

Wireless Networking

Course Title: Wireless Networking
Course No: CSC331
Nature of the Course: Theory + Lab
Semester: V

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description: This course familiarizes students with different concepts of wireless networking including wireless channels, communication techniques, cellular communications, mobile network, and advanced features.

Objective: The main objective of this course is to provide concepts and principles of wireless networking including protocol stacks and standards with the evolution of latest wireless networks.

Unit 1: Introduction [4Hrs]

- 1.1 History and challenges of wireless communications
- 1.2 WLAN technologies: Infrared, UHF narrowband, spread spectrum
- 1.3 Wireless communications standards

Unit 2: Wireless Channel Characterization [4Hrs]

- 2.1 Multipath propagation environment
- 2.2 LTI channel model
- 2.3 Channel correlation function
- 2.4 Large scale path loss
- 2.5 Small scale multipath fading

Unit 3: Wireless Communication Techniques [12Hrs]

- 3.1 Transmission techniques
 - 3.1.1 Introduction to bandpass transmission
 - 3.1.2 Signal space and decision reasons
 - 3.1.3 Digital modulation
 - 3.1.4 Power spectral density
- 3.2 Receiver Techniques
 - 3.2.1 Introduction to fading dispersive channels
 - 3.2.2 Channel impairment mitigation techniques
 - 3.2.3 Diversity
 - 3.2.4 Channel equalization
- 3.3 Multiple Access Technologies
 - 3.3.1 Conflict free multiple access technologies
 - 3.3.2 Spectral efficiencies

Unit 4: Fundamental of Cellular Communications [5Hrs]

- 4.1 Spectrum reuse and re-farming
- 4.2 Cell cluster concept
- 4.3 Co-channel and adjacent channel interference
- 4.4 Cell site call blocking and delay
- 4.5 Channel allocation strategies

Unit 5: Mobility Management in Wireless Networks [6Hrs]

- 5.1 Introduction
- 5.2 Call admission control
- 5.3 Handoff management

- 5.4 Location management for cellular and PCS networks
- 5.5 Traffic calculation

Unit 6: Overview of Mobile Network and Transport Layer [8Hrs]

- 6.1 Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation
- 6.2 IPv6-Network layer in the internet
- 6.3 Mobile IP session initiation protocol
- 6.4 Wireless application protocol
- 6.5 Mobile routing protocols: DSDV, AODV and DSR
- 6.6 Classical TCP improvements: Mobile TCP, Time out freezing, Selective retransmission

Unit 7: Advances in Wireless Networking [6Hrs]

- 7.1 4G: Features, Challenges and Applications
- 7.2 Overview of 4G Technologies
 - 7.2.1 Multicarrier Modulation
 - 7.2.2 Smart antenna techniques
 - 7.2.3 Adaptive Modulation
 - 7.2.4 Cognitive Radio
- 7.3 Introduction to 5G and its vision
- 7.4 Introduction to wireless network virtualization
- 7.5 Concepts of Wireless Sensor Network & RFID
- 7.6 Introduction to optical communication: Li-Fi
- 7.7 Introduction to Software Defined Wireless Networks
- 7.8 Concepts of Open BTS and Open Cellular Networks

Laboratory Works:

1. Implement DSSS, Channel coding, line coding in MATLAB or equiv. tool
2. Analyze performance of WiMAX/WiFi network using NetSim or equiv. tool.
3. Develop QPSK detector and understand the relation between BER and SNR.
4. Implement various pulse shaping filters implemented in wireless communication.
5. Implement wireless routing protocol: DSDV & AODV
6. Create IPv6 based (Ad-hoc & Infrastructure) wireless network environment and evaluate connectivity, delay, latency, throughput etc.
7. Understand Contiki OS and implement IoT/WSN

Recommended Books:

1. Vijay Garg. "Wireless Communications and networking", First Edition, Elsevier 2007
2. John W. Mark and Weisua Zhuang. "Wireless communications and Networking", Prentice hall of India Pvt. Ltd., 2005
3. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012
4. Simon Haykin, Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013