Master’s Degree in ICT for Internet and Multimedia

https://mime.dei.unipd.it/
What is ICT?

Information and Communication Technology

systems (hardware and software) for transmitting, sharing, and processing information
How much is “transport” worth?

Market capitalization of Zoom Video Communications vs. the 15 biggest airlines

Zoom Video Communications
$151.1B

Southwest
$25.2B

RYANAIR
$16.9B

AIR CHINA
$14.0B

DELTA
$21.6B

China Southern
$12.3B

China Eastern
$10.6B

ANA
$7.6B

IAG
$6.9B

Lufthansa
$5.6B

United
$11.0B

American Airlines
$6.4B

JetBlue
$3.5B

easyJet
$3.1B

Source: Lufthansa Innovation Hub, TNMT.com, Yahoo Finance
multimedia & digital arts
smart industry 4.0
multimedia & digital arts
photonics
medical ICT
Internet & security
machine learning for healthcare
communication technologies
quantum information
ICT is pervasive

- Internet, Web browsing, home-banking, ...
- Multimedia streaming, YouTube, Vimeo, PrimeVideo, Netflix ...
- Emails, mobile calls, ...

But this is only the tip of the iceberg...

- **Smart Cities**: IoT sensing/compression/TX technologies
- **Indoor, outdoor, vehicular networks**: radar & TX technologies
- **Multi-access Edge Computing**: edge assisted communications & learning at the network edge (5G/6G mobile nets)
- **Multimedia**: knowledge extraction from videos, point-clouds, etc., augmented & virtual reality, the metaverse, ...
- **New communication paradigms**: intelligent reflecting surfaces, underwater communications, massive MIMO, ...
- **Machine-learning & decision making** for internetworking
- **Network and information security**
- ...
The modern ICT engineer – **tools**

- **Solid mathematical background**
  - Algebra, geometry, probability, statistics, signal theory, ...

- **Cross-disciplinary tools**
  - **Programming**
    - **C/C++**: embedded and Internet-based systems
    - **Python**: scientific computing, machine learning, system integration
  - **Machine learning**
    - Classification, feature extraction, unsupervised vs supervised learning, deep learning, reinforcement learning, ...
  - **Optimization theory & methods**
    - Convex optimization, Mixed-Integer Linear Programming (MILP), sequential optimization for networking, ...
The modern ICT engineer – technology & applications

• Solid background on modern ICT technology
  • Communications: 5G systems, Wi-Fi, Internet, net. protocols, …
  • Multimedia: signal processing & transmission, …
  • TX media: photonic & quantum technology, fiber optics, antennas, mm-waves, …

• Deepening knowledge on specific ICT applications
  • ICT for Industry 4.0
  • Sensing systems, Internet of Things (IoT)
  • ICT for healthcare, e-health
  • More later, …
• A modern & flexible Master’s Degree (2 years)

• Centered on
  • ICT: tools, technology and applications
  • With an eye on modern ICT systems
    • 5G (6G) mobile networks, Internet of Things,
    • Industry 4.0, virtual/augmented reality, e-health, …

• Allows you to shape your study path along three axes
  • Type of technology: communications, multimedia, TX media
  • Cross-disciplinary tools: programming, machine learning, optimization
  • Application domain: mobile nets, Internet, IoT, e-health, …
Four curricula (Cx), eight tracks (Tx)

• **C1 – Communications**
  • T1. Communication technologies
  • T2. Smart Industry 4.0

• **C2 – Cybersystems**
  • T3. Internet & security
  • T4. Multimedia & digital arts

• **C3 – Photonics**
  • T5. Photonics
  • T6. Quantum information

• **C4 – ICT for Life & health**
  • T7. Medical ICT
  • T8. Machine learning for healthcare
Communications

Underwater communication networks

Internet of Things

5G mobile networks

Massive MIMO
Comm & sensing

Wi-Fi

Realtime user tracking

mm-wave radar devices
T1. Communication technologies

Related subjects

- Wireless Networks
- 5G Systems / Optical Networks
- Digital Communications
- Antennas / mm-Wave Devices / Visible Light & Metasurfaces Communications
- Digital Signal Processing
- Satellite Systems
- Fiber Optics
- Convex Optimization / Machine Learning / Programming for TLC
- Information Theory
T2. Smart industry 4.0

Related subjects

- Wireless Networks
- Digital Communications
- Communication Network Design / Internet
- 5G Systems / Antennas
- Digital Signal Processing
- Optimization methods for ICT / Machine Learning
- ICT for Industrial Applications
- IoT & Smart Cities / Digital Forensics / Computer Vision
- Programming for TLC / Programmable Hardware Devices
Internet & Security

Privacy & data protection for network systems

Secure satellite positioning

Icons created by Freepik. Available at www.flaticon.com
T3. Internet & Security

Related subjects

- Wireless Networks / Network Science
- Digital Signal Processing / Game Theory
- Web Applications / Foundations of Databases
- Information Security / Cryptography
- Communication Network Design
- Network Analysis & Simulation / Network Coding
- Computer Vision
Multimedia & Digital Arts

Video segmentation for autonomous vehicles

Virtual Reality
T4. Multimedia & Digital Arts

Related subjects

- Internet
- Digital & Interactive Multimedia / Multimedia Coding
- 3D Augmented Reality
- Natural Language Processing / Human Computer Interaction
- Digital Signal Processing
- Digital Forensics
- Machine Learning / Neural Networks and Deep Learning / Reinforcement Learning
- Video Communication & User Experience
- Computer Vision
Photonics

