ENGINEERING COURSES TAUGHT IN ENGLISH AT INSA LYON

FOR EXCHANGE STUDENTS

2020-2021
INSA Lyon offers a wide range of courses in Science & Technology, from undergraduate level up to PhD. High proficiency in Science and Technology combined with a humanistic lens and openness to the society and the world are key values of the INSA education model. More than 1000 students graduate every year from INSA Lyon, hired by companies worldwide.

The INSA curriculum is a 5-year program and leads to the « Diplôme d’ingénieur », equivalent to a Master of Science. It is divided into two tracks:
- Year 1 and 2: a common track for all engineering students to ensure strong fundamental knowledge
- Year 3, 4 and 5, organized in 9 engineering fields named Departments.

Exchange students are welcome to all INSA Lyon Departments. A majority of courses have to be taken in one of the 9 Departments, then additional courses can be chosen in another. One semester cannot exceed 30 ECTS credits. On average 1 ECTS credit = 20 hours of lectures in-class and personal work. Exchange students can simulate their choice of courses prior to coming to INSA Lyon on exchange-student.insa-lyon.fr

Company internship opportunities are available following one academic semester. The internship is carried out under the supervision of a Department with international students keeping their exchange student status and visa. Each Department has its own organization and network among the numerous global companies and SMEs located in our region, ranking first for industry in France.

INSA Lyon is also a research center with more than 600 researchers working in 23 laboratories, combining education activities and close links with companies and public authorities. It promotes a cross-disciplinary approach towards 5 main societal challenges:
- Digital Society and Information
- Energy for a Sustainable Development
- Environment: Natural, Industrial, and Urban Environments
- Global Health and Bioengineering
- Transport: Structures, Infrastructures, and Mobilities

www.insa-lyon.fr/en/research

French as Foreign language
INSA Lyon has its dedicated language center. Among 10 languages, French as a Foreign language (FLE) is taught by a professional team. Summer school and semester courses are available for international students and are strongly recommended even though they choose courses taught in English.

INSA Lyon was recently qualified again with the highest rate (3*) delivered by the French Government.
The Department of Biosciences trains multidisciplinary engineers, intended to be project managers, specialized in Healthcare, Agro-food and Environmental industries.

2 main training programmes are offered in the Department:

Biochemistry and Biotechnologies provides engineers with a solid scientific and technical background in Life Sciences and Healthcare; shapes them to work in Environmental, Pharmaceutical, Agro-Food and various other fields of chemistry; trains them for management positions, quality control and consulting in industries.

Bio-Informatics and Modeling, designed in collaboration with the University Claude Bernard Lyon 1, trains engineers to be interfaces between biologists, mathematicians and computer scientists; analyze and process biological data, extract relevant information and model biological systems in order to understand the processes of life.

BIOSCIENCES

Ordinary Differential Equations and Modeling 4 ECTS
Algorithimcs and Computer Programming 3 ECTS
Computer Architecture and Operating Systems 1 ECTS
Databases 1 ECTS
Linear Algebra and Matrix Analysis 2 ECTS
Population Genetics and Dynamics 4 ECTS
Difference Equations, PDE 4 ECTS
Theoretical Computer Science 2 ECTS
Artificial Intelligence 3 ECTS
Stochastic Processes and Stochastic Calculus for Biology 2 ECTS
Signal and Image Analysis 2 ECTS
Project in Biological Systems Simulation 2 ECTS
Modeling of Biological Networks 3 ECTS
Structural Virology 2 ECTS

SEMESTER 1 [SEPTEMBER - JANUARY]

Partial Differential Equations and Modeling 2 ECTS
Software Development 3 ECTS
Software Development Project 1 ECTS
X-Ray Crystallography 1 ECTS
High Performance Computing and Development 2 ECTS
Game Theory 1 ECTS

SEMESTER 2 [FEBRUARY - JUNE]

The research project will take place in a laboratory associated with the Department of Biosciences. The student will be mentored by an experienced teacher. Topics are defined independently or in collaboration with companies.

