INGEGNERIA DELLE TELECOMUNICAZIONI

ICT FOR INTERNET AND MULTIMEDIA
• Acronym of Information and Communication Technologies = Systems (both hardware and software) for transmitting, sharing, and processing information
Why **Internet** and **multimedia**?

**Internet** is the biggest and most used telecommunication system in the entire planet.

Nowadays $\approx 50\%$ world population is connected $\rightarrow$ still wide margins for growth.
Why Internet and multimedia?

- **Multimedia** = multiple information sources
- Also multiple ways to communicate (Text, Video, Audio, Augmented reality...)
- The majority of Internet traffic is multimedia!
ICT: cornerstone of the Digital Era

Life Science
eHealth

Computer Science

Networks

Signals & Data

Digital devices

Electrical Engineering
Communications route

Classical and revolutionary transmission techniques
Communications route

5G networks
broadband, low latency connectivity
access through stations: Cellular, mmWave

Massive MIMO
really many transmitting units
access through stations: Antennas, Inf. Theory

Acoustic communications
marine monitoring and networking
access through station: Underwater
Software applications through the entire protocol stack
Mathematical models
understanding and designing the Internet
access through station: Maths

Cognitive and Software-defined
intelligence brought in the interconnection
access through stations: Networks, Game Theory

Smart cities
ubiquitous networking for public services
access through station: Internet of Things
Multimedia route

Multidimensional contents for data-hungry systems
**Immersive reality**
Delivering a full multimedia experience
*access through station*: 3D

**Digitalized perception**
Eyes, ears, brains of robots or autonomous cars
*access through station*: Computer vision

**Medical signal processing**
Advanced diagnosis and treatment
*access through station*: Imaging
Systematic ways to extract knowledge from data
Data analytics route

Distributed data management
Querying the cloud from everywhere
*access through station:* Web

Biometrics
The human body as the sensing field
*access through station:* Human data

Deep learning
Unsupervised artificial intelligence
*access through station:* Machine learning
Quality of life route

Telemicine  Sensors  mHealth  Human Data  Bioinformatics  Bio-EM  Imaging  Signal processing

IT expertise for medical care and mHealth scenarios
Quality of life route

Digital health
Real-time communication for medical apps
*access through station:* Telemedicine

Brain computer interfaces
Neural training against degeneration
*access through:* Neuroscience, Rehabilitation

Molecular photonics
Non-invasive monitoring and diagnostics
*access through station:* Bio-EM
Nanotechnologies route

Reach nanoscale to communicate at the speed of light
Nanotechnologies route

Photonic sensing
Monitoring through dielectric coupling
*access through station:* Fiber optics

Renewable energies
Smart exploitation of natural energy sources
*access through station:* Green

Plasmonics
Electron/photon coupling to go beyond $\lambda$
*access through station:* Photonics
Ensure privacy and data protection for cybersecurity systems
Secure satellite positioning
Preventing localization and navigation forging
*access through station:* GNSS

Digital crime fighting
Detecting false media and documents
*access through station:* Forensics

Quantum cryptography
Ultimate security through quantum physics
*access through station:* Quantum
To sum up

• Innovative scientific topics at the edge of new research horizons

• Matching all tastes from highly mathematical to applied and hands-on

• Interconnecting disciplines with a planned path (we don’t just do “a bunch of cool stuff”)

International priority
Travel is fatal to prejudice, bigotry, and narrow-mindedness, and many of our people need it sorely on these accounts.

