Graduate Track For Intelligent & Innovative Mobility

COMPUTER SCIENCE

ENERGY

ROBOTICS

MECHANICS

CLERMONT AUVERGNE INP

CLERMONT AUVERGNE INP

Institute of Technology

3 graduate schools of Engineering in Clermont-Ferrand

Clermont Auvergne University

Computer science • Biological Engineering • Mechanical Engineering • Civil Engineering • Electrical Engineering • Mathematical Engineering & Data Science • Engineering Physics • Production Systems Engineering • Chemistry & Chemical Engineering

3 engineering graduate schools
Clermont Auvergne INP - ISIMA
Clermont Auvergne INP - SIGMA Clermont
Clermont Auvergne INP - Polytech Clermont

4 engineering prepatory classes (undergraduate level)
La Prépa des INP (Groupe INP)
CPI (Fédération Gay-Lussac)
Prép' Isima
PeiP (réseau Polytech)

2 500 students

189 international cooperation agreements

350 academic & administrative staff

3 Main research centers affiliated to the French National Research Centre (CNRS)

GROUPE INP — Member of the INP Group
+35 public engineering schools in France

1 professional training department

UCA UNIVERSITÉ Clermont Auvergne

Université Clermont Auvergne: A major teaching and research university

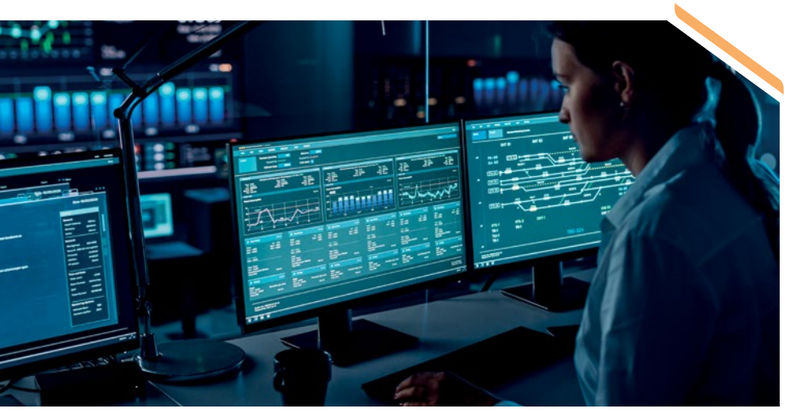
The new Clermont Auvergne University aims to be a major player in development, a major university of education and research with an international dimension. Strongly connected to its territorial environment and to the socio-economic world, it intends to rank among the best French universities in the Shanghai ranking. In a changing world whose references evolve regularly, a university must prepare its students to participate in the construction of the society in which they will evolve. Designing sustainable models of life and production is the unifying theme that UCA wanted to develop, a theme that is based on university research activities that have reached a level of excellence recognized beyond our borders and that responds to society's expectations (how to eat better, move better, live in good health, how to protect populations from the risks of natural disasters). It is a unifying theme that does not exclude any of the university's disciplinary fields and makes it possible to combine academic training with civic education. Finally, it facilitates the integration of students into the world of tomorrow and into companies that are increasingly attentive to the issue of social responsibility.

A label of excellence

In 2017, UCA received the I-Site label. This makes it one of the few universities selected to implement a long-term policy of excellence, develop interactions with their economic environment and attract internationally renowned research teams. The university is also involved in the organization of summer schools and international conferences.

MASTER OF SCIENCE IN COMPUTER SCIENCE

The mission of the international track of our master of science in computer science is to prepare and train the next generation of decision and data scientists. M.S. International-Track students will familiarize themselves with a broad range of theoretical and computational techniques from many areas of the mathematical and computational sciences.



