Master in advanced mechatronics
Mechatronics = synergistic and integrated process of several sciences and skills: control and computer sciences, electronics, mechanics

Which allows to conceive and to design products and systems with augmented or improved functionality

Which requires to consider the conception of the product or system
- in its overall lifecycle
- in a cooperative interdisciplinary approach

But
- being an expert in each domain is impossible
- having a superficial background in each domain would be insufficient

cf European Mechatronics for a new Generation of Production Systems — The Roadmap
Mechatronics = synergistic and integrated process of several sciences and skills: control and computer sciences, electronics, mechanics

- The Master’s students:
  - will gain specialized skills in at least one domain and enough additional skills in other domains to meet the requirements of a multidisciplinary mechatronic project;
  - will become familiar with the requirements of a research activity.
Master in advanced mechatronics

**SOFT SKILLS**
- Materials Science
- Mechanics
- Electronics
- Advanced Mechatronics
- Computer science

**KNOW-HOW**
- Instrumentation
- Control Science

**KNOWLEDGE**

**Professional skills:**
- Scientific communication
- Structuration and funding of Research
- Ethics (Plagiarism)

**Transversal skills:**
- Collaborative work
- Project management
- IP & patents
- Innovation
- Social responsibility
- Language

...
Competencies framework

3 main competencies

1. Design and achieve a mechatronical system
2. Manage a research project
3. Master the skills required for research activities
1. Design and achieve a mechatronical system

✓ By implementing the lifecycle of the system or product

✓ By implementing an integrated process of multiphysics and multi-technology modeling, simulation and design

✓ By choosing, designing and implementing the required sensors and instrumentation

✓ By designing the mechanical and/or electromechanical architecture

✓ By choosing, designing and implementing the digital infrastructure present in and around the system
2. Manage a research project

✓ By organizing his/her activity and the activity of his/her team

✓ By reporting to the research program manager

✓ By considering the questions of eco-responsibility of his/her projects and their legal and economic consequences
3. Master the skills required for research activities

✓ By managing and spreading scientific knowledge
✓ By applying the principles of professional ethics
✓ By knowing how Research is organized and funded
✓ By understanding the issues of intellectual property
✓ By working in an international environment
✓ By managing uncertainty and challenges
Master's degree program structure

- 4 semesters (30 ECTS/semester)
- 3 semesters based on blended learning allowing the customization of the student cursus according to his/her background, his/her research project and his/her professional project:
  - Lectures/tutorials/practicals.
  - Self-learning with e-learning platforms.
  - Individual and collaborative project-based learning in research labs.
  - Supervision of each project by a staff member (associate professor or full professor).
From semesters S7 to S9:

- Project-based learning through research topics and through participation in an international challenge
- Academic learning with a core curriculum and elective courses spanning 3 orientations:
  - Innovative mechatronic product design
  - Autonomous wireless systems
  - Monitoring and control of mechatronic systems

<table>
<thead>
<tr>
<th>Semester</th>
<th>Core Curriculum</th>
<th>Orientation</th>
<th>Projects</th>
<th>Internship</th>
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<tr>
<td>S7</td>
<td>12</td>
<td>3</td>
<td>15</td>
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<td>S8</td>
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<td>S9</td>
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<td>S10</td>
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Overall schedule distribution
S7-S8-S9

- In-class hours/student: 272h
- Estimated e-learning hours/student: 336h
- Projects hours/student: 1250h
Overall schedule distribution
S7-S8-S9

- **In-class hours/student**: 15%
- **Estimated e-learning hours/student**: 18%
- **Projects hours/student**: 67%
Semester 7: core curriculum (12 ECTS)

- Mechatronics common framework
- Metrology for mechatronic systems
- Project management
- Bibliographical tools
- Communication for research

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<tr>
<th>In-class hours/student</th>
<th>Estimated e-learning hours/student</th>
<th>ECTS</th>
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<tbody>
<tr>
<td>68</td>
<td>112</td>
<td>12</td>
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</table>
Semester 7: projects (15 ECTS)

