Master ICT for Internet and multimedia engineering

Presentation Thursday June 10, 2020 will start at 9:00 AM CEST
Ingegneria delle Telecomunicazioni

ICT for Internet and Multimedia
Do you just “transport” information?

Some will tell you that studying ICT just means becoming a “carrier” of information.

truck driver  waiter  or... ??
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

**Ryanair**

$16.9B

**China Eastern**

$12.3B

**Ana**

$10.6B

**United**

$11.0B

**Airfrance**

$7.6B

**IAG**

$6.9B

**American Airlines**

$6.4B

**JetBlue**

$3.5B

**Lufthansa**

$5.6B

**Easy Jet**

$3.1B

**Airfrance**

$1.7B

Notes: Airlines selected based on # of passengers transported in 2019; market cap as of Oct. 26, 2020
Source: Lufthansa Innovation Hub, TNMT.com, Yahoo Finance
Overview
What is ICT?

• Acronym of *Information and Communication Technology*: systems (both hardware and software) for transmitting, sharing, and processing information
Why Internet and multimedia?

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

Nowadays ≃ 50% world population is connected → 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
transit map
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

Digital 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
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

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 cybersecure 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
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 the largest International Masters @ UniPD

- Last year 74 international students enrolled
- This year:
  - 144 admitted already
  - applications are closed, but still being evaluated
Erasmus+

# destinations

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<th>Country</th>
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<td>France</td>
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<td>UK</td>
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<td>Norway</td>
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<td>Germany</td>
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<td>Austria</td>
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<td>Switzerland</td>
<td>1 (SEMP)</td>
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<tr>
<td>Spain (incl. Canary)</td>
<td>8</td>
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</tbody>
</table>

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)
• more agreements (France, Finland) 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 \rightarrow 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
• Supporting scholarship (more than Erasmus) for a period = min(graduation, 24 months)
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 2018

source: XXI survey
Employment rate after 1 year

Graduates of 2018

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

Graduates of 2019

source: XXI survey
Satisfaction rate about the lecturers
( yes = light, no = dark)
Graduates of 2019

source: XXI survey
Is the study load appropriate?
(yes = light, no = dark)

Graduates of 2019

source: XXI survey
Would you choose it again?

Graduates of 2019

source: XXI survey
Other data

• Average duration of studies: 2.2 years (also includes Double Degree students)

• Average graduation mark: 109.7

• Had an experience abroad: 51% (note: another ~30% are foreign nationals)

• Average time from graduation to 1st job: < 2 months
Study plan
MIME is a 2-year (120 ECTS credits) postgraduate course.

In the Italian system, it is a “Laurea Magistrale” of class LM-27.
Admission

Holders of Italian degree $\geq 84/110$

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

Guaranteed for all BS degrees of DEI, DM, DFA @ UniPD
- and easily for students of other universities or degrees
- 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

You can fill gaps even after enrolling

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, anyway
Enrolment steps

1: Pre-enrolment
on uniweb.unipd.it (soon)

2: Career evaluation
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.unipd.it
Study plan: what we offer

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 ETCS credits (2 exams) are “fully elective”
  → you can take previously discarded subjects or even exams from another curriculum or degree
Common characteristics

Professional

• Final MS thesis project of 30 ECTS covering your last semester (including internship or research activity)
• 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!
You can reach them at mime@dei.unipd.it

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

**Motivation**
Explore all layers from PHY to APP

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

ICT is the main enabler of Industry 4.0,
see the new study path!
### Telecommunications

<table>
<thead>
<tr>
<th>MANDATORY</th>
<th>Telecommunication principles = Programming for telecom + Wireless networks</th>
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<tbody>
<tr>
<td>CHOOSE AT LEAST 7</td>
<td>5G systems</td>
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<td>Antennas</td>
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<td>Communication network design</td>
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<td>Computer vision</td>
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<td>Digital communications</td>
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<td>Digital signal processing</td>
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<td>Fiber optics</td>
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<td>ICT for industrial applications</td>
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<td>Information theory</td>
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<td>Internet</td>
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<td>IoT and smart cities</td>
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<td>Machine learning</td>
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<td>Multimedia coding</td>
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<td>Optical and quantum communications</td>
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<td>Optical networks</td>
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<td>Satellite communication systems</td>
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<td>Visible light and metasurface communications</td>
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### Standard path

- Convex optimization
- Embedded real time control
- High level programming
- ICT for automotive and domotics
- ICT robotics
- Industrial communications
- Physics data analysis
- Programmable hardware devices
- Quality engineering
- Quantum information and computing
- Relational marketing
- Digital forensics
- Game theory
- Information security
- Non verbal communication
- Stochastic processes

### Industry 4.0 path

- CAN ALSO CHOOSE

### CHOOSE 1 AMONG

- Project management
- Public speaking
- Public values in media and ICT
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**-oriented
- be careful not to pick too demanding tasks

Mostly focuses on **telecommunications**
- did you like your “fundamentals” course?
Motivation
System interconnection opens up new horizons, inspiring challenges... and amazing opportunities!