SEMESTER 1, SEMESTER 2

Research Project Full Time 30 ECTS / Half Time 15 ECTS

associated labs
BF2I – Functional Biology, Insects and Interaction http://bf2i.insa-lyon.fr/en/
ICBMS – Institute for Molecular and Supramolecular Chemistry and Biochemistry http://www.icbms.fr/
MAP – Microbiology, Adaptation and Pathogenesis Laboratory http://map.univ-lyon1.fr/

Contact: ri-bs@insa-lyon.fr
The Department of Civil Engineering and Urban Planning provides education in the scientific and technical fields of civil engineering and urban planning:
- Building Design, Construction and Management
- Infrastructure Design, Construction and Management
- Urban Development and Renovation.

Major scientific fields addressed:
- Geotechnics; Material and Structural Analysis; Heat and Mass Transfer; Indoor and Outdoor Acoustics and Lighting; Heating, Ventilation, and Air Conditioning (HVAC); Building Energy Management; Water Management and Hydraulics.

A particular attention is paid to cross-disciplinary fields of study: Engineering and Management Tools; Environmental Science; Humanities; Economics and Social Science.

### COURSE

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<thead>
<tr>
<th>Course</th>
<th>Semester</th>
<th>Number of ECTS</th>
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<tbody>
<tr>
<td>Mathematics</td>
<td>S1</td>
<td>2</td>
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<tr>
<td>Computer-Aided Design (CAD)</td>
<td>S2</td>
<td>1</td>
</tr>
<tr>
<td>Urban drainage</td>
<td>S1 or S2</td>
<td>1.5</td>
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<tr>
<td>Adapting cities for climate change</td>
<td>S2</td>
<td>6</td>
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<tr>
<td>Numerical modelling in geomechanics</td>
<td>S2</td>
<td>6</td>
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</table>

**CHOICE OF 1 MODULES OUT OF 3:**

<table>
<thead>
<tr>
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<th>Semester</th>
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<tbody>
<tr>
<td>Energy management in Buildings</td>
<td>S2</td>
</tr>
<tr>
<td>Building design: multidisciplinary approach</td>
<td>S2</td>
</tr>
<tr>
<td>Integrated urban water management</td>
<td>S2</td>
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</table>

### SEMESTER 1 (SEPTEMBER - JANUARY), SEMESTER 2 (FEBRUARY - JUNE)

#### INDIVIDUAL PROJECT

**15 ECTS**

**Bachelor degree level**

The topic and program are defined with a mentor from the Department and are related to Civil Engineering.

#### RESEARCH AND DEVELOPMENT PROJECT

**FULL TIME 30 ECTS / HALF TIME 15 ECTS**

**Master degree level**

The project aims at developing the following knowledges and abilities:
- Understand the nature of R&D activities and challenges for innovation;
- Acquire advanced knowledge in some fields of civil engineering and urban planning, and/or acquire knowledge in complementary fields;
- Discover the limits between well founded knowledge and incomplete/uncertain knowledge;
- Implement scientific principles and methods on a specific research project;
- Develop general abilities [project management, writing reports and scientific papers, oral communication, etc.]

The subject and program are defined with a mentor from the Department and are related to:
- Heat & Mass Transfers in Buildings
- Materials and Structures
- Soils, Geo-materials
- Urban Techniques & Society (a good level of French can be required - for this domain only)
- Urban Water Management