**Mechatronical case study**  
individual

- To study the scientific and technological answers proposed to solve a given problem.  
- 125h, 5 ECTS

**Research**  
collective

- To propose a technological solution of a problem which is part of a research project.  
- 150h, 6 ECTS

**International challenge**  
collective

- To take part in a collective project in the framework of an international challenge.  
- 100h, 4 ECTS
Semester 7: orientations (3 ECTS)

Innovative mechatronic product design
- Materials for Mechatronics
- Physics for mechatronic systems
  
  In-class hours: 23  
  estimated e-learning hours: 40

Autonomous wireless systems
- Signals and systems, Continuous control
- Physics for mechatronic systems

  In-class hours: 12  
  Estimated e-learning hours: 45

Monitoring and control of mechatronic systems
- Signals and systems, Continuous control
- Development and deployment frameworks

  In-class hours: 20  
  Estimated e-learning hours: 34
Semester 8: core curriculum (3 ECTS)

- Modeling, simulation and numerical analysis
- Core skills, research organisations and standards

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<tr>
<td>27</td>
<td>30</td>
<td>3</td>
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</table>
Semester 8: projects (15 ECTS)

**Intellectual property**

- To study a family of published patents related to a mechatronical system.
- 125h, 5 ECTS

**Research**

- To take part in the research project of a member of the permanent academic staff or in a project proposed by an M2 student.
- To study a bottleneck of this project and to propose a solution.
- 150h, 6 ECTS

**International challenge**

- To take part in a collective project in the framework of an international challenge.
- 100h, 4 ECTS
Semester 8: orientations (12 ECTS)

**Innovative mechatronic product design**
- Multiphysics coupling in materials and Design of experiments
- Instrumentation electronics, MEMS and actuators
- Computer-aided design and Finite element simulation

`In-class hours: 78  Estimated e-learning hours: 95`

**Autonomous wireless systems**
- Physics for autonomous wireless systems and Design of experiments
- Instrumentation electronics, MEMS and actuators
- Embedded control and computer science
- Computer-aided design

`In-class hours: 75  Estimated e-learning hours: 115`
Semester 8: orientations (12 ECTS)

Monitoring and control of mechatronic systems

- Embedded control and computer science
- Architecture and robotics
- Data science
- Security: protect the system from intrusion

| In-class hours: 103 | Estimated e-learning hours: 108 |
Semester 9: core curriculum (30 ECTS)

- Embedded systems
- Introduction to supervision methods, models and tools
- Intellectual property, contracts, Law
- Scientific diffusion and Ethics
- Research funding and PhD
- Communication

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<tr>
<th>In-class hours/student</th>
<th>Estimated e-learning hours/student</th>
<th>ECTS</th>
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<tbody>
<tr>
<td>74</td>
<td>50</td>
<td>10</td>
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Semester 9: projects

Research  
*individual*

- To write a scientific article based on the S8 research project or the state of the art on a given mechatronical system.
- 125h, 5 ECTS

Research  
*collective*

- To take part in the research project of a member of the permanent academic staff or in a project proposed by an M2 student.
- To study a bottleneck of this project and to propose a solution.
- 250h, 10 ECTS

International challenge  
*collective*

- To take part in a collective project in the framework of an international challenge.
- 120h, 5 ECTS
Semester 10: Internship (30 ECTS)

USMB Research labs associated to the project

- SYMME: Mechatronics and Materials
- LISTIC: Knowledge and Information Processing
- LOCIE: Energy and Building Engineering
- Particle Physics
- Inter-university Laboratory of Human Mouvement Biology
Contact / Location

- **Contact:**
  resp-am-polytech@univ-smb.fr

- **Location:**
  Savoie Mont Blanc University
  ANNECY Campus
Savoie Mont Blanc: Come and enjoy it!