2-billions of km of optical fiber guarantee world-wide communication

Biophotonics for imaging and sensing
(OCT of zebrafish)

Reconfigurable antennas for 5G/6G communications
(Plasma reflectarray)

Nanophotonics and metamaterials enable light engineering
(A tunable metasurface based on vanadium dioxide)
Quantum information

- **Qubit**
  - $|0\rangle$
  - $|1\rangle$
  - $|0\rangle + |1\rangle / \sqrt{2}$

- **Classical bit**

The perfect random number generator by quantum measurement

Entangled states of two photons for secure communications
T5. Photonics

Related subjects

- photonic devices / nanophotonics / physics and optics at the nanoscale
- optical networks / optical & quantum comm
- antennas / mm-wave devices
- satellite comm systems
- programmable hardware devices / quantum information & computing
- natural language processing / human computer interaction
- biophotonics

fiber optics

DSP
T6. Quantum information

Related subjects

- photonic devices
- physics and optics at the nanoscale
- DSP
- quantum methods for ICT
- quantum optics & laser
- quantum technologies
- optical & quantum communications
- quantum cryptography & security
- machine learning
- quantum information & computing
- fiber optics
- mm-wave devices
- nanophotonics
- optical & quantum communications
ICT for Life & health
ICT for Life & health

- Gesture recognition
- Pose estimation
- Respiration
- Heartbeat
- Gait analysis
- Person identification
T7. Medical ICT

- e-health
- DSP
- Machine learning
- Human data analytics
- Secure digital healthcare
- Biomedical wearable technologies for healthcare and wellbeing
- Sports engineering & rehabilitation devices
- Computational genomics / Neuroimaging
- Biophotonics
T8. Machine Learning for healthcare

- e-health
- DSP
- Machine learning
- Human data analytics
- Computer vision
- Neural networks and deep learning
- Biological data / Digital forensics and biometrics
- Natural language processing / Reinforcement learning
- Life data epidemiology / Physical models of living systems
Typical study plan – credit distribution

1st semester
- 18 curriculum-specific subjects
- 12 exams

2nd semester
- 30 exams

3rd semester
- 24 exams
- 6 soft skills

4th semester
- 9 internship or research training
- 21 MS thesis
Example: T.2 Internet & Security track

**Mandatory courses** (18 credits)
- Internet
- Communication network design
- Digital forensics
- Digital signal processing
- Game theory
- ICT for industrial applications
- Information security
- Internet of things and smart cities
- Machine learning
- Network analysis and simulation
- Network coding
- Network science
- Neural networks and deep learning
- Wireless Networks

**Choose 5 from the following (30 credits)**
- Public speaking lab (3 ECTS)
- Project management (3 ECTS)
- Public values in media & ICT (3 ECTS)
- English B2 (3 ECTS)
- Free choice
- Free choice
- One subject from the MIME offer
- Internship
- Research training

**Choose 3 from the following (18 credits)**
- Big data computing
- Cryptography
- Foundations of databases
- Optimization methods for ICT
- Scientific Computing with Python
- Reinforcement Learning
- Web applications

**Soft skills** (6 credits)
- Thesis

**Total 120 ECTS**
INTERNERSHIPS
INTERNATIONAL BY DESIGN
A truly multicultural environment

English as first and only language
240 international students accepted from 30+ countries on 5 continents
Mobility programs

- You can choose:
  - Erasmus+ to study in EU countries
  - SEMP to study in Switzerland
  - Ulisse program to study in Europe, America, Asia and Oceania
  - DECAMP virtual mobility as a partnership of European universities
  - Double Degree programs with Universidad Politécnica de Madrid and National Taiwan University
  - TIME double degree programs with Danmarks Tekniske Universitetet, Universitat Politècnica de Cataluña, Universidade de Lisboa, Université Catholique de Louvain and Yokohama University.
Some numbers from AlmaLaurea

- Average duration of studies: 2.3 years
- Average graduation mark: 108.1
- Had an experience abroad: 32.2% (during Covid)
- Got a scholarship: 25.6%
- Internships at companies: 64.5%
- Overall satisfaction: 96.6%
- Teaching satisfaction: 97.8%
- Would enroll again: 80%
After graduating (AlmaLaurea)

- 33.3% enter a Ph.D. program
- 57.8% are employed after 1 year
- Average time from graduation to 1st job: 45 days
- Total unemployment rate: 2.4%
- Monthly salary after 1 year: 1690€
- Permanent positions after 1 year: 53.8%
- Monthly salary after 5 years: 2290€
- Permanent positions after 5 years: 80%
ADMISSION PROCEDURE
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 graduates with a Bachelor degree in Information Engineering, Maths, Physics, Computer Science
Admission

• If you are an International student and you do not hold an Italian degree, you will be evaluated by an Admission Committee to verify that an equivalent criterion applies.

• Depending on the country, this translates into different minimum entry requirements on CGPA or percentage.

• Two calls per year: typically one open from November to February and one from March to May (September for EU students).

• Check out https://mime.dei.unipd.it/applications/ for further details.
FURTHER INFO & CONTACTS
mime@dei.unipd.it
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