

Course Title	Computer Networks				
Course Code	WSS501				
Course Type	Required (Both Specializations)				
Level	Master (2nd Cycle)				
Year / Semester	1/1 (Fall)				
Teacher's Name	Chrysostomos Chrysostomou				
ECTS	10	Lectures / week	3	Laboratories / week	0
Course Purpose and Objectives	<p>The aim of the course is to bring in students to the deep concepts and principles underlying the field of modern networking, which are important for the design, application, and evaluation of advanced computer networks. Particular emphasis is given to the development of an understanding 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	<ul style="list-style-type: none"> • Gain in-depth knowledge and understanding of the main principles underlying the field of modern networking and also having a critical awareness of the wider context of advanced computer networks. • Justify the position that traditional network architectures are inadequate for modern networking needs. • List and explain the key requirements for an SDN architecture, and present an overview of an SDN architecture. • Understand the concept of virtual machine, list and explain the key benefits and requirements of NFV, and present an overview of the NFV architecture. • Describe the QoS architectural framework, and IP performance metrics. • Explain the motivations for QoE. • Define QoE, and explain the factors that could influence QoE. • Present an overview of how QoE can be measured, and distinguish between subjective and objective assessment. • Discuss the various application areas of QoE. • Translate metrics from QoS to QoE domain. • Select the appropriate QoE/ QoS mapping model for a given operational situation. • Deploy QoE-centric monitoring solutions over a given infrastructure. • Deploy QoE-aware applications over QoE-centric infrastructure. • Describe the key security requirements and main threats. 				

Prerequisites	None	Required	None
Course Content	<ol style="list-style-type: none"> 1. Elements of Modern Networking <ul style="list-style-type: none"> - The Networking Ecosystem - Example Network Architectures - Ethernet - Wi-Fi - 4G/5G Cellular - Internet of Things - Network Convergence - Unified Communications 2. Requirements and Technology <ul style="list-style-type: none"> - 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 3. Software-defined Networks (SDNs) <ul style="list-style-type: none"> - Evolving Network Requirements - The SDN Approach - SDN Data Plane <ul style="list-style-type: none"> o OpenFlow Protocol - SDN Control Plane <ul style="list-style-type: none"> o Cooperation and Coordination Among Controllers - SDN Application Plane 4. Network Functions Virtualization (NFV) <ul style="list-style-type: none"> - Concepts and Architecture 5. Network Virtualization <ul style="list-style-type: none"> - Architecture and Benefits 6. Quality of Service (QoS) <ul style="list-style-type: none"> - QoS Architectural Framework - Integrated Services Architecture - Differentiated Services - Service Level Agreements - IP Performance Metrics - OpenFlow QoS Support 		

	<p>7. QoE: User Quality of Experience</p> <ul style="list-style-type: none"> - The need for QoE - Definition of Quality of Experience - QoE Strategies in Practice - Factors Influencing QoE - Measurements of QoE - Applications of QoE <p>8. Network Design Implications of QoS and QoE</p> <ul style="list-style-type: none"> - 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 <p>9. Security</p> <ul style="list-style-type: none"> - 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. Lecture notes and presentations are available through the web for students to use in combination with the textbooks.</p> <p>Guided individual and/or group project and assignments are given to develop practical skills while integrating the course theory. Further research literature search is encouraged by assigning students to identify a specific problem related to some possible open research issues, gather relevant scientific information about how others have addressed the problem and report this information in written and/or orally.</p> <p>Lectures are supplemented with supervised and/or unsupervised computer laboratory. Laboratories include demonstrations of taught concepts and experimentation by means of computer simulations and/or packet analysis software.</p>
Bibliography	<ul style="list-style-type: none"> • W. Stallings (2015), <i>Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud</i>, Pearson Education, 1st Ed., ISBN 0-13-417539-5. • Relevant academic research papers.
Assessment	<ul style="list-style-type: none"> • Assignments: 20% • Project Work: 30% • Test: 10% • Final Exam: 40%
Language	English