



## Course Specification Document

<b>Title</b>	Communication Networks
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<b>Credits</b>	1.5 ECTS
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<b>Aims</b>	This course aims to familiarize the student with the modern networking technologies, including wired, optical, and wireless, especially in the mobile context at the physical and Media Access Control (MAC) layers.
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### Intended learning outcomes

On successful completion of this course, the student will be able to:

- Understand the challenges of high-speed communication networks (broadband) based on its type, speed, and range.
- Recognize the general structure of the xDSL system and its variations (ADSL, HDSL, etc.).
- Familiarize himself with some optical communication technologies and systems (FTTx, GON, AON).
- Identify challenges related to wireless channel propagation.
- Understand the principle of OFDM/OFDMA technology and its key parameters.
- Understand the need for multiple antennas and recognize their fundamental technologies and applications in WiFi, 4G, 5G.

### Syllabus

- **General introduction:** Classification of wired and wireless digital communication systems based on range, examples of different application requirements in terms of transmission speed, examples of speeds provided by different communication systems.
- **Telephone-Based networks:** Introduction to PSTN, frequency response of the voice channel, evolution of modems leading to ISDN services, xDSL technology family.
- **Optical networks:** Family of Access (FTTx) and Core Networks optical technologies.
- **OFDM/OFDMA technology in broadband wireless networks:** Issues of selective frequency fading in multipath channels, the need for multi-carrier communication in frequency-selective channels, OFDM principle and OFDMA technology, OFDM signal spectrum, self and inter-symbol interference in OFDM symbols, introduction of guard interval and cyclic prefix, generation and detection of OFDM signal using Fourier transform, case study: OFDMA in WiFi and LTE/4G.
- **Antenna diversity techniques array antennas & MIMO:** Need for multiple antenna technologies, classification of multiple antenna systems based on the number of antennas and users, spatial diversity principle in reception, methods for combining received signals, array antennas and beamforming, spatial multiplexing and SDMA technology, case study: Multiple antennas in WiFi and LTE/4G.

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