In short:

> **Course duration: 2 semesters**
> **Language: English**
> **Starting in September**
> **ECTS: 60**

The students will develop **an expertise in cutting-edge techniques for decision and data sciences** through courses taught by distinguished researchers and significant involvement in research activities. Upon receiving the M.S. degree, these students will be competent not only in **designing effective and innovative methodologies for decision making and data management,** but also **in identifying and implementing the most pertinent software.**

The graduating students will be well-prepared to pursue **a Doctor of Philosophy degree and hence excel in academic or industrial research-and-development jobs.** The M.S. International Track in entirely taught and managed in English to make it accessible to international students who do not speak French. Its program is structured to introduce the students to **the foundations of decision and data sciences** and make them develop deep knowledge in their chosen area of specialization. M.S. International-Track students enrolled through an exchange agreement with Clermont Auvergne INP might be eligible for a diplôme d'ingénieur from ISIMA as well.

Industrial Partners : Michelin, Dassault, Almerys, Braincube, Orange Labs, Coffreo, EDF, Limagrain, DeltaMu, Perfect Memory, Lojelis...

Hosting Graduate School:

CLERMONT AUVERGNE INP — Isima — UCA Université Clermont Auvergne

Contact: Hervé Kerivin - herve.kerivin@uca.fr

PROGRAM

// CORE COURSES

1/ Fundamentals of Optimization - 3 ECTS
2/ Algorithms and Complexity - 3 ECTS
3/ Machine Learning and Data Mining - 3 ECTS
4/ Seminar Series - 3 ECTS

+ Master's thesis at Research Laboratory LIMOS - 9 ECTS

Five courses to choose from:

// DECISION SCIENCE COURSES

5/ Combinatorial Optimization at Work - 3 ECTS
6/ Logic in Computer Science - 3 ECTS
7/ Decision and Learning under Uncertainty - 3 ECTS
8/ Graphs and Algorithms - 3 ECTS
9/ Advanced Topics in Optimization - 3 ECTS

// DATA SCIENCE COURSES

10/ High Performance Computing, Parallel Programming Models, Hybrid Computing, Numerical Reproducibility - 3 ECTS
11/ Advanced Topics in Machine Learning and Data Mining - 3 ECTS
12/ Knowledge Representation and Reasoning - 3 ECTS
13/ Mobile networks and Mobile Data Collection - 3 ECTS
14/ Information System Security - 3 ECTS

INTERNSHIP

- **A five-to-six month internship in an academic research institute or an industrial research-and-development department anywhere in the world.**
- **Starting after March 1st**
- **21 ECTS**

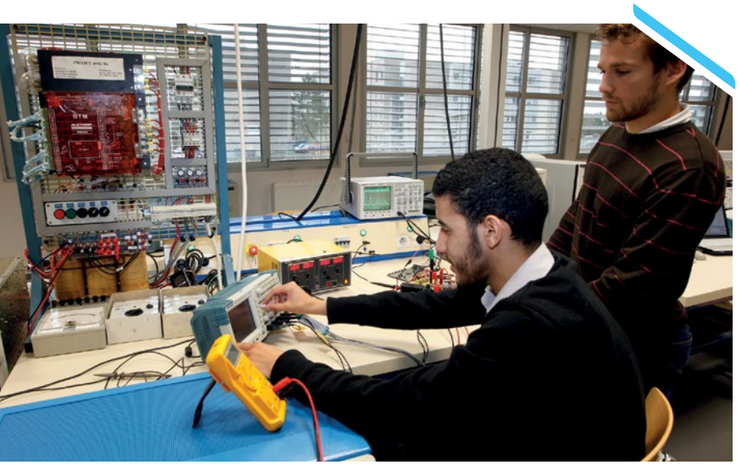
PROGRAM PREREQUISITES

Entering students are expected to either already hold or be half-way through completion of a master's degree in mathematical sciences, computer science, or related fields.

University Clermont Auvergne offers several merit-based scholarships for high-caliber students enrolled in the M.S. International Track, with a preference given to students interested in pursuing a Doctor of Philosophy degree.

MASTER'S DEGREE IN ENERGY FOR SUSTAINABLE ENGINEERING

The mobility of people and objects consumes a large quantity of natural resources, in terms of both materials and energy. Energy efficiency, energy sobriety, and decarbonized energies are the keys for a sustainable future.



