

Course Description – Wireless Communications and Networking

Course title:	Wireless Communications and Networking
Hours per week:	4 hrs. (2 hrs. lecture + 2 hrs. lab)
Number of ECTS / US Credits:	6 ECTS (4 US Credits)
Semester:	Bachelor semester 3 to 6
Objective of the course:	Learn the principles of various type of wireless communications technologies as i.e.: WiFi 802.11, Bluetooth 802.15, WiMAX 802.16, RFID). Learn the structure and functionalities of different network based on wireless communications. Learn with hands-on how to install, analyse and troubleshooting various wireless network configurations and wireless network components within the Wireless Communications and Networking virtual laboratory.
Prerequisites:	Some knowledge in computer networks, or data communications
Teaching methods:	Electronic media presentations, demos, case studies
Assessment methods:	40% of the grade is based on reports/questions on the results of exercises 60% of the grade is based on final exam questions (written exam:90 min)
Language of instruction:	English
Name of lecturer:	Prof. Dr.-Ing. Alexandru Soceanu
Email:	Soceanu@cs.hm.edu

Link: <http://w3-o.cs.hm.edu/~soceanu/>

Time:

Course content:

Computer Networks : Technical Background: Network Architecture Model, Standardization, Network Configuration, TCP/IP Protocol Architecture, Addressing and Routing within TCP/IP Networks, Data Link Layer: CSMA/CD (Ethernet)

Wireless Networks: Introduction: Elements of Wireless Network, Wireless Network Standards, Wireless Links and Network Characteristics,

Wireless LANs: IEEE 802.11 (WiFi) LAN Architecture, Channels and Station association to AP, CSMA/CA-MAC Protocol, Protocol solution for Hidden Terminals Problem: RTS, CTS, IEEE 802.11 Frame Format, Mobility in the same IP Subnet, Global mobility: Addressing, Routing (direct, indirect), Mobile IP, IEEE 802.16 WiMAX Standard, Operation, IEEE 802.16 Message Format, IEEE 802.15 (WPAN): based on Bluetooth, Radio Frequency Identification (RFID), Cellular Mobile vs. Wireless LANs

Data Transmission: Introduction: Analog and Digital Data Transmission, Frequency, Spectrum, Bandwidth, Channel Capacity

Signal Encoding: Introduction: Digital Data Encoding Formats: NRZ, Manchester, Transmitting Digital Data using Analog Signals: Modulation types: Amplitude Shift Keying (ASK); Frequency Shift Keying (BFSK, MFSK); Phase Shift Keying (BPSK, QPSK), Transmitting Analog Data using Digital Signals: Pulse Code Modulation (PCM)

Encoding Signals for Wireless Communication:Introduction: Spread Spectrum Concept, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS)

Wireless Communication Security: Security Requirements, Wired Equivalent Privacy (WEP):

Encryption, Decryption, Problems, WiFi Protected Access (WPA): Preshared Key, IEEE 802.1x Authentication, TKIP-Protocol, WPA Vulnerabilities, IEEE 802.11i Security Standard, Comparison between Security methods

Online exercises within the virtual laboratory of vhb: 1) Installing WLAN 802.11, 2) Analyzing WLAN 802.11, 3) Installing Bluetooth, 4) Analyzing Bluetooth, 5) Mgmt and Troubleshooting WLANs , 6) Security in 802.11 WLANs , 7) QoS in Wireless Communication, 8) Voice-over-IP (VoIP) on Wireless Networks, 9)(Optional) IPv6 Native Operations, 10) (Optional) IPv6 Tunnelling

Recommended Readings - Literature:

1. James F. Kurose & Keith W. Ross: "Computer Networking, A top-down approach featuring Internet", 4th Edition
Pearson, Addison Wesley, New York, 2007
2. William Stallings: "Wireless Communications and Networks". 2nd Edition,
Prentice Hall, London, 2005
3. William Stallings: "Data and Computer Communications", 8th Edition
Prentice Hall, London, 2008
4. Matthew S. Gast: "802.11 Wireless Networks, the definitive Guide",
O'Reilly, Sebastopol, 2005
5. Online tutorials in the virtual laboratory: WLAN 802.11, Mobile IP, Fundamentals on Wireless Communications, Bluetooth, RFID Communications, WiMAX 802.16, WLAN Security, IPV6