

## Materia 4\_35: Wireless communications and 5G

<b>Materia:</b>	Wireless communications and 5G	<b>ECTS:</b>	15
<b>Descriptores</b>	<ul style="list-style-type: none"> <li>Digital Modulations, Quantization, Data Encoding, Channel Estimation, Channel Coding</li> <li>Electromagnetic Waves, Radio Spectrum, Frequency Bands, Antennas, Radio Channel, Propagation Mechanisms, Radio Links, Point-to-Point Links</li> <li>Wireless Network, Digital Mobile Telephony, Cellular Model, WiFi, WiMax, WPAN, WLAN, WMAN, UMTS, LTE, 5G, Network Dimensioning, Indoor Planning.</li> </ul>		
<b>Objetivos generales</b>	<p>This subject has the objective of providing an applied vision of the basic and advanced techniques of digital modulation and data coding, and their use in the most current systems (3G mobile, 4G, wireless, cable, DTT), as well as a brief description of the most promising future technology (5G and 6G). It provides basic knowledge of radio communications with the ability to analyse, design and evaluate the performance of a communications system that uses the radio channel as a transmission medium. Finally, it introduces the basic concepts that apply to existing mobile and wireless communications networks to design and adjust 3GPP wireless and radio access networks.</p>		
<b>Competencia específica</b>	<p>CE 4-35a: Ability to analyse, encode, process and transmit multimedia information using digital signal processing techniques.  CE 4-35b: Ability to select subsystems and systems for radio frequency and design radio links.  CE 4-35c: Ability to select antennas, transmission equipment and systems by electromagnetic, radiofrequency or optical means and the corresponding radio space management and frequency assignment.  CE 4-35d: Ability to apply the techniques underlying telecommunication networks, services and applications in both fixed and mobile, personal, local or long-distance environments, including telephony, broadcasting, television and data, from the point of view of transmission systems.</p>		
<b>Resultados de aprendizaje</b>	<p>Explain the digital modulations most commonly used in communications.  Describe digital channel equalisation and estimation techniques.  Identify the different channel coding techniques and explain the differences between block codes and convolutional codes.  Simulate and analyse the transmission of a modulated signal over an AWGN channel.  Simulate and analyse the transmission of an OFDM signal over a Rayleigh channel.  Design an OFDM communications system over a Rayleigh channel.  Understand the physical phenomena associated with the propagation of electromagnetic waves and the mathematical equations that describe electromagnetic phenomena.  Differentiate the different frequency bands of the radio spectrum and the regulation of their use.  Identify the most common types of antennas and interpret their main radiation parameters.  Distinguish the propagation mechanisms of electromagnetic waves and characterise their influence on the radio channel.  Design and simulate with software support a digital radio link.  Distinguish different wireless networks according to their access and associate them with the standards under which they operate.  Design and adjust 3GPP wireless and radio access networks.  Explain the concept of frequency reuse associated with the cellular model on which digital mobile phone systems are based.  Describe the technological improvements incorporated in the different generations of mobile communications systems up to 5G.  Understand the medium access techniques and modulations most commonly used in mobile communications systems.  Dimension a mobile network.  Optimise the parameters of a UMTS network</p>		
<b>Métodos de evaluación</b>	<ul style="list-style-type: none"> <li>Evaluation: Written open-ended test and Problems</li> <li>Assessment instruments: Checklists and Rating Scales</li> </ul>		