**> Associated labs**

**CETHIL** - Energy and Thermal Engineering
  cethil.insa-lyon.fr

**DEEP** - Waste Water Environment Pollutions
  deep.insa-lyon.fr

**EVS** - Environment City Society
  umr5600.cnrss.fr

**GEOMAS** - Geomechanics, Materials and Structures
  geomas.insa-lyon.fr

**MATEIS** - Materials Science Laboratory
  mateis.insa-lyon.fr/en

**TRIANGLE** - Action, discourses, economic and political thought
  triangle.ens-lyon.fr

**> Contact:** gcu-ri@insa-lyon.fr
The Department of Electrical Engineering trains multidisciplinary engineers in the field of electrical systems. This training provides students with theoretical and practical knowledge in Electronics, Electrotechnical engineering, Automation, Industrial Informatics and Telecommunications [EEAIIT]. Activities related to EEAIIT include: electronic systems for professional and public environments, integrated circuit design, energy production and management, control and supervision of production systems, information technology, telecommunications equipment, network operators...

**ELECTRICAL ENGINEERING**

The project is carried out by a group of students (2 or 3) and covers various aspects of Electrical Engineering. The aim is to design, carry out, test and validate a device or an electrical system defined by a customer. Through this project, students develop initiative and autonomy skills but also their ability to defend their choices and results.

**Contact**: ge-secretariat@insa-lyon.fr

**> Associated labs**

**AMPERE** - Electrical engineering, electromagnetism, automation, environmental microbiology and applications

ampere-lab.fr

**CITI** - Center of Innovation in Telecommunications and Integration of Services

citi-lab.fr

**CREATIS** - Biomedical Imaging Research Lab

creat.isa-lyon.fr

**ICJ** - Institut Camille Jordan, Mathematical Sciences

math.univ-lyon1.fr

**INL** - Lyon Institute of Nanotechnology

inl.cnrs.fr

**LGEF** - Electrical Engineering and Ferroelectricity Lab

lgef.insa-lyon.fr

**ECTS** = European Credits Transfer System
The Department of Energy and Environmental Engineering (GEn) of INSA Lyon offers training opportunities for future professionals, operating in the fields of energy and environmental sciences. The multi-skill academic program enables our students to work in various sectors including energy production and supply, energy efficiency, HVAC and building energy performance, energy consulting, process engineering, waste management, etc.

**RESEARCH AND DEVELOPMENT PROJECT**

25 OR 30 ECTS

This internship is an initiation to scientific research carried out under the supervision of an experienced researcher. It aims to deepen knowledge and abilities in a research problem in scientific English, and to develop experimental or computational skills. At the end of the internship, the student is expected to demonstrate that he/she can conduct a research project and that he/she has learned how to work independently in a research team. It requires creative, self-critical and communication skills. The project is carried out in one of the following themes: energy, heat transfer [CETHIL laboratory] or environmental sciences in waste, water and soil [DEEP laboratory].

**SEMESTER 1 [SEPTEMBER - JANUARY]**

- Challenges and opportunities in environmental management: 4 ECTS
- Energy transition: waste & biomass resources: 5 ECTS
- Energy transition: from fossil fuel to renewable energy - Energy market: 5 ECTS
- Energy transition: project: 3 ECTS
- Wastewater treatment: 3 ECTS
- Energy optimisation: 2 ECTS
- Numerical analysis using EXCEL/VBA: 2 ECTS
- Numerical methods using Matlab: 2 ECTS
- Research and development project: 25 or 30 ECTS
- Short research project: 15 ECTS

**SEMESTER 2 [FEBRUARY - JUNE]**

- Computational fluid dynamics software: 2 ECTS
- Chemical engineering simulation software: 2 ECTS
- Numerical analysis using Matlab: 2 ECTS
- Research and development project: 25 or 30 ECTS
- Short research project: 15 ECTS

> Contact: gen-s@insa-lyon.fr

> Associated labs

**CETHIL** - Energy and Thermal Engineering

cethil.insa-lyon.fr

**DEEP** - Waste Water Environment Pollutions

deep.insa-lyon.fr/en

ECTS = European Credits Transfer System
Industrial engineering concerns production systems, supply and/or distribution of goods or services, their design, implementation, management and improvement with a systemic vision. Industrial engineers are multidisciplinary. They are production managers, able to design, implement and manage complex industrial systems while considering all the technical, organizational, financial and human factors. They are involved in organizing the company in accordance with the principles of sustainability. They apply their skills to improve performance, quality and safety.

