Course Title	Ubiquitous Computing				
Course Code	WSS503				
Course Type	Compulsory (Both Specializations)				
Level	MSc (Level 2)				
Year / Semester	1 / 1				
Teacher's Name	Andreas Constantinides, PhD				
ECTS	10	Lectures / week	3	Laboratories / week	0
Course Purpose	Ubiquitous Computing (*UbiComp*) touches on a wide range of topics including distributed computing, mobile computing, location computing, mobile networking, context-aware computing, sensor networks and many more, expands beyond the traditional challenges of those areas and more importantly demonstrates its value and importance through a device that lies on the backbone of UbiComp. That is, the cell phone, or more precisely the smarpthone where its advanced capabilites in terms of processing power and memory, its extended number of connection modalities and its unlimited number of sensors, made it one of the most widely adopted and ubiquitous computer ever existed. The purpose of this course is to provide students with advanced knowledge in emerging topics of ubiquitous computing in order to extend critical awareness of the issues and challenges associated with this area. Additionally, to allow students to identify and apply essential tools and techniques, as well as enhance their understanding on mobile systems. Furthermore, it covers a wide range of related topics such as context-awareness, privacy and personalization, mobile social networks and crowdsourcing via smartphones. Finally, it enables students to practice in various development platforms and toolkits to successfully design and develop smartphone applications. Emphasis is also given to extend students critical awareness regarding ubiquitous systems business aspect.				
Learning Outcomes	By the end of the course, students should be able to: • Describe the emerging topics of ubiquitous computing, next generation mobile systems (e.g., smartphones, tablets) and their application areas. • Identify and clearly describe the main challenges and issues of those areas. • Apply appropriate methods and tools to tackle those issues and challenges. • Creatively design and develop substantial smartphone applications involving distributed, peer-to-peer, client/server architectures. • Show the ability to design and develop smartphone applications using various platforms, toolkits and third-party libraries on, for example, Android operating system.				

	• Formulate and implement ideas and business strategies on smartphones to provide solutions to challenging business oriented and real-world problems.		
Prerequisites	None	Corequisites	None
Course Content	This course consists of the following ten chapters: • **Chapter 1** is the introductory session for the whole module • **Chapters 2 & 3** deal with topics related to computing areas that lie at the foundations of ubiquitous computing such as distributed and mobile computing. • **Chapter 4** deals with topics associated with challenges and applications of pervasive and ubiquitous computing. • **Chapter 5** covers topics on context-aware computing and systems with focus on how mobile systems can sense the environment and adapt according to the available resources on their surroundings. • **Chapters 6-9** deal with several special topics related to Ubiquitous Computing and Smartphone Systems, including Location-Awareness and localization in both outdoor and indoor environments, Mobile Social Networks, Personalization and Privacy as well as Crowdsourcing with Smartphones. • **Chapter 10** deals with software development on smartphone systems with major focus on smartphone application development on Android operating system.		
Teaching Methodology	The course is designed to introduce and explain the material students are expected to learn through lectures (3 hours per week) in classrooms or lectures theatres, by means of traditional tools or using computer demonstration. Lecture notes and presentations are available through the web (e-learning platform) for students to use in combination with the textbooks. Furthermore, theoretical principles are explained by means of specific examples and for solving specific problems using practical examples. Students are also advised to use the subject's textbook or reference books for further reading and practice. Auditory exercises, where examples regarding matter represented at the lectures, are solved and further, questions related to particular open-ended topic issues are compiled by the students and answered, during the lecture or assigned as homework. Furthermore, group projects are assigned to the students, where literature search is encouraged to identify a specific problem related to some issue, gather relevant scientific information about how others have addressed the problem, design and implement a solution as well as report the final solution in written and orally, via a presentation. Moreover, a number of case study readings are also considered, so as to demonstrate the relevance and practical applicability of mobile and ubiquitous computing methods and systems covered in the various units of this course.		

