Master of Science in ELECTRONICS ENGINEERING

May 27th, 2020

www.elettronica.polimi.it
• Politecnico di Milano: Schools and Masters

• Electronics and Engineering: what and why?

• Master Degree in Electronics Engineering

• Data and Stats
“La Scuola di Atene”, by Raffaello Sanzio, Musei Vaticani, Rome

and original drawings by Raffaello, Pinacoteca Ambrosiana, Milano
Politecnico di Milano

1,300 academics and clerks
1,200 technicians and clerks

45,000 students

4 Schools/Faculties:
- Architecture, Urban Planning & Construction Engineering
- Design
- Civil, Environmental & Land Management Engineering
- Industrial and Information Engineering

12 Departments:
- ... DEIB ...

7 Campuses:
- ... "MI Leonardo" ...

Polimi ranks as the top university in Italy for Engineering and Technology, and among the best all over the world.

**Ranking:**
- #1 Italy,
- #6 Europe,
- #16 World

(in «Engineering & Technology» QS World University Ranking 2019)
POLIMI campuses in Milano

Master in ELECTRONICS Engineering  franco.zappa@polimi.it
Departments (research tasks)

12 Departments (Head of Dept.)

Dept. ARCHITECTURE & URBAN STUDIES (DASTU)
Dept. ARCHITECTURE, BUILDINGS & CONSTRUCTIONS (DABC)
Dept. CHEMISTRY, MATERIALS & CHEMICAL ENG "GIULIO NATTA" (DCMC)
Dept. DESIGN (DESIGN)
Dept. ELECTRONICS, INFORMATION AND BIOENGINEERING (DEIB)
Dep. ENERGY (DENG)
Dept. PHYSICS (DFIS)
Dept. CIVIL AND ENVIRONMENTAL ENG. (DICA)
Dept. MANAGEMENT ENG. (DIG)
Dept. MATHEMATICS (DMAT)
Dept. MECHANICS (DMEC)
Dept. AEROSPACE SCIENCE AND TECHNOLOGY (DAER)
## Schools (Faculties for education)

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<tr>
<th>School of Study</th>
<th>Bachelor</th>
<th>Master</th>
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<td>School of INDUSTRIAL AND INFORMATION ENGINEERING</td>
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<td>24</td>
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<td><strong>OVERALL</strong></td>
<td><strong>28</strong></td>
<td><strong>46</strong></td>
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- **28 Bachelor of Science (B.S.)**
- **46 Master of Science (M.S., graduate)**
- **18 Philosophy Doctor (Ph.D.)**
"3i" School
"Industrial and Information Engineering"

- Largest school of POLIMI with 60% of all students
- > 5100 Bachelor degrees
- > 3500 Master degrees
- 8 Departments involved
- 917 academics and personnel

≈ 22% women
≈ 21% international students

MI Leonardo 47%
MI Bovisa 45%
other campuses 8%
Info on POLIMI and "3i" School

www.polimi.it

www.ingindinf.polimi.it
Study Programme

from other Italian Masters and worldwide Masters

from other Italian Bachelors and worldwide Bachelors

"Master degree" and job or R&D

"Bachelor degree" and job
Masters of Science in "3i"

"MI Leonardo" Campus
AUTOMATION and CONTROL eng.
BIOMEDICAL eng.
CHEMICAL eng.
COMPUTER SCIENCE and eng.
ELECTRICAL eng.
ELECTRONICS eng.
GEOINFORMATICS eng.
PHYSICS eng.
MATERIALS eng. and NANOTECHNOLOGY
MATHEMATICAL eng.
TELECOMMUNICATION eng.

"MI Bovisa" Campus
AERONAUTICAL eng.
DESIGN & eng.
ELECTRICAL eng.
ENERGY eng.
MANAGEMENT eng.
MANAG. of BUILT ENVIRON.
MECHANICAL eng.
MOBILITY eng.
NUCLEAR eng.
SPACE eng.