Mark Twain

International by design

MIME completely in English

with many international opportunities
Fully taught in English

- No English test required beforehand
- But you must understand (basic) English
Incoming students

- **ICT for Internet and Multimedia** is one of 20 UniPD’s International Masters
- So far: 293 applicants (top of UniPD) from 41 countries
- applications are still ongoing
### Incoming students

- **Admitted so far**

<table>
<thead>
<tr>
<th>Country Code</th>
<th>Country</th>
<th>Flag</th>
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<td>Albania</td>
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<tr>
<td>in</td>
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<tr>
<td>pe</td>
<td>Peru</td>
<td>🇵🇪</td>
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</table>
Erasmus+

# destinations

- France: 2
- United Kingdom: 2
- Netherlands: 1
- Germany: 2
- Austria: 1
- Italy: 1
- Ireland: 1
- Denmark: 1
- Serbia: 1 (KA107)
- Switzerland: 1 (SEMP)
- Spain: 8 (incl. Canary)

and counting...
Double degrees

International agreements of Double Degree with top-ranked universities worldwide:

• National Taiwan University (2 positions)
• Universidad Politecnica de Madrid (2 positions)
• U. Jean Monnet Lyon-St.Etienne (in preparation)

Compared to similar programs (e.g TIME) you still get 2 degrees but in ~2 years, not 3
DD: how does it work?

• Apply halfway through 1\textsuperscript{st} year → must earn 60 ECTS in Padova by September

• If selected, spend the 2\textsuperscript{nd} year abroad

• Final thesis done and discussed abroad before a joint committee, also valid for Italian degree

• When abroad, scholarship at least 2\times\text{Erasmus} for a period = \min(\text{graduation}, 24 \text{ months})
Study plan
Frequently Asked Questions

• is it an engineering degree?
• is it a Laurea Magistrale?
• why do you call it a Master?
Admission

Holders of Italian degree ≥ 84/110 with at least 50 ECTS credits in:
- maths (MAT/02, MAT/03, MAT/05, MAT/06)
- physics (FIS/01)
- computer science (INF/01, ING-INF/05)
- telecommunications (ING-INF/02, ING-INF/03)

**Direct access** for all of Padova’s graduates in the Bachelor class L-8 (every “Laurea degree” of DEI)

Also the same holds for Math, Physics, CS @unipd and very likely for many other Italian graduates - foreign candidates have their own evaluation track.
Foundations

Recommended background in

- Signals and systems
- Probability and statistics
- Telecommunications

If in doubt about it → contact the teaching committee
Solutions available without courses before enrolling (e.g., Brixen)

**No English certificate required**, but you need to prove/declare that you understand it
So if you have a certification, even better
- there is an English test within the program, anyways
Enrolment steps

1: Pre-enrolment
from June 17 on uniweb

2: Career evaluation
from June 17 on uniweb.unipd.it/valutazionetitoli
(actually another website!) – all students must do it!

You must perform BOTH - you can do 2 just after 1.

After receiving confirmation of that your career is ok:

3: Enrollment – also on uniweb until October 25
Study plan: what’s new in 2019/20

**EXAMS OF DIFFERENT SIZES**

**MANDATORY EXAMS**

“SERIAL” COURSES

**ALL COURSES = 6 CREDITS**

**HIGHEST FREEDOM OF CHOICE**

“OPEN” COURSES
Common characteristics

Flexible

• Without mandatory exams
• All the exams are of 6 ECTS credits: just choose the preferred disciplines that fit you the most
• 12 ECTS credits (2 exams) are “fully elective” → you can take previously discarded subjects or even exams from another curriculum or degree
Common characteristics

Professional

• Internship of 9 ECTS credits
• Typically combined with the MS Thesis (21 ECTS credits) for an exam-free last semester
• 6 credits for “soft skills”
  • 3 for English B2 level
  • 3 for short courses on project management, public speaking in English or more
Typical study plan

1st semester
- 12 curriculum-specific “integrated course”
- 18 exams

2nd semester
- 30 exams

3rd semester
- 24 exams
- 6 soft skills

4th semester
- 9 internship
- 21 MS thesis

Flexible!
Four areas of specialty = 4 curricula
Teaching committee

When in doubt about choices of curriculum or exams, ask the teaching committee!

