



DIGITAL COMMUNICATIONS	
Enrollment year	2019/2020
Academic year	2019/2020
Regulations	DM270
Academic discipline	ING-INF/03 (TELECOMMUNICATIONS)
Department	DEPARTMENT OF ELECTRICAL, COMPUTER AND BIOMEDICAL ENGINEERING
Course	ELECTRONIC ENGINEERING
Curriculum	Space Communication and Sensing
Year of study	1°
Period	2nd semester (02/03/2020 - 12/06/2020)
ECTS	6
Lesson hours	46 lesson hours
Language	English
Activity type	ORAL TEST
Teacher	GAMBA PAOLO ETTORE (titolare) - 4 ECTS MARINONI ANDREA - 2 ECTS
Prerequisites	The course is aimed at students with a basic knowledge of electrical communication and signal theory
Learning outcomes	The student will learn some of the advanced techniques for digital transmission and coding of the information. Accordingly, he/she will be able to design the basic elements of a modern digital communication system, explaining the rational behind his/her choices.
Course contents	<p>The course is for students with a basic knowledge of transmission techniques and is devoted to digital communications.</p> <p>Course introductory notes. Stochastic variables and processes</p>

Information Theory: entropy.
Information Theory: source coding.
Channel capacity.

Coding techniques for information protection
Codes for error detection and correction
Algebraic codes
Convolutional codes, maximum likelihood decoding, Viterbi algorithm
Concatenated codes
Turbo codes
LDPC codes

Transmission on AWGN channels
Digital signals: PSD and power
Nyquist criterion to avoid intersymbol interference (ISI)
Optimum decoder
Upper and Lower bounds for BER values

Channels with fading
Fading definition and effects
Diversity techniques
Linear equalizers: Zero Forcing Equalizers
Linear equalizers: LMS, fractional and Decision Feedback equalizers.
Introduction to ML equalizers.

Synchronization and syntonization
Frequency error estimates (open-loop and closed-loop)
Phase error estimates (open-loop and closed-loop)
Timing error estimates (open-loop and closed-loop)

OFDM modulation (introduction)

Teaching methods

Lectures (hours/year in lecture theatre): 45
Practical classes (hours/year in lecture theatre): 0
Workshops (hours/year in the lab): 0

The concepts are introduced by means of lectures with slides integrated with explanation at the blackboard. Complementary topics are presented by means of one or two seminars by company representatives introducing examples of real digital communication systems

Reccomended or required readings

J.R. Barry, E.A. Lee, D.G. Messerschmitt. Digital Communication (third edition). Springer 2004

Assessment methods

Oral test, with questions aiming at understanding which are the concepts acquired by the student and his/her ability to explain how the functional blocks of digital systems work. The minimum score to pass the exam is 18, the top one is 30 cum laude.

Further information

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**Sustainable development
goals - Agenda 2030**

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