New Masters
BIOINFORMATICS for COMPUTATIONAL GENOMICS
CYBER RISK STRATEGY AND GOVERNANCE
FOOD eng.
MUSIC and ACOUSTING eng.
2. General presentation of the study programme

The Study Programme in Electronics Engineering prepares the student to conceive, design, manufacture, validate and assess electronic systems and devices aimed at a variety of applications and contexts. The study programme is characterized by a wide range of courses, both theoretical and practical, that aim to provide students with the knowledge and skills necessary to design and develop electronic systems in a wide range of contexts.

The study programme is designed to provide students with a solid foundation in the principles of electronics, as well as an understanding of the latest technological developments. The programme is structured to allow students to specialize in areas such as digital electronics, signal processing, communication systems, and microelectronics.

Projects, Internships, and Final Thesis:

- Projects: Students are encouraged to undertake individual projects that allow them to apply the knowledge and skills acquired during the course. These projects cover areas such as digital signal processing, communication systems, and microelectronics.
- Internships: Students are required to undertake a minimum of 60 hours of professional experience in a relevant field. This experience is supervised and evaluated by an industry partner.
- Final Thesis: Students are required to undertake a final thesis project, which is supervised by a faculty member and evaluated based on its technical content, originality, and the student's ability to present and defend their work.

Students are encouraged to participate in research projects and to undertake internships with industry partners. This experience is invaluable in preparing students for careers in the electronics industry.

The study programme is designed to provide students with the knowledge and skills necessary to design and develop electronic systems in a wide range of contexts. The programme is structured to allow students to specialize in areas such as digital electronics, signal processing, communication systems, and microelectronics. The programme is designed to provide students with a solid foundation in the principles of electronics, as well as an understanding of the latest technological developments.
POLIMI services

**Libraries**: 4 a MI + 1 materials library + 5 in other Campus

**Career Service** [www.careerservice.polimi.it](http://www.careerservice.polimi.it) to prepare to future jobs

**POLIHUB** [www.polihub.it](http://www.polihub.it) to support your ideas and to foster startups

**MOOCS** [www.pok.polimi.it](http://www.pok.polimi.it) to download free online courses by POLIMI
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What is ELECTRONICS?

*embedded* systems, *smart* machines, *communication*, *networks*…

*smart, autonomous, wearable, "…of things" …* systems

for *real* and *virtual* worlds, and for *augmented-reality* for *humans* and *robots*!

Electronics it the **enabling** technology to capture real-world information, to process signals, to make actions and motion, to interact with machines, to **augment the reality** around us!
Where is ELECTRONICS?

components and circuits
science, physics, space

consumer electronics

InternetOfThings & wearable

Electronics is wherever **hardware, products, system, innovation, intelligence**… are!
Where is ELECTRONICS?

automotive and mobility

avionics and transportation

robot and drones

Industrial automation

Electronics is wherever **hardware, products, system, innovation, intelligence**... are!
ELECTRONICS is "inside" ... 

Electronics is **inside** whatever is **intelligent**, **autonomous**, **mobile**, even inside **humans**!
Electronic Engineers start from **electrons** and **holes**, to conceive **nanometric devices**, integrate them in a **micrometric** and **millimetric circuit**, so to define the **macro** system.
... to the big...
… and toward the enormous!
Who is the Electronic Engineer?

