



# UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

## DIGITAL COMMUNICATIONS

<b>Anno immatricolazione</b>	2020/2021
<b>Anno offerta</b>	2021/2022
<b>Normativa</b>	DM270
<b>SSD</b>	ING-INF/03 (TELECOMUNICAZIONI)
<b>Dipartimento</b>	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
<b>Corso di studio</b>	ELECTRONIC ENGINEERING
<b>Curriculum</b>	Microelectronics
<b>Anno di corso</b>	2°
<b>Periodo didattico</b>	Secondo Semestre (07/03/2022 - 17/06/2022)
<b>Crediti</b>	6
<b>Ore</b>	50 ore di attività frontale
<b>Lingua insegnamento</b>	English
<b>Tipo esame</b>	ORALE
<b>Docente</b>	GAMBA PAOLO ETTORE (titolare) - 4 CFU JORNET MONTANA JOSEP MIQUEL - 2 CFU
<b>Prerequisiti</b>	The course is aimed at students with a basic knowledge of electrical communication and signal theory
<b>Obiettivi formativi</b>	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.
<b>Programma e contenuti</b>	The course is for students with a basic knowledge of transmission techniques and is devoted to digital communications.  Course introductory notes. Stochastic variables and processes

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)

#### Metodi didattici

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.

#### Testi di riferimento

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

#### Modalità verifica apprendimento

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.

#### Altre informazioni

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

**Obiettivi Agenda 2030 per lo sviluppo sostenibile**

the exam is 18, the top one is 30 cum laude.

**GOAL 9: INDUSTRIES, INNOVATION AND INFRASTRUCTURE**  
[Gli obiettivi](#)