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The Department of Mechanical Engineering aims to train mechanical engineers in the fields of innovation, R&D and product design and manufacturing. They develop the capacity to carry out major projects, from an original idea to an end product. The department operates from 2 sites: one on the main campus LyonTech-La Doua and the other in Oyonnax, in the heart of the Plastics Vallée. Therefore, some courses take place on the Oyonnax campus. Areas of activity: energy, transports, biomedical and health, sports and leisure, mechatronics and robotics, luxury industry, mechanical constructions and industrial machinery, eco-industry, buildings, plastics processing...

### MECHANICAL ENGINEERING

#### SEMESTER 1 [SEPTEMBER - JANUARY]
- Engineering Mathematics 1: 4 ECTS
- Fluid Mechanics: 6 ECTS
- Engineering materials: 6 ECTS
- Computer science & Numerical methods: 4 ECTS
- Mechanism analysis: 6 ECTS
- Multi-Physics System modelling: 6 ECTS

#### SEMESTER 2 [FEBRUARY - JUNE]
- Analysis of Structural Vibrations: 6 ECTS
- Theory of Elasticity: 6 ECTS
- Control of Linear Systems: 6 ECTS
- Mechanical Design of machine elements: 6 ECTS
- Friction & tribology: 3 ECTS
- Engine & powertrain analysis: 3 ECTS

#### SEMESTER 1, SEMESTER 2
### RESEARCH/ENGINEERING PROJECTS
### FULL TIME 30 ECTS / HALF TIME 15 ECTS
The exchange students will work closely with a faculty member on a project which is related to industrial or academic research activities, in one of the associated labs to the Department listed below.

> Contact : gm-direction@insa-lyon.fr

> Associated labs

**AMPERE** - Electrical engineering, electromagnetism, automation, environmental microbiology and applications 
ampere-lab.fr

**CETHIL** - Energy and Thermal Engineering 
cethil.insa-lyon.fr

**CREATIS** - Research Centre for Image Acquisition and Processing for Health 
creatis.insa-lyon.fr

**DISP** - Decision and Information Systems for Production systems 
disp-lab.fr

**IMP** - Polymer Materials Engineering 
imp.cnrs.fr

**LAMCOS** - Contacts and Structures Mechanics Laboratory 
lamcos.insa-lyon.fr

**LMFA** - Fluid Mechanics and Acoustics Laboratory 
lmfa.ec-lyon.fr

**LVA** - Vibrations and Acoustics Laboratory 
iva.insa-lyon.fr

**MATEIS** - Materials Science Laboratory 
mateis.insa-lyon.fr/en

ECTS = European Credits Transfer System
COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

The Department of Computer Science and Information Technology (IF) offers a general and wide-ranging training recognized among the best in the field in France. All the IT areas are covered (industry, management and science) with emphasis on engineering activities, modelling and integration of complex systems. According to INSA Lyon model core values, students also acquire the foundations of complementary disciplines like teamwork, project management, customer relation and proficiency in foreign languages.

Each promotion is sponsored by a large company. IT graduates work in many sectors such as consulting and software firms, software publishing, large companies in the tertiary sector, computer hardware, etc. They generally occupy positions as research engineers, project managers, experts, consultants, architects or entrepreneurs.