Grasps the **needs** and conceives the **solutions**: creates, simulates, designs, makes, validates, installs… devices, components, circuits, apparatus, systems…

Electronic Engineers operate in all "smart" and **autonomous** sectors of modern life!
Electronics makes your dreams come true

John is **quality manager** in the GT Division of Ferrari, in Maranello

Robert works on an **international scientific experiment** at CERN

Stephan is **principal engineer** on quantum computers at Intel Labs

Helena is **program manager** in Apple

Irene is **3D sensor systems engineer** at Zoox

Graduates in Electronics Engineering go everywhere and **realize dreams** – his/her own and those of other people.
Where the Electronic Engineer works…

Electronic Engineers operate all along the production and supply chain of modern life systems.
Acquired Expertise

- spot what to solve and how
- define specs, requirements, constraints, costs, pros/cons
- select design methodologies and technologies
- design electron devices
- develop integrated circuits, electronic boards, mixed systems
- exploit sensors, actuators, µP, FPGA, DSP, … at best
- integrate electronics into applications (atm, bio, ene, mec, inf, tlc …)
- validate through instrumentation
- manage "ilities" in plants and systems (reliability, manufacturability, testability …)
- profit

Electronic Engineers operate in all sectors from ideas to realization, production and management!
Job Outlooks

- **microelectronics** for semiconductors / integrated circuits
- **high-tech industries** (mechatronics, avionics, energy, automotive, space…)
- **companies** for smart electronics (infotainment, telecomm, computers…)
- **industrial automation** and **robotics** for manufacturing
- **infrastructures** for communications / networks / cloud / grid
- **R&D** genetics / pharmacology / medicine companies
- **start-up & spin-off** companies
- **consultancy and entrepreneurship**
- **public/private scientific/technological organizations**
- … **Ph.D.**
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“Master degree" and job or R&D

from other Italian Bachelors and worldwide Bachelors

“Bachelor degree" and job
Electronics is not Electrical Eng.

Electronics minimizes dissipation/power/bulkiness

Electrical is high voltage/current/power/machines

production, transmission, distribution of electric energy

electrical machines, wide-area power-grid, e-vehicles

electric traction, heavy industry

production, transmission, distribution of electric energy

Electronics is not Electrical Eng.
Goals of the M.S.E.E.

- device
- component
- prototype
- circuit
- physics
- chemistry
- math
- equipment
- system
Useful Contacts

Student email: name.surname@mail.polimi.it
Teacher email: name.surname@polimi.it
Phone number: (02-2399) xxxx

Enrollment to the Master:
(international students) prof. christian.monzio@polimi.it
(Italian students) prof. massimo.ghioni@polimi.it and prof. salvatore.levantino@polimi.it

Study Plans: prof. chiara.guazzoni@polimi.it

Coordinator: prof. franco.zappa@polimi.it
### M.S.E.E.: 1st Year

100 CFU in 2 years: **60 CFU at the 1st year**, corresponding to **7 classes** taught in **English**.

One course of 10 CFU corresponds to 60h of lessons and 40h of exercises.

#### Insegnamenti a scelta dal Gruppo TAB1

<table>
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<tr>
<th>tipologia</th>
<th>Nome Insegnamento</th>
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<th>CFU</th>
<th>di cui di D.I.</th>
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from Bachelor
### M.S.E.E.: 2\textsuperscript{nd} Year

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At the 2\textsuperscript{nd} year only 40 CFU (25 CFU are eligible courses). All in **English**. Finally 20 CFU (6-9 months) of **experimental thesis in the labs** of POLIMI or in a company.
... several electives and choices

<table>
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<th>Denominazione Insegnamento</th>
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<th>CFU</th>
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Hands-on Labs and THESIS

www.polifab.polimi.it
Timeline

5 exam trials for each teaching every year.
### Example of Academic Year

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<tr>
<th>SEZIONE D'ESAME</th>
<th>1° SEMESTRE</th>
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</tbody>
</table>

**1st Semester**
- 3 – 4 teachings
- exams
- 3 – 4 teachings

**2nd Semester**
- 3 – 4 teachings
- exams
- 3 – 4 teachings

**Legend**
- esami di profilo
- lezioni
- festività
- vacanze
- periodo senza esami, revisioni e recuperi facoltativi per laboratori (design)
- prove in itinere (lezioni sospese)
Example of Weekly Schedule

Every week about 24 hours of **LESSONS** and **EXERCISES** in class and 3 hours of **LABORATORIES**
• Politecnico di Milano: Schools and Masters

• Electronics and Engineering: what and why?