Simone Milani  simone.milani@unipd.it
Luca Palmieri  luca.palmieri@unipd.it

You can also ask them how to handle Erasmus+ exchanges or recognition of past extra activity!
Telecommunications
Telecommunications

Motivation
Explore all layers from PHY to APP
ICT is the main enabler of Industry 4.0

Scenarios
Next generation wireless, antenna design, sensors network optimization, security, multimedia, R&D
Telecommunication principles

MANDATORY

Telecommunication principles
- Wireless communications
+ Programming for telecom

CHOOSE 2 FROM

- Databases
  - High level programming
  - Innovation and entrepreneurship
  - Optimization
  - Optoelectronics for green
  - Programmable hardware devices

CHOOSE 8 FROM

- 3D augmented reality
- 5G systems
- Antennas
- Communication network design
- Computer vision
- Digital communications
- Digital signal processing
- Fiber optics
- Game theory
- Information security
- Internet
- IoT and smart cities
- Machine learning
- Multimedia coding
- Network analysis and simulation
- Network coding
- Optical and quantum communications
- Optical networks
- Stochastic processes
Internships at ...

- **ARRI MÜNCHEN (DE)**
  - Signal processing for digital cinema
- **Fiat Chrysler Automobiles TURIN / USA**
  - 5G vehicular communications
- **Huawei MILAN / CHINA**
  - Cellular networks R&D
- **Wind Tre VENICE**
  - National telco operator
- **World Sensing BARCELONA (ES)**
  - Wireless sensors monitoring
- **RFI MESTRE (VE)**
  - Railway network
- **Telenor OSLO (NO)**
  - National telco operator
- **CAME SpA DOSSON DI CASIER (TV)**
  - Safe access
- **Gavia systems ROVIGO**
  - Public WiFi services
- **Bft Spa SCHIO (VI)**
  - Domotic and automation
Is it a good choice for me?

Strong **mathematical** background is needed
• especially in probability and signal theory

Many courses are **project-orientated**
• be careful not to pick too demanding tasks

Mostly focuses on **telecommunications**
• did you like your “fundamentals” course?
Cybersystems

- Networks
- Maths
- Cognitive
- Big Data
- Game Theory
- Web
- Databases
- Human Data
- Machine learning
- Data Protection
- Forensics
- Simulation
- Wireless
- Protocols
- Sensors
- mHealth
- Internet of Things
- GNSS
- Quantum
- Ethical hacking
- Information theory
- Secure systems
Motivation

System interconnection opens up new horizons, inspiring challenges... and amazing job opportunities!

Scenarios

The third platform: Social, Mobile, Analytics, Cloud, Automotive, Tactile Internet, WWW, Blockchain
## Cybersystems

**MANDATORY**
- Network systems
  - = Network science
  - + Internet
- Databases

**CHOOSE 2 FROM**
- Big data computing
- Cryptography
- Graph theory
- High level programming
- Optimization
- Web applications

**CHOOSE 7 FROM**
- 3D augmented reality
- Communication network design
- Computer vision
- Digital forensics
- Digital signal processing
- Game theory
- Human data analytics
- Information security
- IoT and smart cities
- Machine learning
- Multimedia coding
- Network analysis and simulation
- Network coding
- Stochastic processes
- Wireless communications
<table>
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<tr>
<th>Company</th>
<th>Location</th>
<th>Specialties</th>
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<td>Sanmarco Informatica</td>
<td>Grisignano di Zocco (VI)</td>
<td>IT Solutions IoT connected devices</td>
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<tr>
<td>Teypra SRL</td>
<td>ROVIGO</td>
<td>Multimedia R&amp;D</td>
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<tr>
<td>Sony Eutec</td>
<td>Stuttgart (DE)</td>
<td>Voice &amp; data app virtualization</td>
</tr>
<tr>
<td>Mida Solutions</td>
<td>Padova</td>
<td>IoT / Blockchain Software eng.</td>
</tr>
<tr>
<td>Teypra SRL</td>
<td>Padova</td>
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<td>Uqido</td>
<td>Padova</td>
<td>IoT / Blockchain Software eng.</td>
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<tr>
<td>Aquifi</td>
<td>Palo Alto (US)</td>
<td>3D vision</td>
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<tr>
<td>solidThinking</td>
<td>Vicenza / USA</td>
<td>3D rendering</td>
</tr>
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<td>Nokia Bell Labs</td>
<td>Dublin (IR)</td>
<td>Low power networking</td>
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<tr>
<td>Altran Italia</td>
<td>Rome</td>
<td>5G, video 3D, cybersecurity</td>
</tr>
<tr>
<td>Athonet</td>
<td>Bolzano Vicentino (VI)</td>
<td>Software defined networking</td>
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</table>
Is it a good choice for me?