In short:

> Course duration:
3 semesters at POLYTECH Clermont + 1 semester of internship

> Language:
English + additional French language courses

> Starting in: **September**

> ECTS: **60+60**

This master's degree offers students multidisciplinary training in the field of engineering applied to energy production, storage, supply, and management, including mainly:

- renewable energy (bioenergy, solar from materials to panels)
- hydrogen production and power-to-gas
- sustainable mobility based on hydrogen, power, or liquid biofuels
- energy efficiency for industrial and service sectors

Take advantage of specialized training and research bench-scale to pilot-scale facilities of our chemical and biochemical engineering laboratory, and of the engineering physics workshops (CAD, soldering, 3D printing, physicochemical properties) of POLYTECH Clermont for project-based learning.

Industrial Partners:

Institut Pascal (chemical engineering, bioenergy, solar energy, physics), Excellence Laboratory on sustainable mobility (LabEx IMobS3) and CIR ITPS (Innovative Systems for Transportation and Production), Michelin, Bio-Valo.

Hosting Graduate School:

CLERMONT AUVERGNE INP UCA — POLYTECH CLERMONT

Contact: Christophe VIAL - christophe.vial@uca.fr

PROGRAM

1st semester

1/ Energy tools for engineers - 50 hrs
2/ Tools for Chemical Processes in Energy - 50 hrs
3/ Energy modeling tools - 50 hrs
4/ Research and Development Project - 150 hrs
2nd semester
5/ Research and Development Project - 50 hrs

2nd semester

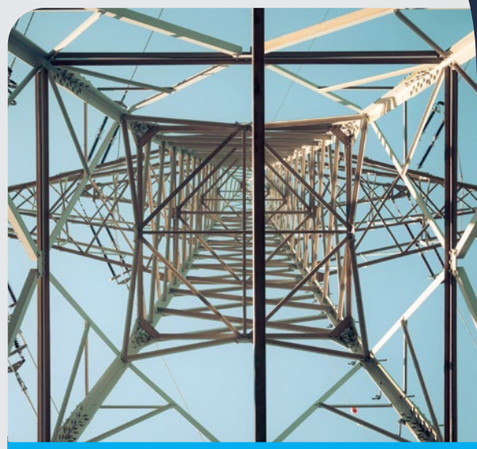
1/ Energy tools for engineers - 50 hrs
2/ Sustainable development - 50 hrs
3/ Project in energy and sustainable development - 50 hrs
4/ Humanities, French, English - 50 hrs
5/ 4-month internship in a research laboratory (academic or industrial)

3rd semester

1/ Energy engineering - 40 hrs
2/ Decarbonized energy - 40 hrs
3/ Energy efficiency - 40 hrs
4/ Energy storage and supply - 40 hrs
5/ Energy management - 40 hrs
6/ Sustainable Mobility - 60 hrs
7/ Research and innovation project - 100 hrs
8/ Humanities, French, English - 40 hrs

4th semester

Final internship (5-6 months)



3 school projects and 2 internships

> 4-month internship between the 2nd and 3rd semesters

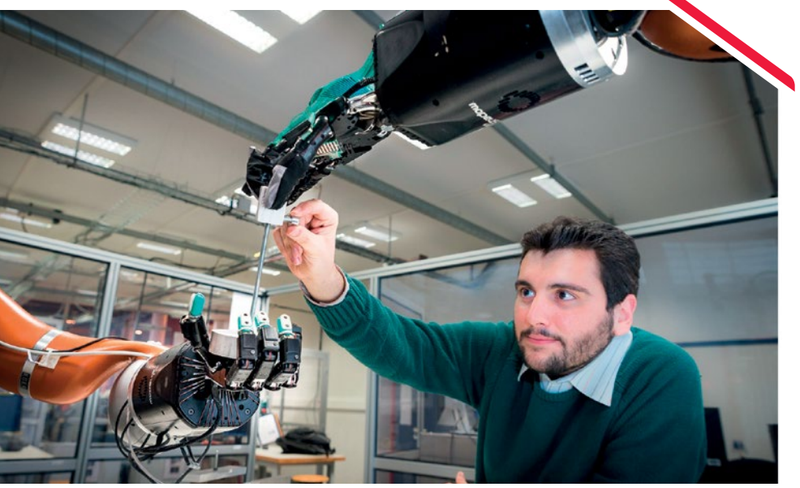
> final internship (5-6 months)