• Master Degree in Electronics Engineering

• Data and Stats
How many graduates?

B.S.E.E.

M.S.E.E.
Time to job

Source: www.careerservice.polimi.it

B.S.E.E.

M.S.E.E.
Who are the students?

Enrolled students to the M.S.E.E.
Distribution of exams' marks

ELECTRONICS

- # di Insegnamenti: 39
- # di Iscritti all'Eseame: 1238
- di cui superati: 500
- % di 30 e Lode: 8.00
- Voto Medio: 26.14
- Deviazione Standard: 3.10

Corso di Laurea
- Aeronautical Engineering - Ingegneria...
- Automation and Control Engineering - I...
- Biomedical Engineering - Ingegneria Bi...
- Chemical Engineering - Ingegneria Chi...
- Computer Science and Engineering - In...
- Electrical Engineering - Ingegneria Elett...
- Electronics Engineering - Ingegneria Ele...
- Energy Engineering - Ingegneria Energ...
- Engineering Physics - Ingegneria Fisica
- Ingegneria della prevenzione e della sic...
- Management Engineering - Ingegneria ...
- Materials Engineering and Nanotechnol...
- Mathematical Engineering - Ingegneria ...
- Mechanical Engineering - Ingegneria M...
- Music and Acoustic Engineering
- Nuclear Engineering - Ingegneria Nucle...
M.S.E.E. employment data

TOTAL OFFERS: 3571

WHERE
- Italy: 92%
- Abroad: 8%

COMPANY SIZE*
- 1 - 250: 66%
- 251 - 1,000: 14%
- > 1,000: 20%
* number of employees

CONTRACT TYPE
- Permanent: 57%
- Fixed-term: 15%
- Apprenticeship: 10%
- Internship: 16%
- Other*: 2%
* project based, occasional collaboration

TOP 10 SECTORS

Electronics and Automation 22.2%
ICT 13.3%
Mechanics and Installation 7.2%
Metallurgy and Metalworking 7.2%
IT Consultancy 6.6%
Business Consultancy 6.4%
Scientific Research and Dev 5.1%
Automotive 3.6%
Business Services 2.8%
Telecommunications 2.6%

MAIN JOBS OFFERED IN TOP 4 SECTORS

Electronics and Automation
- Electronics Engineer: 22.2%
- Computer Scientist & Eng: 16.3%
- Designer: 9.2%
- Sales & Business Developer: 8.1%
- Process Engineer: 6.4%

ICT
- Computer Scientist & Eng: 83.9%
- Software Architect: 8.2%
- Electronics Engineer: 5.7%
- Process Engineer: 4.9%
- Hardware Engineer: 1.9%

MECHANICS AND INSTALLATION
- Computer Scientist & Eng: 13.6%
- Process Engineer: 12.1%
- Electronics Engineer: 12.1%
- Designer: 10.5%

Metallurgy and Metalworking
- Computer Scientist & Eng: 19.5%
- Process Engineer: 18%
- Electronics Engineer: 13.3%
- Designer: 13.3%
- Sales & Business Developer: 9.4%

EMPLOYMENT STATUS
- Employee: 98%
- Self-employed: 2%

CONTRACT TYPE
- Permanent: 68%
- Fixed-term: 16%
- Apprenticeship: 14%
- Other*: 2%
* project based, occasional collaboration

NET MONTHLY SALARY
- €1,807

Where they work
- Italian graduates working abroad: 18%
- International graduates working in Italy: 33%
- Total: 51%

Where they work
- Italian graduates working abroad: 18%
- International graduates working in Italy: 33%
- Total: 51%

Top 5 Sectors

Electronics and Automation: 35%
Automotive: 9%
Telecommunications: 7%
Metallurgy and Metalworking: 5%
Scientific Research and Development: 4%