SEMESTER 1 [SEPTEMBER - JANUARY]

Security and advanced networks 2 ECTS
Data Analytics & Machine Learning 6 ECTS
Privacy and Ethics 6 ECTS
Parallel and GPU computing 6 ECTS
Cloud Computing and Distributed Systems 6 ECTS
Cybersecurity - blockchain and secure multiparty computation 6 ECTS
Programming infrastructure and paradigms for Big Data 6 ECTS

SEMESTER 2 [FEBRUARY - JUNE]

Software Engineering and Modelling 3 ECTS
Data Management for the Web 2 ECTS

SEMESTER 1, SEMESTER 2
RESEARCH PROJECT 10, 20 OR 30 ECTS

The research project takes place in one of the labs associated to the Department. An experienced teacher will mentor the student. Topics cover almost all the areas of computer science. Exchange students have to precise their subject to their academic advisor in the Department. They can choose the duration and the amount of work they want to dedicate to their project, so they can take other courses. Therefore different amounts of ECTS credits can be assigned to the research project.

> Contact : omar.hasan@insa-lyon.fr

> Contact : if.direction@insa-lyon.fr

> Associated labs
CITI - Center of Innovation in Telecommunications and Integration of Services
Citi-lab.fr

DISP - Decision and Information Systems for Production systems
disp-lab.fr

LIRIS - Computer Science Laboratory for Image Processing and Information Systems
liris.cnrs.fr

ECTS = European Credits Transfer System
The Information Science & Technology Semester is a program jointly organized by 3 engineering departments of INSA Lyon:

- Telecommunication Department
- Computer Sciences and Engineering Department
- Electrical Engineering Department

In collaboration with 3 research laboratories: CITI, CREATIS, LIRIS.

A full IST semester program is composed of six scientific courses (to be chosen out of 12) associated to a research project, conducted in one of the 3 research laboratories and which develops high level research in the fields covered by the IST semester. Each week of the IST semester program is structured with 2 days of courses and 3 days in research labs. Note that, the French language course (2 hours per week) is given all throughout the semester in parallel to these courses and projects.

### SEMESTER 1  (SEPTEMBER - DECEMBER)

**TELECOMMUNICATIONS**

- Signal and Image Processing Part 1 - Signal Processing 3 ECTS
- Signal and Image Processing Part 2 - Signal Processing 3 ECTS
- Microwave Systems for Telecommunications Part 1 - Transmission lines 3 ECTS
- Microwave Systems for Telecommunications Part 2 - Antennas and Propagation 3 ECTS

**IT**

- Java Programming 3 ECTS
- Middleware design and implementation 3 ECTS
- Operating Systems 3 ECTS
- Data bases and data mining Part 1 - Data Bases 3 ECTS
- Data bases and data mining Part 2 - Data Mining 3 ECTS
- Software Engineering 3 ECTS

**NETWORKS AND SERVICES**

- Part 1 - Networks 3 ECTS
- Part 2 - Networks 3 ECTS

**RESEARCH PROJECT**

10 ECTS

The students will choose a subject and work within a research team. They will have to build up a bibliographic study in order to develop their own contributions which will be presented in a final report and during an oral presentation. This research project can finish at the end of January.

### SEMESTER 2  (FEBRUARY - JUNE)

**RESEARCH PROJECT**

30 ECTS

The students can lead a research project during a whole semester and thus have enough time to deepen a project and develop a complex and elaborated contribution. A publication and/or a bachelor thesis can be validated at the end of this period.

Subjects cover a wide range of IT fields

Examples of defended thesis:

- Big Data Analytics with Counter-Strike CS:GO
- National Instruments Wireless Transmission Platform
- Programming Distributed Systems in Vert.X & Golo.

> Contact : ist@listes.insa-lyon.fr - www.insa-lyon.fr/en/ist

> Associated labs

**CITI** - Center of Innovation
in Telecommunications and Integration of Services
citi-lab.fr

**CREATIS** - Biomedical Imaging Research Lab
creatis.insa-lyon.fr

**LIRIS** - Computer Science Laboratory
for Image Processing and Information Systems
liris.cnrs.fr

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The Department of Materials Science and Engineering (SGM) trains general engineers whose competencies range from the conception to the manufacturing of built-up products in advanced technology industries. Those industries concern the fields of advanced materials (semiconductors, metals and alloys, polymers, composites, ceramics) and micro and nanotechnologies components. Materials engineers take part in research and development, design, production, quality in different fields such as the industry of electronic components, petrochemistry, iron and steel industry, automotive, aeronautics, construction, energy, packaging, biomedical, cosmetics etc.

