

Wireless Communications

1. **Course number and name:** 020CSFES3 Wireless Communications
2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours
3. **Instructor's or course coordinator's name:** Melhem El Helou
4. **Instructional materials:** Course handouts; standards and white papers; lab experiments

References:

- Andrea Goldsmith, Wireless Communications, 2005.
- Andreas F. Molisch, Wireless Communications: From Fundamentals to Beyond 5G, 3rd edition, 2022.
- Theodore S. Rappaport, Wireless Communications: Principles and Practice, 2nd edition, 2002.

5. Specific course information

a. Catalog description:

This course covers the fundamentals of wireless communications (with emphasis on wireless channel modeling); digital modulation in wireless channels; channel coding and interleaving in fading channels; equalization; diversity; multiple antenna systems; spread spectrum; multicarrier modulation; multiple access; WiFi networks.

b. Prerequisites: None

c. **Required** for Telecommunication Networks option students; **Selected Elective** of Software Engineering option students

6. Educational objectives for the course

a. Specific outcomes of instruction:

- Analyze the fundamentals of wireless communications.
- Model, simulate, and assess wireless communication systems.
- Compute and interpret radio link budgets.
- Design OFDM multi-carrier transmission systems.
- Analyze and plan WiFi networks.

b. PI addressed by the course:

| PI | 1.1 | 1.2 | 1.3 | 2.1 | 2.2 | 2.4 | 6.2 | 6.3 | 6.4 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Covered | x | x | x | x | x | x | | x | x |
| Assessed | | x | x | x | x | x | x | x | x |

7. Brief list of topics to be covered

- Overview of wireless communications: context and motivations, technical challenges, wireless services, wireless spectrum (2 lectures)

- Radio propagation and channel modeling (pathloss, fast/slow shadowing); wireless channel selectivity (4 lectures)
- Radio link budget (2 lectures)
- Performance of digital modulation over wireless channels; capacity of wireless channels (2 lectures)
- Channel coding and interleaving for fading channels (2 lectures)
- Equalization; diversity techniques (1 lecture)
- Multiple antenna systems; spread spectrum (2 lectures)
- Multicarrier modulation; design of OFDM systems (3 lectures)
- Activity on simulating and analyzing wireless communication systems using Matlab (1 lecture)
- Multiple access (2 lectures)
- WiFi networks (3 lectures)