Course Title	Wireless Computer Networks				
Course Code	ACOE422				
Course Type	Elective				
Level	BSc (Level 1)				
Year / Semester	3rd / 4th (Spring)				
Teacher's Name	Chrysostomos Chrysostomou				
ECTS	6	Lectures / week	3	Laboratories/week	0
Course Purpose	The purpose of the course is to provide students with the knowledge of the concepts and principles underlying the field of wireless computer networks, and to enable students develop the skills related to the design, development, application, and evaluation of the key technologies and recent revolutions in wireless, mobile, and cellular networks.				
Learning Outcomes	By the end of the course, the students are expected to: 1. recognize, analyze and assess the recent revolutions in wireless, mobile and cellular networks, and distinguish the benefits and trade-offs of using the various available technologies; 2. describe and contrast multiple radio access protocols; 3. analyze and evaluate multiple division techniques; 4. discuss and illustrate the organization of cellular systems; 5. analyze and assess protocols and mechanisms developed for the network layer to support mobility; 6. outline and assess the key enabling technologies for 4G and 5G systems; 7. explain the advantages and disadvantages related to Wireless Local and Personal Area Networks; 8. identify and analyze applications and scenarios in mobile ad-hoc networks and wireless sensor networks.				
Prerequisites	ACOE323	Co-requisites	None		
Course Content	• **Introduction to Wireless Computer Networks:** Wireless impact. Mobile device revolution. Future trends. The trouble with wireless. Combating problems. Applications of wireless/mobile communications (vehicles, emergencies, business, replacement of wired networks). • **Wireless Transmission:** Signals. Electromagnetic spectrum of Telecommunications. Spectrum considerations. Propagation modes. Signal propagation (path loss, multi-path propagation, shadow, fading). Channel correction Mechanisms. Multiple Input Multiple Output (MIMO) Antennas. Signal-to-Noise Ratio. Bit error rate. Multiplexing (FDM, TDM,				

	OFDM). Spread Spectrum. Frequency Hoping Spread Spectrum. Direct Sequence Spread Spectrum. • **Multiple Radio Access:** Multiple Radio Access Protocols. Contention-Based Protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA. • **Multiple Division Techniques for Traffic Channels:** Concepts and Models for Multiple Divisions. FDMA. TDMA. CDMA. OFDM. SDMA. Comparison of Multiple Division Techniques. • **Cellular Concept:** Cell Area. Signal Strength and Cell Parameters. Capacity of a Cell. Frequency Reuse. How to Form a Cluster. Cochannel Interference. Cell Splitting. Cell Sectoring. Traffic Engineering. • **Traffic Channel Allocation**: Static Allocation versus Dynamic Allocation. Fixed Channel Allocation (FCA) - Simple and Complex Borrowing Schemes. Dynamic Channel Allocation (DCA) - Centralized and Distributed Dynamic Channel Allocation Schemes. Hybrid Channel Allocation (HCA) Schemes and Flexible Traffic Channel Allocation Schemes. Allocation in Specialized System Structure - Channel Allocation in One-Dimensional Systems, Reuse Partitioning–Based Channel Allocation, Overlapped Cells–Based Channel Allocation. • **Mobile Communication Systems**: Cellular System Infrastructure. Registration - Operation of cellular systems. Handoff Parameters and Underlying Support. Roaming Support - Home Agents, Foreign Agents, and Mobile IP, Rerouting in Backbone Routers. Security and Privacy - Wireless System Security. • **Wireless Mobile Networks:** 4th Generation Systems and Long Term Evolution (LTE). 5th Generation System. System architecture and Services. • **Wireless Local and Personal Area Networks:** Infrastructure and ad-hoc networks. Wireless LAN Technology and the IEEE 802.11 Wireless LAN Standard (System architecture, Standards (802.11a/b/g/n/ac and newer developments). IEEE 802.15 (WPAN – Wireless Personal Area Networks) - IEEE 802.15.1 (Bluetooth Architecture and Specifications - Bluetooth High Speed and Bluetooth Smart), IEEE 802.15.4 (Low-rate WPAN, ZigBee protocol). • **Mobile ad-hoc and sensor networks:** Overview of mobile ad-hoc networks and wireless sensor networks (applications and scenarios). Ad-hoc routing protocols. Wireless sensor network characteristics and design requirements. Routing techniques in wireless sensor networks.
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	Textbooks: • C. Beard and W. Stallings, ***Wireless Communication Networks and Systems***, Pearson Education, 1st Ed., 2016 • Dharma P. Agrawal, Qing-An Zeng, ***Introduction to Wireless and Mobile Systems***, Cengage Learning, 4th Edition, 2015. References: • Jochen Schiller, ***Mobile Communications***, Pearson, 2nd Ed., 2004
Assessment	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: • Assignments/Homework: 20% • Test: 20% • Final Exam: 60%
Language	English