Course Title	**Communications for Smart Systems**				
Course Code	**WSS530**				
Course Type	Specialization (Elective)				
Level	Master (2nd Cycle)				
Year / Semester	1 / 2 (Spring)				
Teacher's Name	Chrysostomos Chrysostomou				
ECTS	10	Lectures / week	3	Laboratories / week	0
Course Purpose and Objectives	The aim of the course is to bring in students to the deep concepts and principles underlying the field of key enabling communication technologies for smart systems, which are important for the design, application, and evaluation of modern communication networks. Particular emphasis is given to the development of an understanding of the recent revolutions relating to special issues like the Bluetooth and IEEE 802.15, enabling wireless local area network technologies for smart systems, LTE and 5G systems, wireless sensor networks applications to smart systems, the Internet of Things (IoT), Machine-to-Machine (M2M) Communications, Device-to-Device (D2D) Communications, Smart Transportation Systems (STSs), and Vehicular Networks (VANETs) in Smart City Systems.				
Learning Outcomes	• Gain in-depth knowledge and understanding of the main principles underlying the field of key enabling communication technologies for smart systems, and also having a critical awareness of the wider context of modern communication networks. • Discuss the new trend of connected objects in the context of smart systems and their challenges. • Discuss representative examples of WSNs applications in smart systems. • Describe access technologies to be used for the WSNs applications. • Identify Bluetooth application areas. • Analyze the concepts behind the Bluetooth High Sped and Bluetooth Smart. 1. Distinguish between High Data and Low Data Rate WPANs. 2. Describe the ZigBee architecture. • Identify IEEE 802.11 family of standards and discuss applications of WLANs to smart systems, and the challenges posed. • Discuss the key enabling technologies for 4G and 5G systems. • Describe the LTE and the LTE-A features, handover management, and the emerging concept of "smart city" in the context of LTE systems. • Explain the scope of the Internet of Things.				

	• List and discuss the principal components of IoT-enabled things. • Compare and contrast the ITU-T and IoT World Forum IoT reference models. • Describe different IoT implementations. • Identify M2M system key elements and technologies. • Describe dominant M2M application domains. • Identify and discuss major advantages and disadvantages of D2D networks. • Ascertain the efficacy of D2D networks for proximity services. • Explore emerging technologies such as social D2D networks, and simultaneous wireless information and power transfer (SWIPT) for D2D networks. • Analyze the emerging technologies in the fields of the Smart Cities, focusing on STSs. • Describe VANET applications in smart cities along with challenges, solutions and existing implementations.		
Prerequisites	WSS501	Required	None
Course Content	1. Introduction and Overview of Key Enabling Technologies for Smart Systems - Trends and Challenges - Survey of Major Key Enabling Technologies for Smart Systems - Examples 2. Wireless Sensor Networks (WSN) Applications to Smart Systems - WSN Applications Examples - Access Technologies - Routing Strategies - Power-saving Methods - Security Concerns 3. Bluetooth and IEEE 802.15 - Wireless Personal Area Networks (WPANs) - Bluetooth Motivation - Bluetooth Specifications - Bluetooth High Speed and Bluetooth Smart - IEEE 802.15 - High Data and Low Data Rate WPANs - ZigBee 4. Enabling Wireless Local Area Network (WLAN) Technologies for Smart Systems - Development of IEEE 802.11		

	- IEEE 802.11 Architecture - Smart Systems Solutions and Requirements 5. LTE and 5G systems - Cellular network evolution - Handover management - Empirical case: smart cities 6. The Internet of Things: Overview, Architecture and Implementation - The IoT Era - The Scope of the Internet of Things - Components of IoT-Enabled Things o RFID - ITU-T IoT Reference Model - IoT World Forum Reference Model - IoT Implementation 7. Machine-to-Machine (M2M) Communications - Concept of M2M Technology - M2M System Key Elements and Technologies - M2M Application Domains 8. Device-to-Device (D2D) Communications - Concept of D2D Technology - Performance and Different Network Deployment Scenarios 9. Smart Transportation Systems (STSs) in Critical Conditions - Smart Transportation Systems - Network Design for Smart Transportation Systems in Critical Conditions - QoS Applications for STS 10. Vehicular Networks (VANETs) in Smart City Systems - VANET Architecture - Vehicular Cloud Infrastructure - VANET Challenges and Solutions in Smart Cities - Vehicular Clouds Challenges and Solutions in Smart Cities - Open Issues and Future Directions in Vehicular Smart City Systems
Teaching Methodology	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. 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. 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.
Bibliography	• M. S. Obaidat and P. Nicopolitidis (2016), *Smart Cities and Homes: Key Enabling Technologies*, Morgan Kaufmann, 1st Ed., ISBN 0-12-803454-8. • C. Beard and W. Stallings (2016), *Wireless Communication Networks and Systems*, Pearson Education, 1st Ed., ISBN 0-13-359417-3. • Relevant academic research papers.
Assessment	• Assignments: 20% • Project Work: 30% • Test: 10% • Final Exam: 40%
Language	English