ADMISSION CRITERIA

- **Applicants should already have passed/validated a bachelor's degree in Physics, Physical Chemistry, Materials Engineering, Chemical Engineering, or Biochemical Engineering.**
- **The selection process will be based on the examination of the application file (cv, transcript of the BEng, English language certification). The candidate may be invited to an interview.**

MASTER'S DEGREE ARTIFICIAL PERCEPTION & ROBOTICS

Robotics is currently one of the most popular topics, and robots have the potential to solve complex challenges in the areas of transportation, factories of the future, agriculture, medical care, production and food supply.



In short:

> Course duration: 2 semesters

> Language: English

> Starting in: September

> ECTS: 60

This master's degree offers students **a multidisciplinary education in the field of artificial perception and robotics.** Students will **learn how to model, design and control a robotic system** in numerous applications, particularly in the specific context of intelligent and autonomous vehicles. This master's degree will improve the employment prospects of students by providing them **with relevant theoretical knowledge and practical skills** to become robotics engineering experts in their field. At the end of their course, students will:

- **Master the scientific foundations of robotics** (mechanics, automatic systems, artificial intelligence...)
- **Apply the mathematical tools** necessary to model robotic systems.
- **Understand, identify and implement the numerical tools** involved in robotics
- **Capitalize on robotics** in order to design complex intelligent systems.

Hosting graduate school: ÉCOLE UNIVERSITAIRE DE PHYSIQUE ET D'INGÉNIERIE
Université Clermont Auvergne

Contact: Romuald AUFRERE - romuald.aufrere@uca.fr

PROGRAM (30 hrs - 3 ECTS for each course)

1/ Mathematical tools for Robotics
2/ Modeling of Mechanisms, Machines and Robots
3/ Control of robotic systems
4/ Multi-sensory perception
5/ Learning for robotics
6/ Advanced Programming and ROS
7/ Artificial vision
8/ Driver Assistance System
9/ French (common to all SFRI Graduate Tracks)
10/ Humanities

Interships :

- During 4th semester : starting in March in an academic laboratory or private company in France or abroad.

Industrial and research partners:

- Michelin, Limagrain, Sherpa Engineering, Logiroad, Vedecom, CEA, Thalès, YOGOKO, 4D-Virtualiz.

Research laboratories

CAREER PROSPECTS

The potential jobs for APR Master's students are related to public/ private research and to engineering. Related fields include the automotive industry, aeronautics, space, transportation, medical, defence, materials, pharmaceutical industry, food industry, rail transport or chemistry.

Opportunities range from large multinational groups to start-ups, and include keeping with a PhD contract. Here are some examples of PhD theses recently carried out by APR Master's students:

- **Evaluation of deep reinforcement learning methods for robotic exploration** (ONERA / SIGMA Clermont collaboration)
- **Optimal traversability analysis for the safety of robot displacements** (Université Laval (CANADA) / INRAE / Institut Pascal collaboration)
- **Contributions to multisensory perception in a disturbed environment through deep learning** (Institut Pascal / CEREMA collaboration)

ADMISSION CRITERIA

Candidates should have or should be in the process of obtaining a Master 1 degree in the fields of robotics, automatic systems, computer science or signal processing. The selection process will be based on the examination of the application and the candidate may be invited to an interview.

MASTER'S DEGREE IN INNOVATIVE MECHANISMS AND ROBOTS

The program is designed to promote a high-quality educational offer in the areas of advanced design and control of complex systems with a particular focus on industrial machines and robots.