	Case-studies can illustrate that what students have studied in each chapter is not just of academic or theoretical value but also has value in terms of improving real-life challenges.
Bibliography	The following textbooks are associated with topics considered at various points throughout this course. • John Krumm (2016), Ubiquitous Computing Fundamentals, CRC Press • Dan Chalmers (2011) Sensing and Systems in Pervasive Computing: Engineering Context Aware Systems, Springer • Jia W. and Zhou W. (2005) Distributed Network Systems: From Concepts to Implementations (Network Theory and Applications) 2005th Edition, Springer • Pitoura E. and Samaras G. (1998), Data Management for Mobile Computing Kluwer Academic Publishers, The above textbooks are recommended as sources of additional reading for students so as to elaborate on the course's material. Students can also find additional examples that they can use for practice. Furthermore, students are also encouraged to explore other online / print sources that are related to topics covered in this course such as the following: • Rafael Alexandrou, Harris Papadopoulos, Andreas Konstantinidis, "Smartphone Indoor Localization using Bio-Inspired Modeling" , Nature-Inspired Computation in Navigation and Routing Problems, Springer, 2019 • Andreas Konstantinidis, Panagiotis Irakleous, Zacharias Georgiou, Demetrios Zeinalipour-Yazti and Panos K. Chrysanthis, "IoT Data Prefetching in Indoor Navigation SOAs" , ACM Transactions on Internet Technology (TOIT'18), 20 pages, 2018. • Wu, C., Yang, Z. and Liu, Y., 2015. Smartphones based crowdsourcing for indoor localization. Mobile Computing, IEEE Trans. on, 14(2), pp.444-457.A. Konstantinidis, G. Nicolaides, G. Chatzimilioudis, G. Evagorou, D. Zeinalipour- Yazti and P. Chrysanthis, "Radiomap Prefetching for Indoor Navigaiton in Intermittently Connected WiFi Networks", IEEE 16th Intern. Conference on Mobile Data Management (MDM '15), IEEE Press, 2015. • Andreas Konstantinidis, Georgios Chatzimilioudis, Demetrios Zeinalipour-Yazti, Paschalis Mpeis, Nikos Pelekis, Yannis Theodoridis, "Privacy-Preserving Indoor Localization on Smartphones." IEEE Trans. on Knowledge and Data Engineering (TKDE '15), IEEE Computer Society, USA, 2015 • C. Laoudias, G. Constantinou, M. Constantinides, S. Nicolaou, D. Zeinalipour- Yazti, and C. Panayiotou, "The airplace indoor positioning platform for android smartphones," in MDM, 2012 • G. Chatzimilioudis, A. Konstantinidis, C. Laoudias and D. Zeinalipour-Yazti,, "Crowdsourcing with Smartphones", IEEE Internet Computing, SI: Crowdsourcing, 2012.Andreas Konstantinidis, Demetrios Zeinalipour-Yazti, Panayiotis Andreou, George Samaras, and Panos Chrysanthis, "Intelligent Search in Social Communities of Smartphone Users", Distributed and Parallel Databases, Springer Press, Vol: 31, No: 2 Pages: 115-149, 2013. • Y. Gu, A. Lo, and I. Niemegeers, "A survey of indoor positioning systems for wireless personal networks," Communications Surveys Tutorials, IEEE, vol. 11, no. 1, pp. 13–32, First 2009. • H. Liu, H. Darabi, P. Banerjee, and J. Liu, "Survey of wireless indoor positioning techniques and systems," Systems, Man, and Cybernetics, Part C: Applications and Reviews, IEEE Transactions on, vol. 37, no. 6, pp. 1067–

	1080, Nov 2007. • Online Textbook: Hanneman, Robert A. and Mark Riddle. 2005. Introduction to social network methods. Riverside, CA: University of California, Riverside. • Chellappa, R.K. and Sin, R.G., 2005. Personalization versus privacy: An empirical examination of the online consumer's dilemma. Information Technology and Management, 6(2-3), pp.181-202. • M. Gruteser and D. Grunwald. Anonymous usage of location-based services through spatial and temporal cloaking. In Proceedings of the 1st Intl. Conference on Mobile Systems, Applications and Services, MobiSys '03, pages 31–42, 2003. • L. Sweeney. K-anonymity: A model for protecting privacy. Int. J. Uncertain. Fuzziness Knowl.-Based Syst., 10(5):557–570, Oct. 2002.
Assessment	The Students are assessed via continuous assessment throughout the duration of the Semester, which forms the Coursework grade and the final written exam. The coursework and the final exam grades are weighted 50% and 50%, respectively, and compose the final grade of the course. Various approaches are used for the continuous assessment of the students, such as class participation and laboratory work, group project design, implementation and presentation. The assessment weight, date and time of each type of continuous assessment is being set at the beginning of the semester via the course outline. An indicative weighted continuous assessment of the course is shown below: • **Participation Activities** (10% of total marks for module) • **One marked (group) project** (30% of total marks for module) • **Presentation of group project** (10% of total marks for module) • **One closed-book, 3-hour exam** (50% of total marks for module) Students are prepared for final exam, by revision on the matter taught, problem solving and concept testing and are also trained to be able to deal with time constrains and revision timetable. The criteria considered for the assessment of each type of the continuous assessment and the final exam of the course are: (i) the comprehension of the fundamental concepts and theory of each topic, (ii) the application of the theory in solving related problems and (iii) the ability to apply the above knowledge in complex real-life problems. The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Language	English