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

And a new path in Digital Arts!
Cybersystems

Network systems = Foundations of databases + Internet
Network science
Digital and interactive multimedia

CHOOSE AT LEAST 6
3D augmented reality
Communication network design
Computer vision
Digital forensics
Digital signal processing
Game theory
Information security
Information theory
IoT and smart cities
Machine learning
Multimedia coding
Network analysis and simulation
Network coding
Neural networks and deep learning
Stochastic processes
Usability and user experience

Big data computing
Convex optimization
Computer engineering for music and multimedia
Cryptography
Digital storytelling
High level programming
History of animation
Human computer interaction
Laboratory of big data analytics
Learning from networks
Natural language processing
Sound design and music technology
Web applications

CHOOSE AT LEAST 2

Life data epidemiology
Network dynamical systems
Non verbal communication
Photojournalism
Wireless networks

CHOOSE 1 AMONG
Project management
Public speaking
Public values in media and ICT
Internships at ...

- Sanmarco Informatica
  - GRISIGNANO DI ZOCCO (VI)
  - IT Solutions
- Teypra SRL
  - ROVIGO
  - IoT connected devices
- Sony Eutec
  - STUTTGART (DE)
  - Multimedia R&D
- Mida Solutions
  - PADOVA
  - Voice & data app virtualization
- Ugido
  - PADOVA
  - IoT / Blockchain Software eng.
- Aquifi
  - PALO ALTO (US)
  - 3D vision
- solidThinking
  - VICENZA / USA
  - 3D rendering
- Nokia Bell Labs
  - DUBLIN (IR)
  - Low power networking
- Altran Italia
  - ROME
  - 5G, video 3D, cybersecurity
- Athonet
  - BOLZANO VICENTINO (VI)
  - Software defined networking
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**
Motivation
Photonics and light-based technologies are drivers of this century’s industry.

Scenarios
Hyperspectral analysis, earthquake monitoring, optical neurosynaptic networks, quantum computers.

I’m taking the new Quantum Information path!
<table>
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<tr>
<th>MANDATORY</th>
<th>Photonic technologies = Fiber optics + Photonic devices</th>
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<td>Molecular photonics</td>
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<td>Quantum information and computing</td>
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<td>CHOOSE AT LEAST 6</td>
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<td>Optical networks</td>
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<td>Quantum cryptography and security</td>
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<td>Satellite communication systems</td>
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<td>Visible light and metasurface communications</td>
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<td>Nanostructured materials</td>
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<td>Photovoltaic science and technology</td>
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<td>Programmable hardware devices</td>
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<td>5G systems</td>
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<td>Convex optimization</td>
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<td>Economic policy and local development</td>
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<td>Non verbal communication</td>
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<td>Information theory</td>
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<td>Physics data analysis</td>
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<td>CAN ALSO CHOOSE</td>
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| CHOOSE 1 AMONG                | Project management                                       |
|                               | Public speaking                                          |
|                               | Public values in media and ICT                           |
Internships at ...

**Leonardo**
CARSOLI (AQ)
Thin films for space optics

**Qascom**
BASSANO DEL GRAPPA (VI)
Secure satellite communications

**DeltaOhm**
PADOVA
Photo radiometric sensors

**CEIT**
MONSELICE (PD) / SVIZZERA
Fiber optical networks

**NTSG**
ROMA
Fiber sensing and monitoring

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**Calearo Antenne**
ISOLA VICENTINA (VI)
Antennas for 5G and automotive

**Infineon**
PADOVA / AUSTRIA
Semiconductors and IoT

**Adant**
PADOVA
Reconfigurable antennas

**SIT**
PADOVA
Measurement for safety

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**Nidek Medical**
ALBIGNASEGO (PD) / GIAPPONE
Optometrical instrumentation
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)
**Motivation**

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

**Scenarios**

Neuroscience, augmented reality, genomics, healthy ageing, sport, wearable sensors