**MATERIALS SCIENCE AND ENGINEERING**

**SEMESTER 1 (SEPTEMBER - JANUARY)**

- Physics of Materials – Solid state physics 3 ECTS
- Electronics - Electronic circuits Signal Systems 3 ECTS
- Mechanics – Elasticity and beam mechanics 2 ECTS
- Material Mechanics – Mechanical behaviour of materials 4 ECTS
- Materials engineering – Material selection 2 ECTS
- Nanotechnology – Nanofabrication of advanced integrated circuits 2 ECTS
- Optoelectronics – Photonic materials and components 2 ECTS
- Microelectronics Integrated Electron Devices 2 ECTS
- Nanotechnology and Semiconductors 2 ECTS
- Chemistry – Polymer formulation and blends 2 ECTS
- Materials and Life Science - Biomaterials 2 ECTS

**SEMESTER 2 (FEBRUARY - JUNE)**

- Electronics – Semiconductor Materials 2 ECTS
- Finite Elements Simulation 2 ECTS

**SEMESTER 1, SEMESTER 2**

**RESEARCH PROJECT**

**FULL TIME 30 ECTS / HALF TIME 15 ECTS**

The research project will take place in a laboratory associated with the Department of Materials and Engineering. The student will be mentored by an experienced teacher. Topics are mostly suggested by a company.

Examples of defended thesis:
- Simulation of hip implants: optimization of the shape of the implants according to the patient
- 3D manufacturing of metals by robocasting
- Effect of an applied current on phase transformations.

> Contact: sgm@insa-lyon.fr

> Associated labs
- **IMP** - Polymer Materials Engineering
  imp.cnrs.fr
- **INL** - Lyon Institute of Nanotechnology
  inl.cnrs.fr
- **MATEIS** - Materials Science Laboratory
  mateis.insa-lyon.fr

ECTS = European Credits Transfer System
INSA SHORT PROGRAMS

INSA Lyon offers international students the possibility of a short stay on its vibrant campus, located in France’s Capital of Gastronomy and European Capital of Smart Tourism in 2019. During the program students will gain experience in innovative scientific fields, develop social science skills and learn French. INSA Lyon short programs give them credits and lead them to open themselves to others, in a multicultural environment. Participants agree that INSA Lyon short programs gave them a stepping stone for further studies and a boost for their career.

SMART LYON - MARCH

2 weeks - 2 ECTS

• COURSES (30 CONTACT HOURS)

1. Smart Cities
2. French as a foreign language

• ACTIVITIES

Cultural visits in Lyon and surroundings, social activities organised by students associations.

> For further information: www.insa-lyon.fr/en/smart-lyon

ECTS = European Credits Transfer System
INNOV@INSA - MAY-JUNE

4 weeks | 6 US / 12 ECTS credits

- COURSES (90 CONTACT HOURS)

1. Connected devices and Smart devices
2. Management and Innovation in Europe
3. French language, cross-cultural communication, industry and society

Students have to choose between track 1 or 2. Track 3 is mandatory.

- ACTIVITIES

Cultural visits in Lyon and surroundings, social activities organised by students associations.

> For further information: www.insa-lyon.fr/en/innovinsa-may-june

ECTS = European Credits Transfer System
INNOV@INSA - JUNE-JULY

4 weeks | 12 ECTS credits

• COURSES (90 CONTACT HOURS)
  1. Management and Innovation in Europe
  2. French language, cross-cultural communication, industry and society

• ACTIVITIES
  Cultural visits in Lyon and surroundings, social activities organised by students associations.

> For further information: www.insa-lyon.fr/en/innovinsa-july

ECTS = European Credits Transfer System