Course Title	Communications for Smart Systems				
Course Code	WSS530				
Course Type	Specialization (Elective)				
Level	Master (2nd Cycle)				
Semester	2 or 3				
Teacher's Name	Chrysostomos Chrysostomou, PhD				
ECTS	10	Lectures / week	3	Laboratories / week	0
Course Purpose	The purpose 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 provide students with the knowledge of recent revolutions relating to special issues like enabling wireless local area network technologies for smart systems, Bluetooth and IEEE 802.15, LTE and 5G systems, wireless sensor networks (WSNs) 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	By the end of the course, the students are expected to: 1. develop in-depth knowledge of the main principles underlying the field of key enabling communication technologies for smart systems; 2. recognize the new trend of connected objects in the context of smart systems and their challenges; 3. outline representative examples of WSNs applications in smart systems; 4. identify, analyse and evaluate access technologies to be used for the WSNs applications; 5. define and examine Bluetooth application areas; 6. analyse the characteristics behind the Bluetooth High Sped and Bluetooth Smart; 7. distinguish between High Data and Low Data Rate WPANs; 8. describe the ZigBee architecture; 9. identify IEEE 802.11 family of standards and outline applications of WLANs to smart systems, and the challenges posed; 10. analyse the key enabling technologies for 4G and 5G systems; 11. define and examine the LTE and the LTE-A features, handover management, and the emerging concept of "smart city" in the context of LTE systems; 12. explain the scope of the Internet of Things;				

	13. list and outline the principal components of IoT-enabled things; 14. compare and contrast the ITU-T and IoT World Forum IoT reference models; 15. describe and evaluate different IoT implementations; 16. identify M2M system key elements and technologies; 17. describe and evaluate dominant M2M application domains; 18. identify and outline major advantages and disadvantages of D2D networks; 19. determine the efficacy of D2D networks for proximity services; 20. investigate emerging technologies such as social D2D networks, and simultaneous wireless information and power transfer (SWIPT) for D2D networks; 21. analyse the emerging technologies in the fields of the Smart Cities, focusing on STSs; 22. describe and evaluate VANET applications in smart cities along with challenges, solutions and existing implementations.		
Prerequisites	WSS501	Required	None
Course Content	• **Introduction and Overview of Key Enabling Technologies for Smart Systems:** Trends and Challenges. Survey of Major Key Enabling Technologies for Smart Systems. Examples. • **Wireless Sensor Networks (WSN) Applications to Smart Systems:** WSN Applications Examples. Access Technologies. Routing Strategies. Power-saving Methods. Security Concerns. • **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. • **Enabling Wireless Local Area Network (WLAN) Technologies for Smart Systems:** Development of IEEE 802.11. IEEE 802.11 Architecture. Smart Systems Solutions and Requirements. • **LTE and 5G systems:** Cellular network evolution. Handover management. Empirical case: smart cities. • **The Internet of Things:** Overview, Architecture and Implementation. The IoT Era. The Scope of the Internet of Things. Components of IoT-Enabled Things. RFID. ITU-T IoT Reference Model. IoT World Forum Reference Model. IoT Implementation. • **Machine-to-Machine (M2M) Communications:** Concept of M2M Technology. M2M System Key Elements and Technologies. M2M Application Domains. • **Device-to-Device (D2D) Communications:** Concept of D2D Technology. Performance and Different Network Deployment Scenarios. • **Smart Transportation Systems (STSs) in Critical Conditions:** Smart Transportation Systems. Network Design for Smart Transportation		

	Systems in Critical Conditions. QoS Applications for STS. • **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. 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 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. Lecture notes and presentations are available for students to use in combination with the textbooks and references, through the university's e-learning platform.
Bibliography	• M. S. Obaidat and P. Nicopolitidis, ***Smart Cities and Homes: Key Enabling Technologies***, Morgan Kaufmann, 1st Ed., 2016 • C. Beard and W. Stallings, ***Wireless Communication Networks and Systems***, Pearson Education, 1st Ed., 2016 • Relevant academic research articles in the literature.
Assessment	The assessment of the course includes a written test, a final written exam, and an individual and/or group project and research literature review. The weights for each assessment component are: • Research Literature Review: 15% • Project Work: 35% • Test: 10% • Final Exam: 40%
Language	English