AEEE422 - Communications Systems II

Course Title	Communications Systems II				
Course Code	AEEE422				
Course Type	Compulsory				
Level	BSc (Level 1)				
Year / Semester	4^{th} / 1^{st}				
Teacher's Name	Dr. Haris Haralambous				
ECTS	6	Lectures / week	3	Laboratories/week	1
Learning Outcomes	Upon successful completion of the course students will be able to: 1. Describe the basic principles and characteristics of digital communications. 2. Evaluate performance of digital communication systems and calculate quantization error, bit and baud rates, transmission bandwidth, Signal to Noise ratio and Power Spectral Density of line codes. 3. Explain basic transmission impediments such as effects of noise, eye patterns, intersymbol interference and bit synchronization issues. Suggest possible solutions. 4. Demonstrate how data can be encoded using linear block codes and convolutional codes, and analyse the error detection and/or correction capabilities of each code. 5. Analyse data encoding and digital modulation techniques. 6. Describe the techniques related to multiplexing and multiple access. 7. Use software such as MATLAB to analyse linear block codes and convolutional codes, as well as to investigate the performance with respect to SNR of the digital modulation techniques such as BPSK, DPSK, QPSK and QAM. 8. State the principles of multiplexing and compare approaches of multiuser communication systems, i.e. FDMA, TDMA and CDMA.				
Prerequisites	AEEE321	Co-requisites	None		
Course Content	• **Signal and Data transmission:** Comparison of analog and digital data transmission. Transmission impairments. Shannon's and Nyquist's theorems. Channel capacity over noisy and noise-free environments, Signal to Noise Ratio. Analog to Digital conversion, quantization, PAM and PCM. • **Error control coding fundamentals:** The ability of codes to detect and to correct errors. Linear block codes, cyclic codes and convolutional codes (Generator and parity check matrices, Syndrome decoding, Hamming codes, BCH Codes, CRC codes). Structure of coders and decoders.				

	• **Signal encoding techniques:** Digital encoding schemes (RZ, NRZ-L, NRZI, Bipolar-AMI, Pseudoternary, Manchester, Differential Manchester). Digital modulation techniques (ASK, FSK, PSK, DPSK, QPSK, QAM). • **Multiplexing and Multiple Access:** Frequency Division, Time Division Multiplexing techniques. Orthogonal Frequency Division Multiplexing. Frequency division, time division, code division and spatial division multiple access.
Teaching Methodology	Students are taught the course through lectures by means of computer presentations. Homework require students to describe, explain, justify, and illustrate the main concepts taught at lectures. Lecture notes and presentations are available through the web for students to use in combination with the textbooks.
Bibliography	Textbooks: • Ali Grami ,**"Introduction to Digital Communications 1st Ed"**, Elsevier, 2015 • L. W. Couch II, ***Digital and Analogue Communication Systems***, 8th edition, Prentice Hall, Pearson, 8th Ed., 2013 References: • John Proakis, Masoud Salehi **"Digital communications, 5th Ed"**, Mg Grow Hill, 2020 • P. Lathi, ***Modern Digital and Analog Communication Systems***, 3rd edition, Oxford University Press, 1998
Assessment	Students are assessed on the theoretical aspects of the course through tests, and the final exam, while lab exercises cover the applied and hand-on aspects of the course. Coursework will comprise of one test, a set of lab exercises, and three-hour closed book exam. The weights for each assessment component are: • Assignments 20% • Tests: 20% • Final Exam 60%
Language	English