A mixture of math, computer science, telecom

- you certainly need good programming skills

A system-wide perspective, with an eye on cross-disciplinary topics, and an open mindset
Photonics

- Wireless Protocols
- Sensors
- Internet of Things
- Quantum
- Optical communications
- Green
- Fiber optics
- Antennas
- Information theory
- mmWave
- Cellular
- Underwater
- Bio-EM
- Photonics
- Laser
- Digital
- Signal processing
- Imaging
Photonics

Motivation

Photonics and light-based technologies are drivers of this century's industry

Scenarios

Hyperspectral analysis, earthquake monitoring, optical neurosynaptic networks, quantum computers
Photonic technologies
- Fiber optics
- Photonic devices
Molecular photonics

5G systems
Antennas
Biophotonics
Digital communications
Digital signal processing
Information theory
Internet
IoT and smart cities
Machine learning
Nanophotonics
Optical and quantum communications
Optical networks
Programmable hardware devices
Wireless communications

Mandatory

Choose 2 from:
- Nanostructured materials
- Optoelectronics for green
- Photovoltaic science and technology
- Quantum information and computing
- Quantum optics and laser
Internships at ...

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Specialization</th>
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</thead>
<tbody>
<tr>
<td>Leonardo</td>
<td>CARSOLI (AQ)</td>
<td>Thin films for space optics</td>
</tr>
<tr>
<td>Qascom</td>
<td>BASSANO DEL GRAPPA (VI)</td>
<td>Secure satellite communications</td>
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<td>DeltaOhm</td>
<td>PADOVA</td>
<td>Photo radiometric sensors</td>
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<tr>
<td>CEIT</td>
<td>MONSELICE (PD) / SVIZZERA</td>
<td>Fiber optical networks</td>
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<td>NTSG</td>
<td>ROMA</td>
<td>Fiber sensing and monitoring</td>
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<td>Calearo Antenne</td>
<td>ISOLA VICENTINA (VI)</td>
<td>Antennas for 5G and automotive</td>
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<td>Infineon</td>
<td>PADOVA / AUSTRIA</td>
<td>Semiconductors and IoT</td>
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<td>PADOVA</td>
<td>Reconfigurable antennas</td>
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<td>SIT</td>
<td>PADOVA</td>
<td>Measurement for safety</td>
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<tr>
<td>Nidek Medical</td>
<td>ALBIGNASEGO (PD) / GIAPPONE</td>
<td>Optometrical instrumentation</td>
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</table>
Is it a good choice for me?

Your proficiency in **physics** will be put to the test
• electromagnetism, quantum, physics of matter

But you need a very **engineering** attitude
• laboratory activity is really important here

(Yes, this is our **real lab** and not a stock picture)
Life & Health

Motivation
ICT improves well-being with pervasive monitoring, prevention/cure, rehabilitation

Scenarios
Neuroscience, augmented reality, genomics, stroke/accident prevention, healthy ageing, sport, wearable sensors, everyday life
## Life & Health

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<td>3D augmented reality</td>
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<td>= Digital signal processing</td>
<td>Biophotonics</td>
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<td>+ eHealth</td>
<td>Computer vision</td>
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<td>Machine learning</td>
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<td>Internet</td>
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<td>IoT and smart cities</td>
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<td>Multimedia coding</td>
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<td>Human computer interaction</td>
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<td>Imaging for neuroscience</td>
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<td>Life data epidemiology</td>
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<td>Molecular photonics</td>
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<tr>
<td>Neurorehabilitation and BCI</td>
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<tr>
<td>Quantitative life science</td>
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<tr>
<td>Sports engineering and rehab</td>
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</table>

MANDATORY: Choose 6 from the list above.

