Course Title	Computer Networks II				
Course Code	ACOE323				
Course Type	For BSc Computer Engineering, BSc Computer Science: Compulsory For BSc Electrical Engineering: Technical Elective				
Level	BSc (Level 1)				
Year / Semester	3rd (Fall)				
Teacher's Name	Chrysostomos Chrysostomou				
ECTS	6	Lectures / week	3	Laboratories/week	0
Course Purpose	The aim of the course is to familiarize students with the concepts and the principles underlying the field of computer networks, and to enable students develop the skills related to the network performance (delay, loss, and throughput), reliable data transfer, routing (traditional, SDN), network management, and wireless and mobile networked environments.				
Learning Outcomes	By the end of the course, the students are expected to: 1. Recognize and implement simple quantitative models for end-to-end throughput and delay that take into account transmission, propagation and queuing delays; 2. illustrate possible attacks to networks; 3. identify, explain, analyze and assess the principles for reliable data transfer; 4. illustrate how congestion occurs, its effects and mechanisms to control it; 5. describe software defined networking and identify benefits and challenges; 6. define, discuss and differentiate the data plane and control plane at the Network layer; 7. outline and compare the properties of dynamic routing algorithms; 8. design, implement and evaluate the operation of dynamic routing algorithms; 9. illustrate the operation of interior and exterior routing protocols, and justify the need for hierarchical routing; 10. identify, discuss and assess the functionalities of data plane switches, SDN controller, and control applications; 11. define network management, explain and analyse the infrastructure for network management, and illustrate how SNMP protocol operates; 12. identify and illustrate the key concepts in wireless and mobile networked environments.				
Prerequisites	ACOE313		Co-requisites	None	

Course Content	• **Computer Networks and the Internet:** Delay, loss, and Throughput in packet-switched networks (Overview of delay, Queuing delay and packet loss, End-to-end delay, Transmission and propagation delay, Throughput in computer networks). Processes Communicating. Non-persistent and persistent connections. Web Caching. Networks under attack. • **Reliable Data Transfer:** Multiplexing and demultiplexing. Principles of reliable data transfer (Pipelined reliable data transfer protocols, Go-Back-N, Selective Repeat). TCP round-trip time estimation and timeout. TCP reliable data transfer. Principles of congestion control (causes and costs of congestion, Approaches to congestion control). TCP congestion control. • **Network Layer – The Data Plane:** Overview of Network Layer – Data and Control plane. What's inside a router (Input port functions, Switching fabrics, Output ports, Where does queuing occur, Scheduling policies). Generalized forwarding and Software Defined Networking (SDN). OpenFlow data plane abstraction. OpenFlow flow table entries. OpenFlow example. • **Network Layer – The Control Plane:** Overview of per-router control plane (traditional) and logically centralized control (software defined networking). Routing algorithms (Link-state routing algorithm, Distance-vector routing algorithm). Hierarchical routing. Routing in the Internet (Intra-AS routing: OSPF, Inter-AS routing: BGP). The SDN control plane. Benefits of SDN. SDN perspective: data plane switches, SDN controller, and control applications. Components of SDN controller. OpenFlow protocol. SDN control/data plane interaction example. OpenDaylight (ODL) controller. ONOS controller. SDN challenges. • **Network Management:** What is network management? Infrastructure for network management. MIB - management information base. SNMP protocol. SNMP protocol message types and formats. • **Wireless and Mobile Networks:** Wireless link and network characteristics. CDMA. IEEE 802.11 wireless LANs ("Wi-Fi"). 802.15 – personal area network. Cellular Internet access (architecture, standards). Mobility management principles (addressing and routing to mobile users). Mobile IP. Wireless and mobility: Impact on higher-layer protocols.
Teaching Methodology	Students are taught the course through lectures by means of computer presentations. Lectures are supplemented with assignments aiming to help students develop practical skills by illustrating the concepts taught at lectures. The familiarization of computer network simulators and/or packet analysis software has been gained through the ACOE313 course. Homework is provided consisting of practical problems to help students apply their gained knowledge and identify the principles taught at lectures. Lecture/Coursework notes and presentations are available for students to use in combination with the textbooks and references, through the university's e-learning platform.
Bibliography	Textbook: • James Kurose and Keith Ross, ***Computer Networking: A Top-Down Approach***, Pearson, 8th Edition, 2021

<table>
<tr><td></td><td>References:
William Stallings, Data and Computer Communications, Pearson, 10th Edition, 2014</td></tr>
<tr><td>Assessment</td><td>The assessment of the course includes one written test and a final written exam with practical and theoretical questions. Homework and assignments are provided to help students familiarizing with and illustrating the concepts taught at lectures.
The weights for each assessment component are:
<table>
<tr><th colspan="2">Assessment Weights:</th><th>Partial</th><th>Total</th></tr>
<tr><td rowspan="4">Continuous Assessment</td><td>One Test</td><td>50%</td><td rowspan="3"></td></tr>
<tr><td>Two Assignments</td><td>30%</td></tr>
<tr><td>One Homework</td><td>20%</td></tr>
<tr><td>Continuous Assessment:</td><td>100%</td><td>40%</td></tr>
<tr><td colspan="3">Final Exam</td><td>60%</td></tr>
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<tr><td>Language</td><td>English</td></tr>
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