Università degli Studi di L'Aquila - Dipartimento di Ingegneria e Scienze dell'Informazione e Matematica

Course catalogue

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Programme of Course "WIRELESS COMMUNICATIONS"

- Code: I2T014
- Type of course unit: Elective (Laurea Magistrale in Ingegneria Informatica e Automatica curriculum Generale), Elective (Laurea Magistrale in Ingegneria Informatica e Automatica curriculum Automatica), Elective (Laurea Magistrale in Ingegneria Informatica e Automatica curriculum Informatica), Compulsory (Laurea Magistrale in Ingegneria delle Telecomunicazioni curriculum Comune)
- Level of course unit: Postgraduate Degrees
- Semester: 1

Number of ects credits: (Laurea Magistrale in Ingegneria delle Telecomunicazioni) 9 (workload 225 hours), (Laurea Magistrale in Ingegneria Informatica e Automatica) 9 (workload 225 hours)

Teachers: Fortunato Santucci

1	**Course objectives**	The goal of this module is to provide the fundamental set of concepts, techniques and standards that relate to modern systems for wireless communications and networking. On successful completion of this module, the student should understand i) the fundamental characteristics of wireless channels and related statistical models, ii) modern digital techniques for high capacity and wide-band transmissions on the wireless channel, iii) the set of relevant standardized systems for wireless communications in the cellular domain, broadband wireless access, ad-hoc networks, short range communications, wireless sensor networks and Internet-of-Things paradigms. The student are educated to tackle both design and operation problems, and to acquire the ability to model and solve networking problems in both traditional (e.g. communications services, internet services, etc.) and novel application contexts (e.g. industrial automation, environmental monitoring, ITS, etc.). The module is tightly connected with the modules of Digital Communications, Digital Electronics, Embedded Systems, Radiopropagation, Multimedia communications, Telecommunication Networks II.
2	**Course content and learning outcomes (dublin descriptors)**	Topics of the module include: • Wireless systems: introduction and overview on architectures, technologies and applications. • The wireless channel: from physical behavior to statistical channel modeling with Bello's functions; relevant channel models: WSSUS, GWSSUS, MIP and Doppler spread, doubly-dispersive channels and related parameters in time and frequency; spatio-temporal models. • Digital transmissions over the wireless channels: performance analysis of digital modulation schemes, diversity techniques, spread spectrum systems, OFDM; Multiple Access Techniques: FDMA, TDMA, CDMA, OFDMA. • Cellular mobile radio systems: architecture, co-channel and multiple access interference, spectral efficiency, mobility management, coverage and design criteria. • Relevant standards for cellular communications: detailed analysis of GSM, GPRS, EDGE, UMTS, HSDPA and LTE. • Wireless LAN and wireless MAN: IEEE 802.11 and 802.16 (topic mainly addressed in Tel. Networks II). • Wireless networks without infrasctructure: ad-hoc networks and mobile ad-hoc networks (MANET). • Wireless Personal Area Networks and RFID: overview and analysis of the IEEE 802.15.x standard set (including Bluetooth, low and high data rate PAN) and emerging standards in ISA and IETF, Ultra Wide-Band (UWB) technologies for short-medium range; architectures and protocols for RFID systems. • Wireless sensor networks (WSN): architectures and protocols based on IEEE 802.15.4, and related applications. On successful completion of this module, the student should : • On successful completion of this module, the student should have solid knowledge of advanced theory and techniques for digital transmissions over wireless channels, standard architectures and protocols of modern wireless networks.

		• The student should have knowledge and understanding of design methods for wireless links and networks, as well as for wireless network planning and management. • The student should understand and explain the complete path from specification of system requirements, choice of wireless technology, development and simulation of an appropriate system model for validation, and eventual step to SW development on a target platform. • The student should demonstrate skill in analyzing problems, elaborate appropriate written documentation and oral presentations of problems, solutions, and validation methods. • The student should demonstrate capacity for reading and understanding any textbooks and scientific papers on specific matters, with particular emphasis on research oriented literature and documents that describes standard systems.
3	**Course prerequisites**	The student should be aware of fundamentals of digital communications systems, telecommunication networks and internetworking.
4	**Teaching methodsand language**	Lectures, exercises, practical sessions in simulation and real test-beds, invited talks by industry speakers, thematic workshops. **Language**: English **Reference textbooks** • R. L. Peterson, R. E. Ziemer, D.E. Borth, ***Introduction to Spread Spectrum Communications***. Englewood Cliffs, Prentice Hall. 1995. • Andreas Molisch, ***Wireless Communications***. J. Wiley & sons. 2005. *http://ieeexplore.ieee.org/xpl/bkabstractplus.jsp?bkn=5635423* • Andrea Goldsmith, ***Wireless Communications***. Cambridge University Press. 2005.
5	**Assessment methods**	Oral exam and presentation/discussion of a project work. Students are encouraged to carry out the project work in team and to also take a topic that can be carry out jointly with the Embedded Systems module.