

# Graduate Track For Intelligent & Innovative Mobility



COMPUTER SCIENCE  
ENERGY  
ROBOTIC  
MECHANICS





# 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 preparatory classes  
(at 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)

**INP** Member of the INP Group  
+35 public engineering school in France

**1** professional training department



## EDUCATION



## RESEARCH



## PROMOTION OF RESEARCH



### 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 :

- > Training period : 2 semesters
- > Language : English
- > Starting in : September 2022
- > 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 is 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 ISIMA as well.

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

**Hosting Graduate School :**



Contact : [herve.kerivin@uca.fr](mailto: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

### One specialization to choose between :

#### // DECISION SCIENCE

- 5/ Combinatorial Optimization at Work - 3 ECTS
- 6/ Approximation Algorithms - 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

- 10/ High Performance Computing - 3 ECTS
- 11/ Advanced topics in machine learning and datamining - 3 ECTS
- 12/ Knowledge representation and reasoning - 3 ECTS
- 13/ Mobile networks and Mobile Data Collection - 3 ECTS
- 14/ Information System Security - 3 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.

## INTERNSHIP

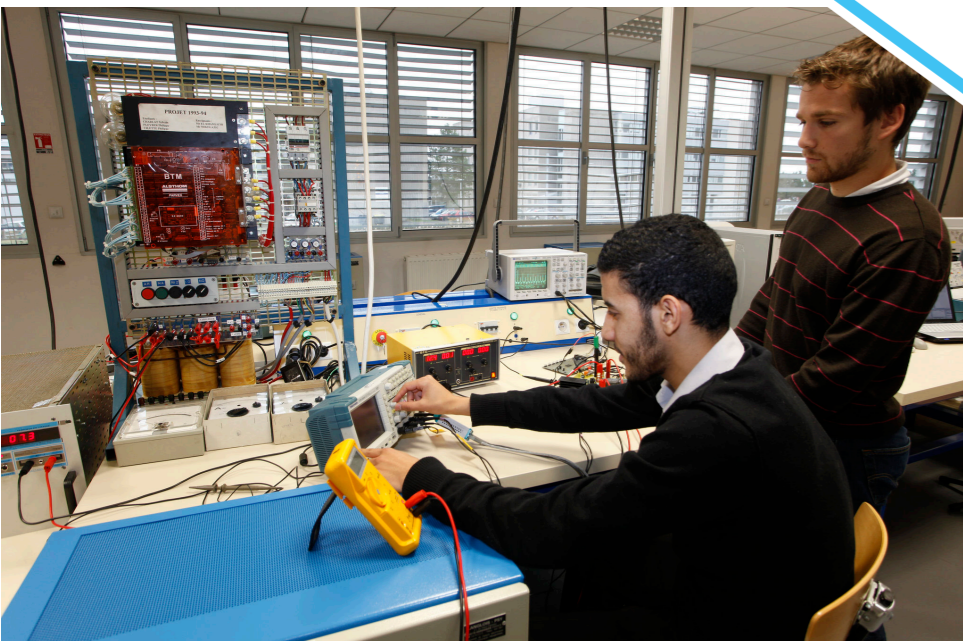
- A five-to-six month internship in an academic research institute or an industrial research-and-development department anywhere in the world.

- Starting after March 1<sup>st</sup>

- 21 ECTS

# 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:

> **Training period:**  
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 the 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 :



Contact: Christophe VIAL - [christophe.vial@uca.fr](mailto:christophe.vial@uca.fr)

# PROGRAM

## 1<sup>st</sup> semester

- 1/ Energy tools for engineers - 50 hrs
- 2/ Specialized energy tools in chemical and biochemical engineering - 50 hrs
- 3/ Specialized energy tools in engineering physics - 50 hrs
- 4/ Project in energy and sustainable development - 150 hrs
- 5/ Humanities, French, English - 50 hrs

## 2<sup>nd</sup> 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)

## 3<sup>rd</sup> 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

## 4<sup>th</sup> semester

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.

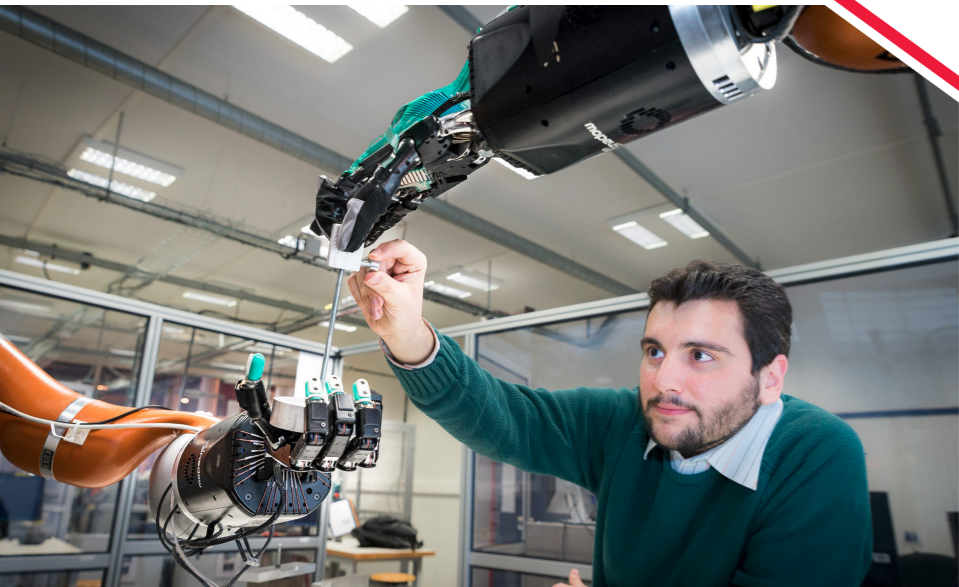


## 3 school projects and 2 internships

- > 4-month internship between the 2<sup>nd</sup> and 3<sup>rd</sup> semesters
- > final internship (5-6 months)