In short:

> *Diplôme d'ingénieur Grande Ecole*

> Duration: 2 years

> Starting in: September

> Training period:
3 semesters at SIGMA Clermont
+ 1 semester of internship

> Language: English
+ additional French language courses

> ECTS: 30/semester

After completion the students will have mastered the different areas of complex mechanisms such as:

- Mechanical modelling & design
- Material modelling
- Control engineering, sensor integration, artificial intelligence
- Robotics applications

The course covers all the main themes necessary to be able to deal with complex mechanisms and robots as a whole, rather than just concentrating on one particular area.

Hosting graduate school: CLERMONT AUVERGNE INP UCA — Sigma Clermont

Contact: Youcef MEZOUAR - youcef.mezouar@sigma-clermont.fr

PROGRAM

1ST SEMESTER

1/ Computer Aided Design (28 hours)
2/ Machine learning (28 hours)
3/ System engineering, innovation and sustainable design (26 hours)
4/ Basic robotics (28 hours)
5/ Programming for robotics (28 hours)
6/ Computer vision (28 hours)
7/ Real time systems (28 hours)
8/ How to design your personal and professional development plan (20 hours)
9/ Marketing (20 hours)
10/ Project (30 hours)
11/ French basics (28 hours)
12/ French (28 hours)
13/ Elective language course (15 hours)

2ND SEMESTER

1/ Dynamics (24 hours)
2/ Electrical actuators in robotics and machine-tools (28 hours)
3/ Industrial Process/Additive Manufacturing (28 hours)
4/ Advanced robotics (28 hours)
5/ Reinforcement learning for robotics (28 hours)
6/ Modelling of Mechatronics Systems (28 hours)
7/ Project (50 hours)
8/ French for business (28 hours)
9/ Marketing and management: cultural and societal aspects (16 hours)
10/ Fundamentals of management (36 hours)
11/ Economy: business game (24 hours)
12/ Elective courses (20 hours)
13/ Elective language course (20 hours)

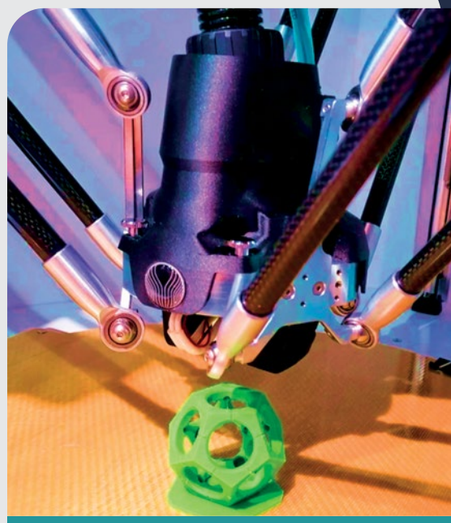
ASSISTANT-ENGINEED INTERNSHIP (MINIMUM 15 WEEKS)

3RD SEMESTER

1/ Innovative materials (28 hours)
2/ Softwares for Dynamics and Materials (28 hours)
3/ Sustainable Manufacturing and Innovation (30 hours)
4/ Sensor integration (28 hours)
5/ Application of Intelligent Robotics (28 hours)
6/ Special Topics on perception and robotics (28 hours)
7/ Project (90 hours)
8/ English (32 hours)
9/ Second foreign language (26 hours)
10/ Job marketing: class told in English (14 hours)
11/ Responsibility of the engineer (16 hours)
12/ Management (16 hours)
13/ Elective courses (40 hours)
14/ Elective language courses (20 hours)

4TH SEMESTER

1/ Internship (minimum 22 weeks)
2/ Preparation for certification in French language



> 4 scientific semester projects and 2 internships:

- 16-week internship between the 2nd and 3rd semesters
- Final 22-week internship

> In collaboration with industrial partners and research laboratories

> Scholarship opportunities are available for excellent candidates.

> PhD scholarships will also be offered after the Master's degree for top performers.

ADMISSION CRITERIA

- **Applicants should hold a valid Bachelor's degree.**
- **The selection process will be based on the examination of the application file (CV, transcript of the BEng, English language certification). The candidate may be invited to an interview.**

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