

Communication Technologies and Multimedia

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(On Behalf of all the CTM-LM Faculty)

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Dipartimento di Ingegneria dell'Informazione Elettronica | Informatica | Telecomunicazioni | Automatica

A Course for the Future



- The "Digital Economy"
 - Accounts for 15.5% of global GDP (Oxford Economics)
 - Grows 2.5 times faster than other economic sectors (Oxford Economics)
- No Communications ... No Digital Economy
- CTM-LM teaches the fundamentals of communications, fixed, mobile & the Internet
- It is an international degree
 - Entirely taught in English
 - Double degree agreements
 - 50% (and more) of foreign students





Communications & Multimedia



- It's boring and painful, but ... think about our past 2 years ...
- We "survived" because we had
 - Telecommunications: transferring data (all of it!) around the world
 - Transmission techniques (optics, antennas, propagation)
 - Networks and Protocols
 - Multimedia: video and audio to make conferences
- You can call it "The Internet" ... but ...

The four legs of the global network



Electromagnetic propagation

Transmission technologies

antennas optics nanotechnolo quantum tec

signal processing modulations error correcting codes information theory

• Networking

protocols & routing security and criptography Wi-Fi access, cellular 5G and beyond

Multimedia Signal Processing

digital video and voice encoding streaming and conferencing scene analysis image processing and deep learning

Admission



- Minimal requirements, all in fundamental science
- No specific requirement related to Communications and Multimedia
 - The flexibility of the degree lets you choose what is best for you and

SSD o insieme di SSD	Numero di crediti minimo da acquisire
MAT/01, MAT/02, MAT/03, MAT/04, MAT/05, MAT/06, MAT/07, MAT/08, MAT/09, FIS/01, FIS/02, FIS/03, FIS/04, FIS/05, FIS/06, FIS/07, CHIM/07, ING-IND/10	24

Year 1 Classes

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- Fundamentals of digital communications
- Choices to customize based on your preference

Primo anno (attivo nell'a.a. <mark>2022-23)</mark>	CFU	Attività	Per	SSD
1 DIGITAL COMMUNICATIONS				
- Information theory (6)	6	В	<i>S1</i>	ING-INF/03
- Digital modulation and channel coding (6)	6	В	S1	ING-INF/03
2 A scelta tra:				
NETWORK SECURITY	6	В	S2	ING-INF/03
MICROWAVE ENGINEERING	6	В	S2	ING-INF/02
3 A scelta tra:				
DATA-DRIVEN SYSTEM MODELLING	6	С	<i>S1</i>	ING-INF/04
QUANTUM TECHNOLOGIES	6	С	S1	FIS/03
4 IMAGE PROCESSING AND VISUALIZATION				
- Digital image processing (6)	<mark>6</mark>	B	<u>52</u>	ING-INF/03
- Fundamentals of computer graphics (3)	3	F	<u>52</u>	ING-INF/03
 Processing and Communications Laboratory (3) 	<mark>3</mark>	F	<mark>51</mark>	ING-INF/03
5 A scelta tra:				
HEALTH INFORMATION SYSTEMS	6	С	S1	ING-INF/05
AMMINISTRAZIONE DI SISTEMA	6	С	<i>S1</i>	ING-INF/05
SISTEMI INFORMATIVI EVOLUTI	6	С	<i>S1</i>	ING-INF/05
6 ELECTRONICS SYSTEMS FOR TELECOMMUNICATIONS				
- Digital Systems for Telecommunications (3)	3	C	<u>51</u>	ING-INF/01
- Measurements and Instrumentation for telecommunications (3)	3	C	<mark>51</mark>	ING-INF/07
7 ANTENNAS AND WIRELESS SYSTEMS LABORATORY				
- Antennas (6)	6	В	S2	ING-INF/02
- Wireless systems laboratory (3)	3	F	S2	ING-INF/02
8 A SCELTA DELLO STUDENTE	9	D		

Year 2 Classes



- Fundamentals of streaming and "multimedia" services
- Choice (2/4) of courses focusing on different aspects of the 4 legs

Ipotesi del Secondo anno (attivo nell'g,g, 2021-22)	CFU	Attività	Per	SSD
9 MULTIMEDIA COMMUNICATION SERVICES	9			
- Multimedia Information Coding and Description (6)		В	<u>S1</u>	ING-INF/03
- Traffic Modelling and Streaming (3)		F	<u>S1</u>	ING-INF/03
10 DIGITAL AUDIO PROCESSING ADVANCED METHODS FOR INFORMATION REPRESENTATION PHOTONICS VEHICLI AR NETWORKS AND COOPERATIVE DRIVING	6	В		
11 DIGITAL AUDIO PROCESSING ADVANCED METHODS FOR INFORMATION REPRESENTATION PHOTONICS	6	В		
VEHICULAR NETWORKS AND COOPERATIVE DRIVING				

Year 2 Classes



- More choices
- Thesis

12 A scelta tra:				
OPTICAL COMMUNICATION SYSTEMS	9	В	S2	ING-INF/02
- Optical Communication Components (6)		В	S2	ING-INF/02
- Optical Communication Networks (3)		F	S2	ING-INF/02
REMOTE SENSING	9		A	
- Remote Sensing Data Analysis (6)		В	S1	ING-INF/03
- Remote Sensing Data Acquisition (3)		F	<u>\$1</u>	ING-INF/02
8 A SCELTA DELLO STUDENTE	9	D		
13 PROVA FINALE	15	E		



Electromagnetic propagation

- Optical Communications
 - Non-linear Optics, Nano Structures, Flat Optics, ...
- Photonics
 - Surface propagation on graphene
- Antenna design
 - Free Space propagation
 - Urban propagation
 - Arrays

antennas optics nanotechnologies quantum technologies











signal processing modulations error correcting codes information theory



- Information representation
- Information theory and information modeling
 - What is information?
- Modulation and Demodulation
 - Mapping information on signals
- Forward Error Correcting Codes
 - Adjusting "physics"





Networking

- Protocol Design, Protocol Analysis
- Secure Networking
- Mobile and Vehicular Networks
- Wi-Fi Sensing
- Privacy Protection
- 5G
- SDN/NFV
- Slicing and virtualization



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Video and voice manipulation

- Audio processing
 - Speech and music recognition
- Movie and image representation
- Medical Imaging
- AI-based Image Interpretation
- Cognitive video interpretation
 - Stimuli-based



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Digital Audio Processing



PIANO CHORDS RECOGNITION

Deep Learning by Convolutional Neural Networks







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