Top 5 Areas of Expertise

Design: 73%
Research and Development: 67%
Planning: 13%
Operations: 13%
Quality and Control: 9%
Internationalization

www.polimi.it/it/servizi-e-opportunita/studiare-allestero

Study abroad committee:
- prof.ssa Federica Foiadelli (Erasmus, worldwide except China)
- prof.ssa Flavia Grassi (Double degree and exchange with China)
- dott.ssa Michela Longo (Double degree, expect China)
## Manifesto degli studi

### Insegnamenti del 1º Anno di corso

<table>
<thead>
<tr>
<th>Codice</th>
<th>Attività Formativa</th>
<th>SSD</th>
<th>Denominazione Insegnamento</th>
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More info at:
**Information events**

The School of "Industrial and Information Engineering" organizes several information and guidance events each year, in order to explain to interested students what Engineering is and what the various Study Programmes are.

In particular, both the Bachelor of Science (i.e., the three-years "Laurea") and the Master of Science (i.e., the two-years "Laurea Magistrale") Degrees in Electronic Engineering have been actively presented at the following events:

- **OPEN DAY 2020** (held online on April 27, 2020), addressed to Italian high-school students interested in the Bachelor's first level degree in "Electronic Engineering". Video about the study programme and students interview.

- **POLIMI e Scuola di INGEGNERIA INDUSTRIALE e GESTIONE** and also **Ingegneria ELETTRONICA** (held on December 2, 2019, in Italian), addressed to students of the Scientific and Technical High School of Salesiani in Sesto San Giovanni.

- **ELECTRONICS ENC. Study Programme’s Quality Assurance** (held on October 31, 2019) to students at the second year of the M.S.E.E., on AQ (Quality Assurance). AVA procedure (self-evaluation, periodic Evaluation, Accreditation), proactive role of students, Students' Representatives within the Study Programme's Council and within the Joint Professors-Students Committee.

- **QUALITY ASSURANCE** (held on October 9, 2019) to students at the M.S.E.E. providing an overview on "Bologna process", AQ (Quality Assurance), APA (Autovalutazione, Valutazione periodica e Accreditamento, i.e. self-evaluation, periodic evaluation, and Accreditation) procedure, role of MIUR (Italian Ministry of Education, University and Research), role of ANVUR (Agenzia Nazionale di Valutazione dei sistemi Universitari e della Ricerca, Italian evaluation agency for university and research), and periodic visit of CEV (Commissione di Esperti della Valutazione, evaluation experts committee).

- **LESSON ZERO** (held on October 3, 2019) to students at the M.S.E.E., providing an overview on POLIMI, Schools, Departments, Organization, Students' role, Services and Opportunities and Contact persons, M.S.E.E. programme, courses and credits, thesis tipologies and evaluations, internal and external thesis, final grade, thesis topics on the research developed at POLIMI on Electronics.

- **LEZIONE ZERO** (held on September 27, 2019) to freshmen at the first year of the Laurea (B.S.E.E.), providing an overview on POLIMI Schools, Departments, Organization, Students' role, Services and Opportunities and Contact persons, B.S.E.E. programme, courses and credits, internship.

- **WELCOME DAY 2019** (held on September 11, 2019), addressed to international students enrolling to the Master of Science in "Electronics Engineering" (M.S.E.E., i.e. the "Laurea Magistrale").

- **SUMMER SCHOOL 2019** (held on June 11, 2019), addressed to the best students of the second-to-last year of secondary high schools in Italy, illustrating the Study Programmes of both Laurea (B.S.E.E.) and Laurea Magistrale (M.S.E.E.) in Electronic Engineering at POLIMI.

- **MASTERS’ Degrees at POLIMI 2019** (held on May 14, 2019), addressed to first-level B.S. students interested to apply to the second-level Master’s Degree (LM) in ‘Electronics Engineering’.

- **ELECTRONICS**, a brief review of some applications of electronics in everyday’s life.

