



Course Syllabus

Course Code	Course Title	ECTS Credits
COMP-531DL	Mobile and Wireless Networks	10
Prerequisites	Department	Semester
COMP-525DL	Computer Science	Fall
Type of Course	Field	Language of Instruction
Required for Mobile Systems Concentration	Computer Science	English
Level of Course	Lecturer(s)	Year of Study
2 nd Cycle	Dr. Nicholas Loulloudes	2 nd
Mode of Delivery	Work Placement	Corequisites
Distance Learning	N/A	N/A

Course Objectives:

The course aims to provide students with fundamental knowledge into core concepts of the latest and next generation mobile and wireless networks. Throughout the course, students will be exposed to theoretical and practical aspects regarding the architecture and applications of Cellular, LTE, and 4G/5G systems. In addition, basic concepts of Wireless LAN (WLAN), Mobile Peer-to-Peer (MP2P), wireless sensor networks (WSN) and emerging opportunistically connected mobile/vehicular networks (MANET and VANET), will be explored.

Specifically, this course will provide students with:

- Solid understanding on the taxonomy of wireless networks, in terms of infrastructure and communication paradigm.
- The fundamental principles of electromagnetic wave propagation, and the parameters that dictate its performance.
- Overall understanding of Wireless Networks as distributed, multi-user, resource limited systems; and why multiple access control is required and what kind of solutions exist.

- First-hand experience in the effects of mobility on WSN, MANET and VANET, using simulative efforts.
- Deep knowledge in principles of layered architectural network design.
- Theoretical foundations in the core principles underpinning modern cellular systems.
- Network planning techniques, connectivity requirements analysis and design of resource allocation mechanisms including power control for fixed-rate and rate-adaptive systems.
- Knowledge in routing protocols and mobile IP for Wireless Mobile Networks.
- Exploration and understanding of basic network performance metrics for evaluating and maintaining Quality of Service (QoS) in broadband mobile and wireless communication systems.
- Necessary background to distinguish among various performance metrics for different wireless/mobile infrastructures, and were applicable link those metrics with the network economics of an enterprise.
- Penetration into state-of-the-art performance evaluation schemes, as well as efficient monitoring and management of wireless network resources.

Hands-on experience for demonstrating and assessing topology formation and resource utilization efficiency, through established experimentation platforms that utilize High Performance Computing infrastructures.

Learning Outcomes:

After completion of the course, students are expected to be able to:

1. Have a clear and concise understanding of communication techniques and protocols used in Cellular networks, LTE, 4G/5G mobile systems, MP2P, WSN and MANET/VANET.
2. Distinguish and adequately explain principal concepts underpinning the development of broadband mobile and wireless systems, as well as assess application specific scenarios and thereby identify any issues or related problems and their respective solutions.
3. Analyze and demonstrate fundamental network performance measures following established computer science paradigms, and have a clear and defined realization of end-to-end wireless network evaluation concepts.

4. Determine and demonstrate various design issues in mobile and wireless systems for seamless and reliable communication considering fundamental concepts such as Radio Coverage, Capacity, Bit and Frame-Error Rate.
5. Successfully evaluate communication protocols under different realistic performance and environmental scenarios, including hands-on experience with discrete-event frameworks such as Network Simulator (ns3).
6. Develop advanced knowledge and analyze techniques on how to monitor network threads/processes, as well as identify inter-operational characteristics in a wireless network system.

Survey and research state-of-the-art areas of high performance mobile and wireless systems.

Course Content:

1. Introduction and applications of Mobile and Wireless Networks.
2. Overview of Wireless Network Topologies (Infrastructure/Infrastructure-less, Stationary/Mobile), their layered architectures, current and emerging technologies.
3. Fundamentals of mobile and wireless network communications in the presence of a noisy channel, multiple access techniques.
4. Wireless radio resource management (RRM), rate adaptation, handover, power allocation and control.
5. Mobility models for Wireless Networks and their effects on end-to-end communication.
6. Fundamentals of modern Cellular Networks and their architectures.
7. Routing protocols for Wireless Networks and solutions to obstacles induced by mobility.
8. Performance analysis of remotely hosted communications, metric interpretation, QoS metrics and techniques based on requirements of delay sensitive wireless Internet applications.
9. Efficient management of network resources through Power and Energy adaptation
10. Capacity Analysis and Evaluation, comparison of analytical models with simulations.
11. Performance evaluation schemes for network monitoring and efficient resource management.
12. State-of-the-art survey of the related bibliography on Wireless and Mobile systems.

Learning Activities and Teaching Methods:

Distance Learning Lectures, Videos, Presentations, Tutorials, Theoretical Exercises and Assignments

Assessment Methods:

- Assignments
- Course Project (programming, individual project)
- Final Examination

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Wireless Communications & Networks	William Stallings	Pearson	2005	<u>ISBN13:</u> 9780131918351
Ad Hoc Mobile Wireless Networks: Principles, Protocols, and Applications	Subir Kumar Sarkar, T.G. Basavaraju, C. Puttamadappa	CRC Press	2012	<u>ISBN-10:</u> 1466514469 <u>ISBN-13:</u> 978-1466514461

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Resource Management in Mobile Computing Environments	Constandinos X. Mavromoustakis, George Mastorakis, Evangelos Pallis	Springer	2014	<u>ISBN-10:</u> 3319067036 <u>ISBN-13:</u> 978-3319067032
Wireless Communications: Principles and Practice	Theodore S Rappaport	Dorling Kindersley	2002	<u>ISBN-10:</u> 0130422320
Mobile Communications, 2 nd Edition	Jochen Schiller	Pearson	2004	<u>ISBN-13:</u> 9780321123817