# 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:

- > **Training period:** 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.aufreere@uca.fr](mailto:romuald.aufreere@uca.fr)

## PROGRAM (30 hrs - 3 ECTS for each course)

- 1/ Mathematic tools for Robotics
- 2/ Modeling of Mechanisms, Machine 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) Humanities
- 10/ Humanities

## 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.



### Internships :

- 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

- Institut Pascal, INRAE

# MASTER'S DEGREE IN MECHANICS AND MATERIALS FOR SUSTAINABLE ENGINEERING

The mobility of people and objects consumes a large quantity of natural resources, in terms of both materials and energy. The design, manufacture, mechanical performance, maintenance and recycling of products must now integrate environmental concerns.



## In short:

> **Master's degree in mechanical engineering** (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**

This master offers students **multidisciplinary training in the field of mechanical engineering**, including in particular:

- **mechanical design**, integrating the **choice of materials** according to their **impact on the environment**
- **general knowledge on bio-based materials**
- **development and elaboration of new biopolymers and biocomposites** intended for 3D printing
- **management of the life cycle of a part**, a product or a structure, including the planning and optimization of maintenance.

Take advantage of specialized training, design and print your own biocomposites in the FabLab, and test the parts in the materials testing lab! And if you need any help, for your study program or in your everyday life, just ask your SIGMA buddy!

Hosting graduate school:



Contact: Xavier BALANDRAUD - [xavier.balandraud@sigma-clermont.fr](mailto:xavier.balandraud@sigma-clermont.fr)

## PROGRAM

### 1<sup>ST</sup> SEMESTER

- 1/ Introduction to French language (10h)
- 2/ French (48h)
- 3/ How to design your personal and professional development plan (20h)
- 4/ Mechanical engineering project (30h)
- 5/ Project in mechanics and materials for sustainable engineering (220h)
- 6/ Elective courses in mechanics and materials

### 2<sup>ND</sup> SEMESTER

- 1/ Structural optimization (28h)
- 2/ Fracture mechanics (28h)
- 3/ Maintenance optimization (36h)
- 4/ Bio-based materials (36h)
- 5/ Composite materials (28h)
- 6/ Project (50h)
- 7/ French for business (26h)
- 8/ French (26h)
- 9/ Marketing and management (36h)
- 10/ Economy (22h)
- 11/ 16-week internship (between the 2<sup>nd</sup> and 3<sup>rd</sup> semesters)

### 3<sup>RD</sup> SEMESTER

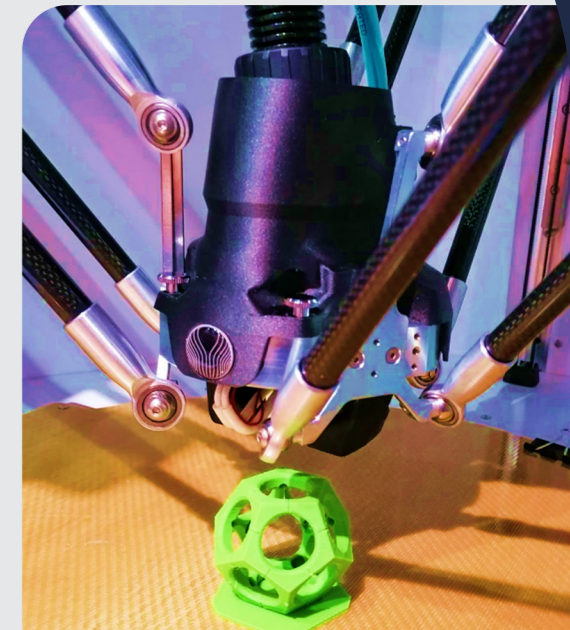
- 1/ Sustainable manufacturing and innovation (30h)
- 2/ Innovative materials (28h)
- 3/ Experimental characterization of materials (28h)
- 4/ Impact of materials on environment (28h)
- 5/ Uncertainty quantification (28h)
- 6/ Project (150h)
- 7/ English (24h)
- 8/ Job marketing (14h)
- 9/ French (26h)

### 4<sup>TH</sup> SEMESTER

- 1/ Management (16h)
- 2/ Engineer responsibilities (16h)
- 3/ TOEIC preparation
- 4/ Preparation for certification in French language
- 5/ Final 22-week internship

## ADMISSION CRITERIA

- Applicants should hold a valid Bachelor's degree in Mechanical 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.



> 4 scientific semester projects and 2 internships:

- 16-week internship between the 2<sup>nd</sup> and 3<sup>rd</sup> 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.



## Clermont Auvergne INP

27 rue Roche Genes  
CS 20265  
63178 Aubière Cedex

clermont-auvergne-inp.fr