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The Study Programme (Corso di Studi, CSdS) in Electronics Engineering trains the student to design, use, and innovate electronic devices, circuits and systems, to guide the evolution of this technological field with competence and professionalism, and to promote its deployment in countless sectors and in most diversified applications, where Electronics plays a key role. The objective of the Study Programme in Electronics Engineering is to train professionals with a rich and robust scientific and technological background, which combine physical-chemical-mathematical understanding of the most advanced technologies with cutting-edge engineering skills, necessary to conceive, design, and develop applications, products, and systems to be deployed in the most diversified fields, often enabling new markets and inventing new application scenarios.

"Electronics Engineering is at the basis of all technologies in today’s Information age, fostering all aspects of life, work, and society."

Research in electronics technologies is continuous, incessant, and increasingly stimulated by the most diverse and demanding applications. For example, ever-faster microprocessors and increasingly dense memories are the essential electronic constituents of any computer and processing system. Ultra-sensitive and miniaturized semiconductor sensors, which continually dialogue with each other and with the outside world, are fundamental to acquire real world’s signals. Embedded systems can understand, manage, and control objects around us and can implement actions through drones and robots. Not to speak of the ubiquity of electronic systems in telecommunications, where the development of ever faster and more complex electronic circuits enabled the explosion of cellular, fiber optic, and satellite communications.

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**Master in ELECTRONICS Engineering**

[franco.zappa@polimi.it](mailto:franco.zappa@polimi.it)
More on www.elettronica.polimi.it

Alumni

Alberto Sangiovanni-Vincentelli was born in Milan in 1941. He received an MS in Electronic Engineering cum laude from Politecnico di Milano in 1967. After graduation, he joined the Department of Electronic Engineering as a research fellow and then as a professor in 1972. He then joined Electrical Engineering and Computer Sciences at the University of California, Berkeley, where he held the Edgar L. Adams Chair. Among various visiting positions, he was at IBM T.J. Watson Research Center in 1980 and at MIT in 1983. In 1991, he received the IEEE Medal for outstanding contributions that have had an exceptional impact on the development of electronic and circuit engineering or related fields (a co-Founder of Cadence and Synopsys) in recognition of his work on the development of CAD tools for integrated circuits. He is a fellow of the IEEE, ACM, MIEEE, and IEEE Computer Society. He was also elected to the National Academy of Engineering, and to the National Academy of Sciences. In 1993, he was elected to the American Academy of Arts and Sciences. He is a member of the American Academy of Arts and Sciences, and a Fellow of the Institute of Electrical and Electronic Engineers. He is a fellow of the American Academy of Arts and Sciences, and a Fellow of the Institute of Electrical and Electronic Engineers. He is a fellow of the American Academy of Arts and Sciences, and a Fellow of the Institute of Electrical and Electronic Engineers. He is a fellow of the American Academy of Arts and Sciences, and a Fellow of the Institute of Electrical and Electronic Engineers. He is a fellow of the American Academy of Arts and Sciences, and a Fellow of the Institute of Electrical and Electronic Engineers. He is a fellow of the American Academy of Arts and Sciences, and a Fellow of the Institute of Electrical and Electronic Engineers.

Mario Colaro was born in Bergamo (Italy) in 1983. He studied at Politecnico di Milano (Milan, Italy) where he obtained his laurea degree in Electronic Engineering in 2009 and a PhD in Information Technology in 2012, with a thesis on organic photodetectors and memory devices. In March 2013, he joined the group of Prof. Irving Faminow at the Canadian Laboratory (Cambridge, UK) as a post-doctoral researcher. He worked at Cambridge for 3 years on high resolution imaging and functionalization of organic materials and devices, and on charge injection and transport in organic field-effect transistors. In April 2016, he was appointed as prinicipal investigator at the Center for Nano Science and Technology of the Swiss Federal Institute of Technology, where he is now the leader of the lab on organic electronics.

Master in ELECTRONICS Engineering

franco.zappa@polimi.it