

AEEE504 - Wireless and Personal Communications

Course Title	Wireless and Personal Communications				
Course Code	AEEE504				
Course Type	Technical Elective				
Level	Masters (2nd Cycle)				
Year / Semester	1 or 2				
Teacher's Name	Assistant Prof Symeon Nikolaou				
ECTS	8	Lectures / week	3	Laboratories/week	0
Course Purpose	<p>The aim of the course is to familiarize the students with advanced concepts and principles of wireless and cellular communications. Students should be in position to analyze the dominant propagation models in urban and rural environment and calculate the radio coverage area using the Friis' equation and the empirical models that dictate the propagation environment under investigation. They should be able to distinguish between slow and fast fading channels and between frequency selective and flat fading channels. Students should be able to analyze to compare and judge the basic characteristics of cellular mobile phone systems and distinguish between competing multiple access schemes, such as TDMA, FDMA, and the modern widespread schemes of OFDMA and WCDMA. They should also be in position to use the basics of queuing theory and the Erlang models to define the call rejection probability for a given re-use factor and for given total bandwidth. They should be in position to interpret the needs and requirements for the use of MIMO systems over conventional SISO transceivers.</p>				
Learning Outcomes	<ol style="list-style-type: none"> 1. Analyze the radio wave propagation principles, free space path loss and shadow fading, and assess the effect on wireless communication systems if different fading conditions apply. 2. Compare the operation principles of modern cellular systems and appraise the concepts of channel reuse, co channel interference, interference reduction techniques and dynamic range allocation. 3. Judge the available modulation schemes, the pulse shaping selection and the spectrum needs for different types of digital modulation. 4. Interpret the need for linear equalizers usage and the necessity for maximum likelihood sequence estimation. 5. Judge and argue how to make a choice between different multiple access schemes like FDMA, TDMA, and CDMA in comparison with the use of random access protocols. 6. Combine the performance of a conventional transceiver (SISO) with multiple input multiple output systems (MIMO) and argue for the advantages of receiver and transmitter diversity. 				

Prerequisites	AΕΕΕ424, ΑΕΕΕ501 or equivalent	Corequisites	None
Course Content	<ul style="list-style-type: none"> • Overview of Wireless Communications History of Wireless Communications. Current Wireless Systems. The wireless spectrum standards • Path Loss and Shadowing Radio Wave Propagation. Transmit and Receive Signal Models. Free-Space Path Loss. Shadow Fading. • Capacity of Wireless Channels Capacity in AWGN. Capacity of Flat-Fading Channels. Capacity of Frequency-Selective Fading Channels • Cellular Systems and Infrastructure-Based Wireless Networks Cellular System Fundamentals. Channel Reuse. Interference Reduction Techniques. Dynamic Resource Allocation • Digital Modulation and Detection Signal Space Analysis. Amplitude and Phase Modulation. Frequency Modulation Pulse Shaping. AWGN Channels. Fading. Intersymbol Interference. Coding for Wireless Channels. Linear Block Codes. Convolutional Codes • Equalization Equalizer Types. Linear Equalizers. Maximum Likelihood Sequence Estimation • Multiuser systems Multiple Access. Frequency-Division Multiple Access (FDMA). Time-Division Multiple Access (TDMA). Code-Division Multiple Access (CDMA). Random Access. Pure ALOHA. Slotted ALOHA • MIMO Systems MIMO Channel Capacity. MIMO Diversity Gain: Beamforming, Diversity/Multiplexing Tradeoffs. Receiver/transmitter diversity 		
Teaching Methodology	<p>Students are taught the course through lectures (3 hours per week) in classrooms or lectures theatres, by means of traditional tools or using computer demonstration.</p> <p>Topic notes are compiled by students, during the lecture can also be downloaded from the lecturer's webpage. Students are also advised to use the subject's textbook or reference books for further reading and practice in solving related exercises. Tutorial problems are also submitted as homework and these are solved during lectures or privately during lecturer's office hours</p>		
Bibliography	<p>(a) <u>Textbooks:</u></p> <ul style="list-style-type: none"> • A . Goldsmith, "Wireless Communications", Cambridge University Press, 2005. <p>(b) <u>References:</u></p> <ul style="list-style-type: none"> • Simon Haykin, Michael Moher, "Modern Wireless Communications" , 		

	<p>Prentice Hall, 2005.</p> <ul style="list-style-type: none"> • Andreas F. Molisch, Wireless Communications, 2nd, Wiley-IEEE, 2010. • T. S. Rappaport, "Wireless Communications, Principles and Practice, Prentice Hall, 2002
<p>Assessment</p>	<p>The Students are assessed via continuous assessment throughout the duration of the Semester, which forms the Coursework grade and the final written exam. The coursework and the final exam grades are weighted 60% and 40% respectively, and compose the final grade of the course.</p> <p>Various approaches are used for the continuous assessment of the students, such as mid-term written exam, quizzes. The assessment weight, date and time of each type of continuous assessment is being set at the beginning of the semester via the course outline. An indicative weighted continuous assessment of the course is shown below:</p> <ul style="list-style-type: none"> • Assignments/Quizzes 10 % • Mid-Term written exams 40 % • Project 50 % <p>Students are prepared for final exam, by revision on the matter taught, problem solving and concept testing and are also trained to be able to deal with time constraints and revision timetable.</p> <p>The criteria considered for the assessment of each type of the continuous assessment and the final exam of the course are: (i) the comprehension of the fundamental concepts and theory of each topic, (ii) the application of the theory in solving related problems and (iii) the ability to apply the above knowledge in more complex design problems. The above criteria are weighted 20%, 60% and 20%, respectively.</p> <p>The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.</p>
<p>Language</p>	<p>English</p>