Security Threats. 		
Teaching Methodology	<p>Students are taught the course through lectures by means of computer presentations. Lectures are integrated by invited talks from experts from industry.</p> <p>Guided individual and/or group project is given to enable students to develop the skills required for integrating the course theory. To this end, research literature review is encouraged by assigning students to identify a</p>		

	<p>specific problem related to some possible open research issues, gather relevant scientific information about how others have addressed the problem, investigate/analyze/evaluate and compose this information in written and/or orally.</p> <p>Lecture notes and presentations are available for students to use in combination with the textbooks and references, through the university's e-learning platform.</p>
Bibliography	<p>Textbook:</p> <ul style="list-style-type: none"> • W. Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud, Pearson Education, 1st Ed., 2016. <p>References:</p> <ul style="list-style-type: none"> • James Kurose and Keith Ross, Computer Networking: A Top-Down Approach, Pearson, 7th Edition, 2017 • Relevant academic research articles in the literature
Assessment	<p>The assessment of the course includes a written test, a final written exam, and an individual and/or group project and research literature review.</p> <p>The weights for each assessment component are:</p> <ul style="list-style-type: none"> • Research Literature Review: 15% • Project Work: 35% • Test: 10% • Final Exam: 40%
Language	English