CHOOSE 3 FROM: Choose 3 from the list below.
Internships at ... 

Malvestio
VILLANOVA DI CAMPOSAMPIERO (PD)
Sensors for hospital bed

Khymeia
NOVENTA PADOVANA (PD)
Virtual reality for neurorehab

Policlinico Sant’Orsola
BOLOGNA
Infectious diseases unit

BrainTrends
ROMA
Brain biosignal sensing

Phoenix RTO
PADOVA
Hyperspectral for agrifood

AMPED TRIESTE
Forensics multimedia

Nidek Medical
ALBIGNASEGO (PD) / GIAPPONE
Ophtalmology ocular diagnosis

Inst. Behavioral Neurobiology
TUBINGEN (D)
Paralysis/stroke monitoring

Inst. Tecnologico de Canarias
CANARY ISLANDS (E)
CAD for bone reconstruction

WYSS Center
ZURICH (CH)
FMRI-BCI analysis, Neuroprosthetics
Is it a good choice for me?

Requires interest in both ICT & medical subjects

- you must acquire solid skills in both areas; thus, also math, computer science, telecommunications
- a rigorous engineering program

Note that you will not find:

- general courses in chemistry or physiology
- courses of biology, biomechanics, biomaterials
Goal vs Tool

- Automazione vs Telecommunications
- Informatica vs Cybersystems
- Elettronica vs Photonics
- Biomedica vs Life&Health
Master's degree ICT Internet Multimedia Engineering

Job market
Yes, everything looks cool, still... will I find a job (and a good one) afterwards? Are "classical" degrees better for the job market?

IMPRESSIVE. MOST IMPRESSIVE.

BUT WHAT ABOUT JOB PROSPECTS?
**A double track for the job market**

Enterprises working **on** ICT
from hardware to software, access/transport/application

Enterprises working **using** ICT
networking, data analytics, security, energy efficiency
Job market

Local and global enterprises

Abroad for education or work

R&D at universities or research centers

Internship options
Monthly salary after 1 year

Graduates of 2017

source: XX survey
Employment rate after 1 year

Graduates of 2017

source: XX survey
Satisfaction rate about the program
(yes = light, no = dark)

Graduates of 2018

source: XX survey
Satisfaction rate about the lecturers
(yes = light, no = dark)

Graduates of 2018

source: XX survey
How is the teaching load?
(light or heavy = dark)

Graduates of 2018

source: XX survey
Would you choose it again?

Graduates of 2018

source: XX survey
Monthly salary after 1 year
(comparison with Italy)

Graduates of 2017

source: XX survey
Would you choose it again?
(comparison with Italy)

Graduates of 2018

source: XX survey
Other data

• Average duration of studies: 2.6 years (also includes Double Degree students)
• Average graduation mark: 108.1
• Had an experience abroad: 35% (note: another ~25% are foreign nationals)
• Average time from graduation to 1st job: 2.0 months

source: XX survey
After the degree: PhD?

About 30% of graduates of our MSc pursue higher education toward a PhD.

Our department offers a highly qualified PhD program in Information Engineering.

Graduates of the last 10yrs from our MSc+PHD are now:

• Professors/academic researchers: Purdue, Irvine, UC3M Madrid, Malaysia Pahang, New York Univ, Univ. Firenze, Michigan, Porto, San Diego, Kentucky, Dresden, Aalborg, Rochester, Norce Bergen Norway

• Industrial project engineers: Gameloft, Nokia, Ublox, Athonet, TIM, Qascom, SIAV, Aquifi, Ceam, Mount Sinai Hospitals NY, Wind-tre, McKinsey, Urbana Smart, ElettronicaBiomedicale, DLR, Calearo Antenne, ESA, Cisco, Microsoft
A scholarship/award assigned to promising students to help them pursue the degree in “ICT for Internet and multimedia”

Based on: (i) academic track record; (ii) interview with the Evaluation Committee

2 awarded prizes of 5000 euros each

The call will be out soon: check the website www.unipd.it/borse-premi-studio-studenti
Questions
Contacts

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Slides available at:
/mime.unipd