The new path is on Machine Learning for healthcare!
| Life & Health |  
|--------------|--------------------------------------------------|
| **MANDATORY** | Digital processing for life and health = Digital signal processing + Machine learning |
| **CHOOSE AT LEAST 6** | 3D augmented reality  
| | Biometrics  
| | Biophotonics  
| | Computer vision  
| | Digital forensics  
| | E-health  
| | Game theory  
| | Human data analytics  
| | Internet  
| | Life data epidemiology  
| | Multimedia coding  
| | Network science  
| Neural networks and deep learning  
| Stochastic processes  
| Secure digital healthcare  
| Usability and user experience |
| **CHOOSE AT LEAST 3** | Clinical engineering and health tech  
| | Computational genomics  
| | Human computer interaction  
| | Learning from networks  
| | Molecular photonics  
| | Neuroimaging  
| | Neurorobotics and neurorehabilitation  
| | Quantitative life science  
| | Precision medicine  
| | Reinforcement learning  
| | Sports engineering and rehabilitation devices |
| **CAN ALSO CHOOSE** | Economic policy and local development  
| | Foundation of databases  
| | Human electrophysiology  
| | Non verbal communication |
| **CHOOSE 1 AMONG** | Project management  
| | Public speaking  
| | Public values in media and ICT |
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

WYSS Center
ZURICH (CH)
FMRI-BCI analysis, Neuroprosthetics

Inst. Tecnologico de Canarias
CANARY ISLANDS (E)
CAD for bone reconstruction
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
After graduation: a PhD?

About 1 in 4 of our MSc graduates pursue higher education towards a PhD. Our department offers a highly qualified PhD program in Information Engineering. Graduates in the last 10 yrs from our MSc+PhD are now

- **Professors/academic researchers** at: Purdue, Irvine, Michigan, Carlos III Madrid, Malaysia Pahang, New York Univ., Firenze, Porto, UC San Diego, Kentucky, TU Dresden, Aalborg, Rochester, Norce Bergen Norway

- **Industrial project engineers** at: Gameloft, Nokia, u-blox, TIM, Qascom, SIAV, Aquifi, Ceam, Mount Sinai Hospitals NY, Wintre, McKinsey, Urbana Smart, DLR, Airbus, Calearo antennas, European Space Agency, Cisco, Microsoft , Athonet
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 & answers
Preparatory classes

Q: You mentioned the possibility to acquire missing prerequisites by attending some summer courses before the semester starts. Are those courses going to be held online?

A: No, the summer classes we mentioned in the presentation (e.g., the introductory class in Telecommunications) are only held in presence at the Brixen site of the University of Padova.
Q: How can we have more information and discuss the study plan before the start of classes?

A: You can start by visiting our program’s web site mime.dei.unipd.it where you can find all the classes and curricula listed. If you need further clarification, write an email to the address mime@dei.unipd.it and you will get in touch with the teaching committee.
Q: Do students coming to Padova for the master's program have the legal right to work?

A: For Italian and EU students it is legally possible to also work and seek employment. For international students, this depends on the type of visa they obtain. The University poses no restriction.
Q: What is the University of Padova scholarship policy for foreign students?

A: Beside the Infineon scholarship, several other funding opportunities are available, either with UniPD scholarships awarded on a merit basis, or with Veneto regional grants for low income Italian and international students. More information is given at www.unipd.it/en/scholarships
English language certificate

Q: My English language certificate is valid at the time of my application and enrollment, but will expire before my graduation. Can I use this certificate to obtain the necessary language credits? Or will I need to obtain a new certificate?

A: Yes, it is sufficient that you apply for recognition of the language ECTS credits before your certificate expires. You can do that at any point in your academic career. A list of the acceptable certifications is available at this link.
Internships

Q: When the time comes for the internship, will we get recommendations for the opportunities?

A: Yes, there is a dedicated internship orientation event, usually at the start of the Spring semester. Moreover, internship opportunities are regularly posted on the program’s blog Life@MIME and the university Career Service also collects internship offers: www.unipd.it/en/stages-and-job-placement
Online teaching

**Q:** Are the classes going to be taught online or offline in the next year?

**A:** With the vaccination campaign well underway and gaining momentum week after week we are reasonably confident to resume classroom teaching in the next semester. However, on line teaching tools may still be useful and convenient. After all, even before the pandemic outburst, a lot of class material and class exchanges (e.g., turning homeworks in) was available on line.
Vaccination and travel restrictions

**Q:** I have taken a Covid-19 vaccination which is not approved by WHO yet. Will I be able to come to Padova and attend classes?

**A:** For health and safety information regarding coming to Italy please check indications by the Italian Ministry of Health on their webpage
Q: How is the career evaluation performed for international applicants?

A: The procedure described in the “Enrollment steps” slide is for applicants holding an Italian bachelor degree. Other applicants should follow the instructions at www.unipd.it/en/studying-padova/admission/how-apply/study-english-how-apply
Contacts

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mime@dei.unipd.it
mime.dei.unipd.it

Slides available at:
/mime.unipd